APPENDIX C
JURISDICTIONAL RESOURCE INFORMATION

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ENVIRONMENTAL SERVICES, INC.
9401-C Southern Pine Boulevard
Charlotte, North Carolina 28273

TECHNICAL MEMORANDUM

TO: **Carl Gibilaro, PE**
PBS&J

FROM: **Paul Petitgout**

DATE: **February 12, 2010**

RE: **Review for Potential On-Site Mitigation**
Monroe Connector/Bypass
STIP R-3329 and R-2559
Mecklenburg and Union Counties, North Carolina

The purpose of this memorandum is to document potential on-site mitigation opportunities within the project study area to possibly aid in meeting the compensatory mitigation requirements of the proposed Monroe Connector/Bypass. For purposes of this memorandum, "on-site" is defined as an area in the vicinity of the preferred alternative, extending from the US 74/I-485 interchange near the town of Matthews in Mecklenburg County, to between the towns of Wingate and Marshville along US 74 in Union County.

Site Selection Methodology

Potential restoration sites were identified by examining aerial photography in areas where wetlands and streams were found to be coincident with disturbed land uses. Based on aerial photography interpretation, areas judged to have restoration/enhancement potential were recorded and those areas without potential were discounted. Specific methodology and data used in identifying wetland and stream restoration sites are described separately in this section. Aerial photography used in the identification of all restoration/enhancement sites was provided by PBS&J. The aerial photography, in concert with other data sets including soils (SSURGO database), hydrology, contour data (NCDOT), and county parcel data were used to locate the potential mitigation areas.

Site selection criteria were developed with consideration for guidance from the United States Army Corps of Engineers (USACE 2003) and the North Carolina Ecosystem Enhancement Program (NCEEP 2004). The following guidelines were generally observed:

Stream Restoration/Enhancement

- Stream projects must have a minimum of 50 feet conservation easement on both sides of the stream for the entire project length. Easements are measured from the top of the stream bank on both sides of the stream. The easement may be wider if there is room for additional planting (up to 200 feet from the top on either side of the stream) or if there is a wetland component to the project (no easement width limit).
    - One side of stream must be free of utilities.
    - Streams with a utility on one side must have a 50 foot easement in addition to any existing utility easement. The width of the utility cannot count towards the 50 foot requirement.

- The stream segment proposed for restoration must be greater than or equal to 2,000 linear feet in length; however, exceptions may be made under certain circumstances. There is no maximum length for a stream project. Stream restoration opportunities that are less than 2,000 linear feet, but involve relocation of the existing stream as a result of the proposed roadway, were also considered.

- Less than 10 square miles drainage area (typically 1st and 2nd order streams, 3rd order streams in some cases), and no greater than a 3rd order stream.

- Proposed stream segments can be perennial or intermittent as indicated on USGS 24K Quadrangle Maps and/or in the NRCS Soil Surveys. No more than 50 percent of the proposed restoration or enhancement project can be intermittent.

- Proposed stream segments cannot generally occur over more than three property parcels that are under different ownership.

Wetland Restoration/Enhancement

- Hydric soils must be present (might be relic).

- Original wetland hydrology is altered by ditching, tile drains, filling, or other means caused by human influences.

- Proposed wetland restoration area lacks appropriate wetland vegetation.

- Minimum of 2 acres (unless associated with a stream project) in size, but no maximum.

- Site is not comprised entirely of invasive vegetation species (i.e. manageable within reason).

After identification of potential mitigation opportunities, sites were further evaluated in the field. Field evaluations at prospective mitigation sites were performed over the course of two days by staff with extensive experience in mitigation implementation. Evaluations included an

assessment of soils, hydrology, vegetative cover, and landscape/watershed characteristics. Sites were evaluated with consideration for an existing buffer and proximity to existing jurisdictional systems. Notes were collected regarding species composition, soil matrix and chroma, and any site constraints (e.g. active farming, culverts, utilities). Site photos were also collected.

Based on this review, ESI indentified over 25 sites, totaling approximately 2,000 acres that potentially contain stream mitigation opportunities. Of the 25 sites that had mitigation potential, 21 of them were not recommended because they violated one or more of the guidelines listed above. Four of the sites located during this review are considered viable mitigation opportunities and are described below (Table 1), and their general locations depicted on Figure 1. It should be noted that, in general, the mitigation opportunities extended across multiple parcels, which makes procuring these areas as potential mitigation sites much more difficult. However, all of the sites selected for review contain no more than three ownerships.

Table 1. Parcel Data for Selected Mitigation Opportunities.

PIN	Owner	Mailing Address	Acreage	Mitigation Site Number
M7081003 07081003	Vance Adam Sherin (and others) –Heirs	7216 Oak Spring Road Indian Trail, NC 28079	45.3 45.3	Site 1
07081002	Vance Adam Sherin (and others) – Heirs	7403 Stinson-Hartis Road Indian Trail, NC 28079	32.2	Site 1
K7078011	Crosland – Fairhaven LLC	227 W. Trade Street Charlotte, NC 28202	84.6	Site 1
07078012C	Kathleen Bowden	3725 Morningstar Drive Mathews, NC 28105	17.1	Site 1
07027033 90	Carlton Tyson (and others), Trustee	PO Box 748 Monroe, NC 28111	60.7	Site 2
07027033A	Franklin W. Howey, Jr.	PO Box 429 Monroe, NC 28111	37.0	Site 2
08303014	Billy F. Acycoth	2211 White Store Road Monroe, NC 28112	38.3	Site 3
08273001	Thomas Ray & Judy H. Poplin	3310 Poplin Road Monroe, NC 28110	182.0	Site 3
02211024 02211024 H	Thomas E. & Sarah H. Traywick	PO Box 131 Wingate, NC 28174	16.4 38.5	Site 4
02211024 G	NCDOT	206 Charter Street Albemarle, NC 28001	66.8	Site 4

Following field evaluations, ten parcels were found that contain opportunities for stream mitigation. These parcels are grouped into 4 sites (Sites 1-4) and are described below. Figures and photographs for each site are also provided. All of the recommended sites will require additional analysis and feasibility studies to determine the full mitigation potential.

Site 1: Oak Spring Road Site
Mitigation Opportunity: Stream Enhancement

Site one (Figure 2, Photo Plate 1), the Oak Spring Road Site, is located approximately 2,500 feet north of the intersection of Oak Spring Road and Stinson-Hartis Road, in western Union County. The site consists of four tax parcels, two of which are under the same ownership. The potential mitigation area consists of a severely degraded, 2,000 foot stream reach of North Fork Crooked Creek. Cattle operations on this property have severely degraded the overall stability and water quality of this reach of North Fork Crooked Creek. Stream enhancement potential exists due to the reach's degraded dimension and profile along with its non-existent riparian buffer. Riffles

and pools appear to be ill-formed and mid-channel bars are also forming, causing this stream reach to become more unstable.

Stream enhancement techniques that could possibly be utilized for this reach include (but are not limited to) bank stabilization, the use of in-stream structures to redefine the stream profile, construction of bankfull benches (where appropriate), the planting of a riparian buffer, and exclusion of the cattle from the restored riparian buffer area through fencing. No contact has been initiated with the landowner(s). Additional analysis and feasibility studies will be required to determine if stream mitigation activities are both practical and cost effective for this site.

The mitigation activity multiplier for stream enhancement ranges from 1.0 to 2.5, depending on the range of techniques that are prescribed for a particular site. With this range of multipliers in mind, a stream reach of approximately 2,000 linear feet would generate approximately 800 to 2,000 stream mitigation units (SMU). The USACE, in conjunction with NC Division of Water Quality (NCDWQ) and all other relevant regulatory agencies, will ultimately determine the mitigation credit ratio for each mitigation project.

Site 2: Rocky River Road Site
Mitigation Opportunity: Stream Enhancement

Site two (Figure 3, Photo Plate 2) is located approximately 3,000 feet north of the intersection of Rocky River Road and Secrest Shortcut Road. The site consists of two tax parcels that total approximately 97.8 acres. The current land use would be characterized as cultivated agricultural land. The site contains approximately 1,800 linear feet of perennial stream and 1,800 linear feet of intermittent stream that would be available for mitigation. Both reaches can be generally described as having relatively steep banks, low sinuosity and a non-existent riparian buffer. The stream banks are eroded in some areas as a result of the lack of a maintained buffer between the stream and the cultivation activities.

Mitigation potential within Site 2 consists of stream enhancement opportunities along approximately 1,800 linear feet of perennial stream and 1,800 linear feet of intermittent stream. Stream enhancement approaches that are appropriate for the perennial and intermittent reaches of Site 2 include (but are not limited to) the excavation of a bankfull benches (when necessary), the use of in-stream structures to redefine the stream dimension and profile, and the planting a riparian buffer that will enhance stream bank stability, increase channel shading, and provide travel corridors for wildlife.

The mitigation activity multiplier for stream enhancement ranges from 1.0 to 2.5 depending on the techniques that are applied to the site. Stream enhancement of approximately 3,600 linear feet of intermittent and perennial stream could result in 1,440 to 3,600 SMU. The USACE, in conjunction with NCDWQ and all other relevant regulatory agencies, will ultimately determine the mitigation credit ratio for each mitigation project.

Site 3: Poplin Road Site
Mitigation Opportunity: Stream Enhancement

Site three (Figure 4, Photo Plate 3) is located approximately 2,500 feet north of the intersection of Poplin Road and Secrest Shortcut Road. The site consists of two tax parcels that total

approximately 220.3 acres. The current land use would be characterized as cultivated agricultural land. The site contains approximately 4,225 linear feet of perennial stream that would be available for mitigation. This reach can be generally described as having relatively steep banks, low sinuosity and a non-existent riparian buffer. The stream banks are eroded in some areas as a result of the lack of a maintained riparian area between the stream and the cultivated agricultural land.

Mitigation potential within Site 3 consists of stream enhancement opportunities along approximately 4,225 linear feet of perennial stream. Stream enhancement approaches that are appropriate for this perennial reach on Site 3 include (but are not limited to) the excavation of a bankfull benches (when necessary), the use of in-stream structures to redefine the stream dimension and profile, and the planting a riparian buffer that will enhance stream bank stability, increase channel shading, and provide travel corridors for wildlife.

The mitigation activity multiplier for stream enhancement ranges from 1.0 to 2.5 depending on the techniques that are applied to the site. Stream enhancement of approximately 4,225 linear feet of intermittent and perennial stream could result in 1,690 to 4,225 SMU. The USACE, in conjunction with NCDWQ and all other relevant regulatory agencies, will ultimately determine the mitigation credit ratio for each mitigation project.

Site 4: Poplin Road Site
Mitigation Opportunity: Stream Enhancement

Site four (Figure 5, Photo Plate 4) is located approximately 500 feet east of the intersection of Phifer Road and Forest Hills School Road. The site consists of three tax parcels that total approximately 121.7 acres. The current land use would be characterized as pasture land. The site contains approximately 425 linear feet of perennial stream and 2,100 linear feet of intermittent stream that would be available for mitigation. Both reaches can be generally described as having relatively steep banks, low sinuosity and a non-existent riparian buffer. The stream banks are eroded in some areas as a result of the lack of a maintained buffer between the stream and the adjacent pasture land.

Mitigation potential within Site 4 consists of stream enhancement opportunities along approximately 425 linear feet of perennial stream and 2,100 linear feet of intermittent stream. Stream enhancement approaches that are appropriate for the perennial and intermittent reaches of Site 4 include (but are not limited to) the excavation of a bankfull benches (when necessary), the use of in-stream structures to redefine the stream dimension and profile, cattle exclusion fencing, and the planting a riparian buffer that will enhance stream bank stability, increase channel shading, and provide travel corridors for wildlife.

The mitigation activity multiplier for stream enhancement ranges from 1.0 to 2.5 depending on the techniques that are applied to the site. Stream enhancement of approximately 2,525 linear feet of intermittent and perennial stream could result in 1,010 to 2,525 SMU. The USACE, in conjunction with NCDWQ and all other relevant regulatory agencies, will ultimately determine the mitigation credit ratio for each mitigation project.

Wetland Mitigation Opportunities

During the review for potential wetland and stream mitigation sites, no wetlands sites were revealed that met the site selection criteria described above. There may be the potential for wetland mitigation created through the stream mitigation opportunities, but the amount would be small (potentially less than 0.25 acre).

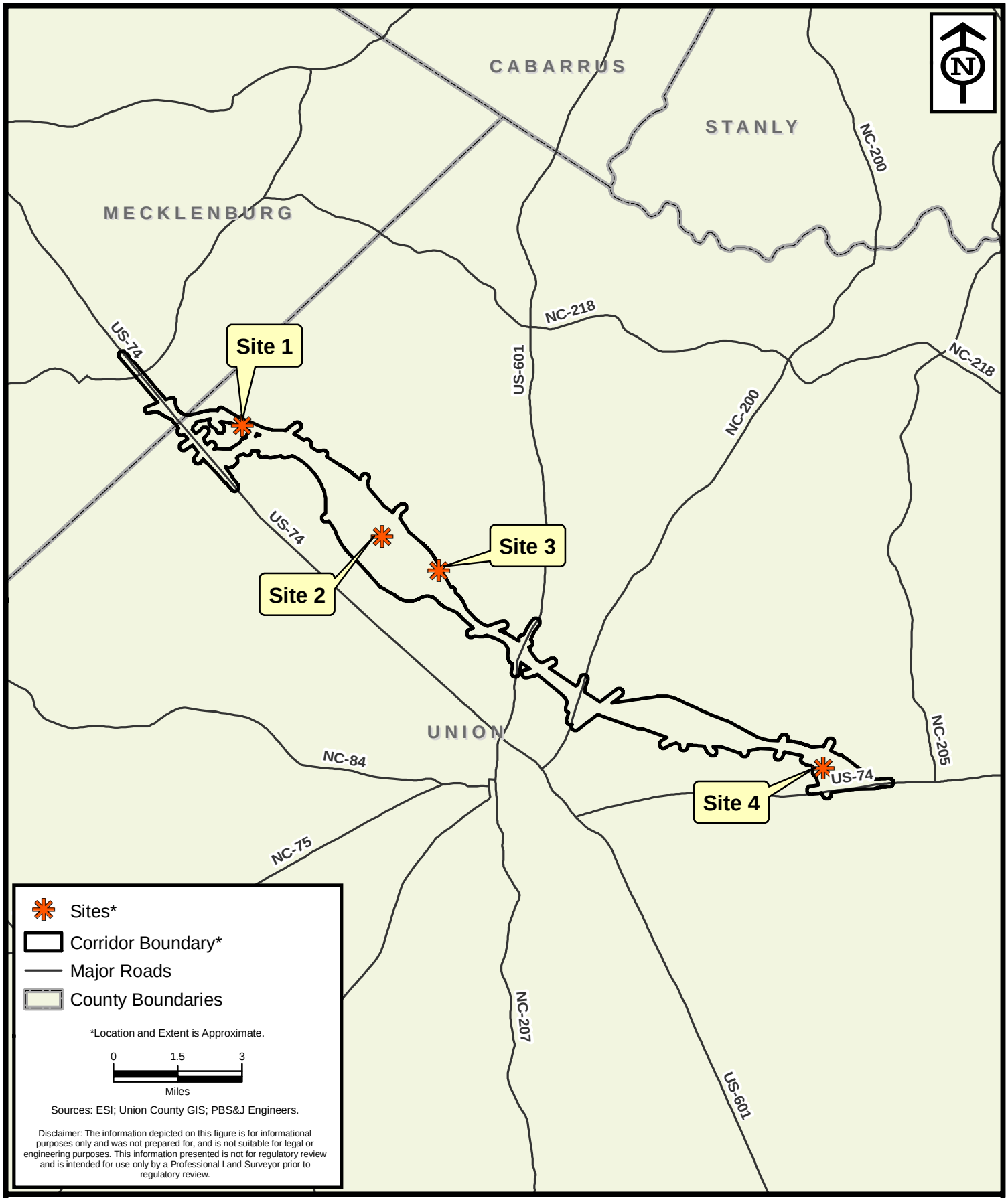
Literature Cited

NC Ecosystem Enhancement Program. 2004. Guidelines for Riparian Buffer Restoration. NC Department of Environment and Natural Resources. 12 pp.

US Army Corps of Engineers. 2003. Stream Mitigation Guidelines. USACE Wilmington District, Regulatory Branch. 26 pp + appendices.

Acknowledgement

ESI would like to acknowledge PBS&J for providing the template for this technical memorandum.



NORTH CAROLINA Turnpike Authority

Potential On-Site Mitigation Overview

Monroe Connector / Bypass

Mecklenburg and Union Counties, North Carolina

Project:	ET09028.00
Date:	Jan. 2010
Drwn/Chkd:	JDS/JRN
Figure:	1

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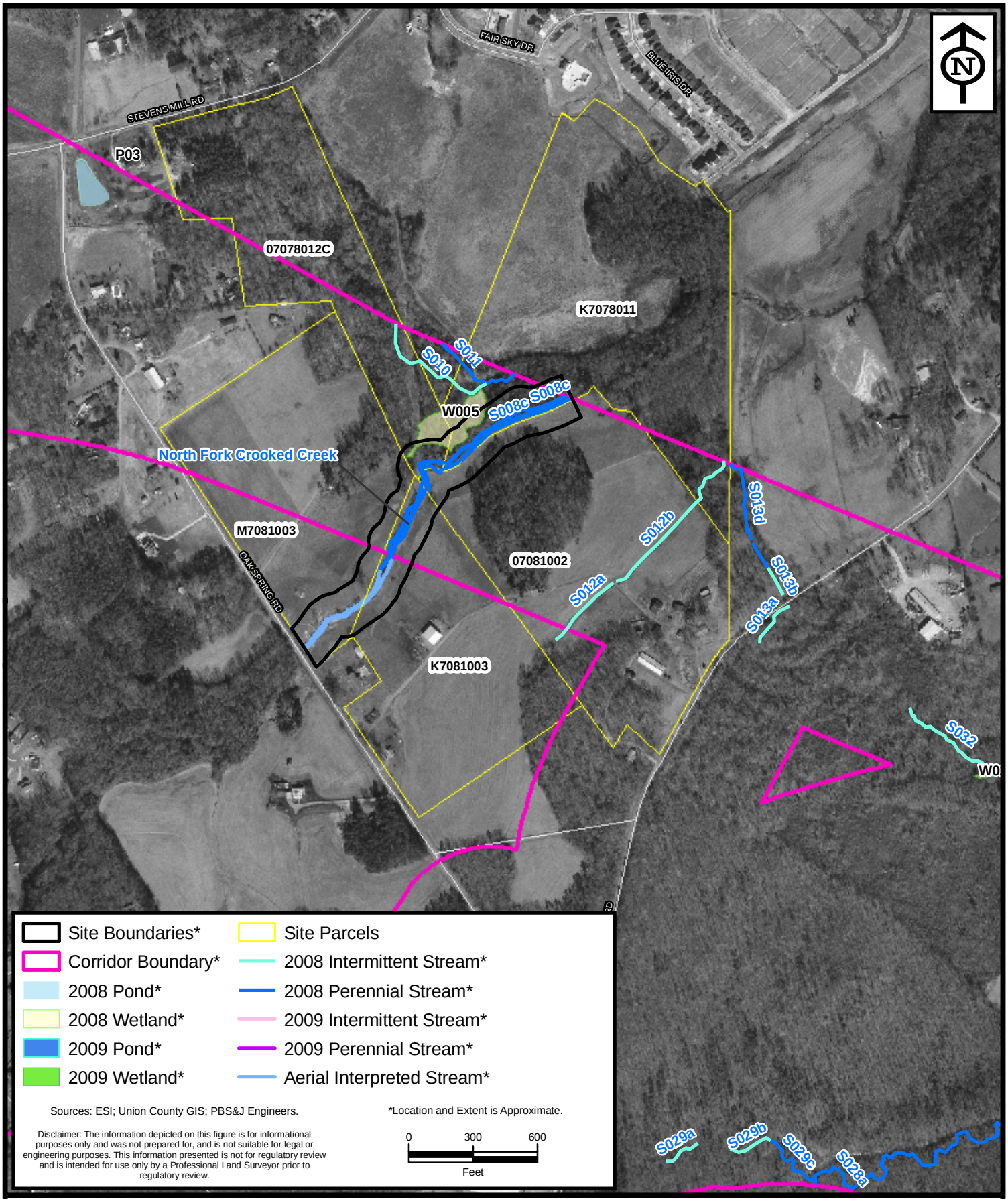

NORTH CAROLINA Turnpike Authority

Potential On-Site Mitigation - Site 1

Monroe Connector / Bypass

Mecklenburg and Union Counties, North Carolina

Project:	ET09028.00
Date:	Jan. 2010
Drwn/Chkd:	JDS/JRN
Figure:	2

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Photo 1: View of North Fork Crooked Creek and adjacent pastureland comprising Site 1.

Photo 2: View of eroding banks and extensive sediment deposition within Site 1.

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Site Photographs

Potential On-Site Mitigation - Site 1
Monroe Connector-Bypass

Union County, North Carolina

Project:	ET09028.00
Date:	Jan 2010
Drwn/Chkd:	JMB/SPP
Photo Plate:	1

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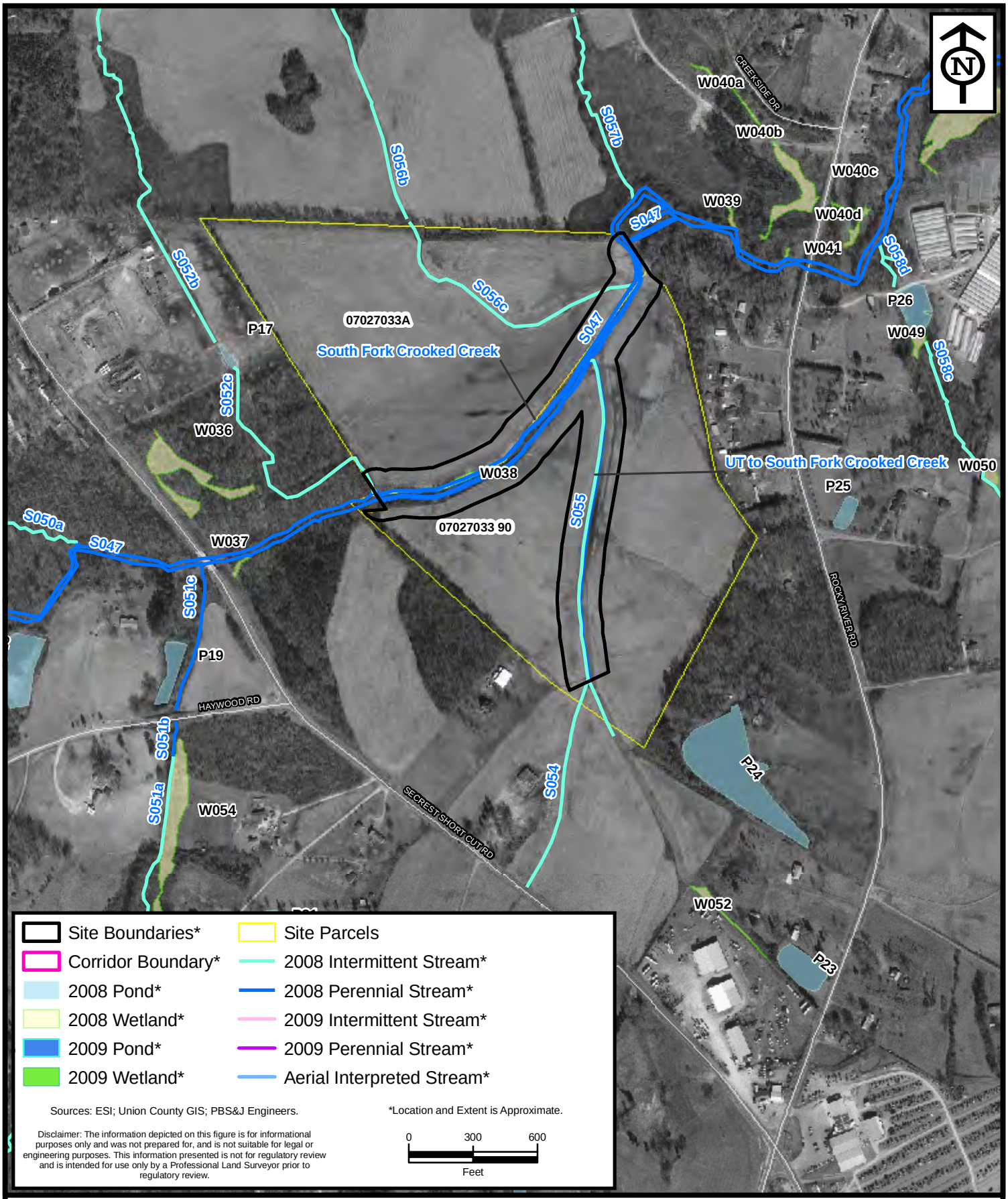

NORTH CAROLINA Turnpike Authority

Potential On-Site Mitigation - Site 2

Monroe Connector / Bypass

Mecklenburg and Union Counties, North Carolina

Project:	ET09028.00
Date:	Jan. 2010
Drwn/Chkd:	JDS/JRN
Figure:	3

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Photo 1: View of North Fork Crooked Creek and adjacent pastureland comprising Site 1.

Photo 2: View of eroding banks and extensive sediment deposition within Site 1.

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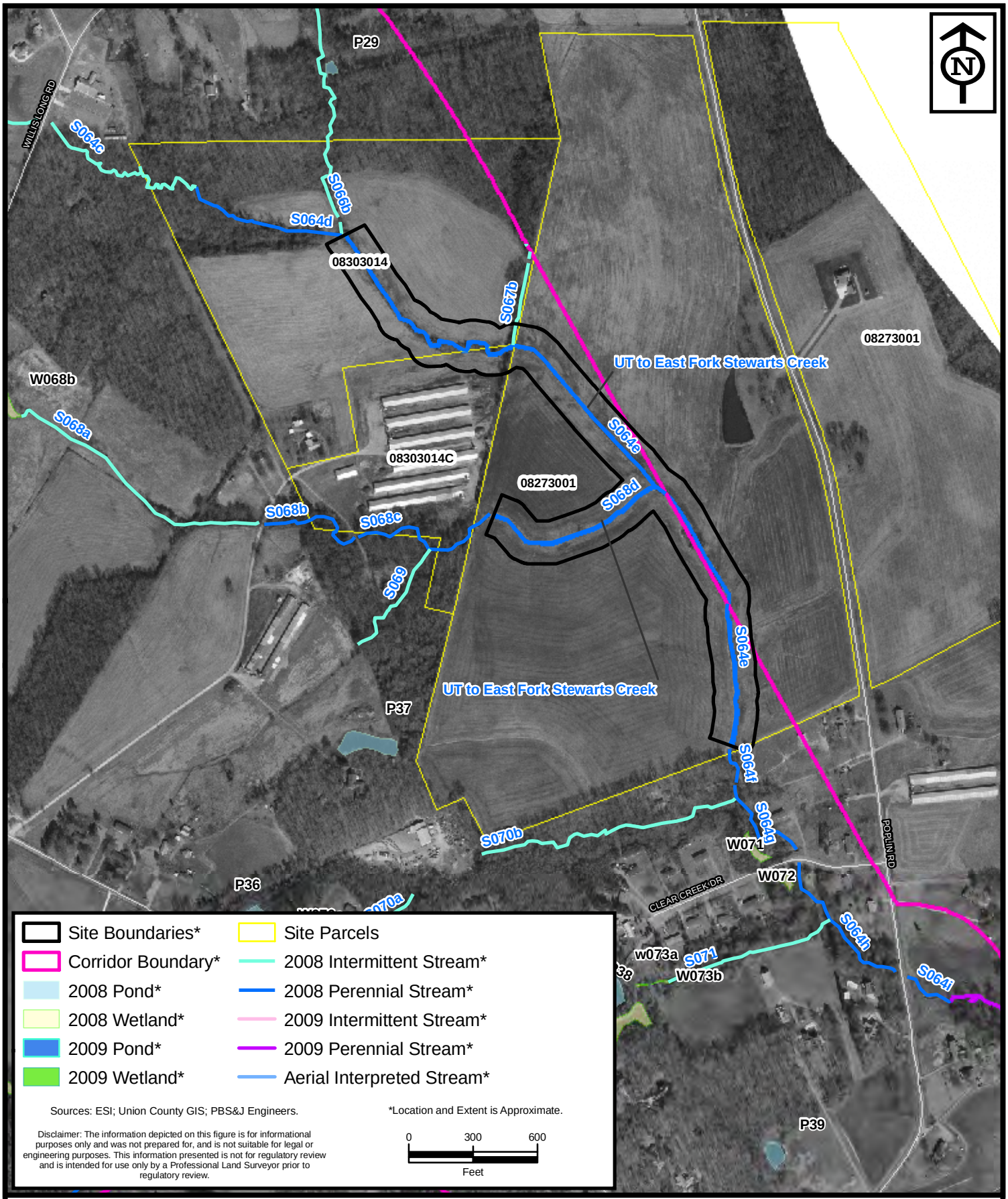
Site Photographs

Potential On-Site Mitigation - Site 1
Monroe Connector/Bypass

Union County, North Carolina

Project:	ET09028.00
Date:	Jan 2010
Drwn/Chkd:	JMB/SPP
Photo Plate:	1



NORTH CAROLINA Turnpike Authority

Potential On-Site Mitigation - Site 3

Monroe Connector / Bypass

Mecklenburg and Union Counties, North Carolina

Project:	ET09028.00
Date:	Jan. 2010
Drwn/Chkd:	JDS/JRN
Figure:	4

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Photo 5: View of channelized UT to East Fork Stewarts Creek and adjacent agricultural field within Site 3.

Photo 6: View of southwestern tributary exhibiting severe bank erosion and non-existent riparian buffer within Site 3.

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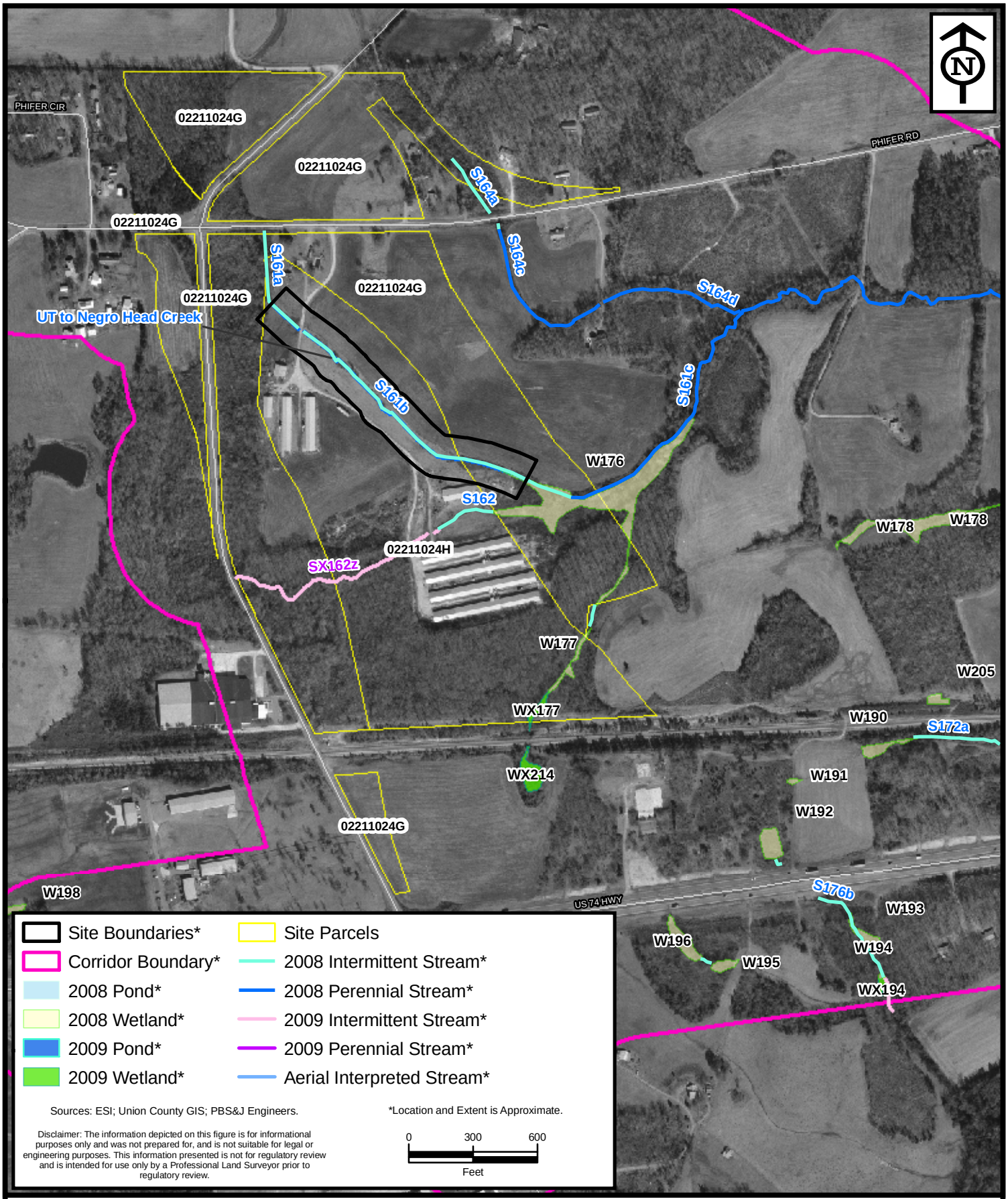
Site Photographs

Potential On-Site Mitigation - Site 3
Monroe Connector/Bypass

Union County, North Carolina

Project:	ET09028.00
Date:	Jan 2010
Drwn/Chkd:	JMB/SPP
Photo Plate:	3



NORTH CAROLINA Turnpike Authority

Potential On-Site Mitigation - Site 4

Monroe Connector / Bypass

Mecklenburg and Union Counties, North Carolina

Project:	ET09028.00
Date:	Jan. 2010
Drwn/Chkd:	JDS/JRN
Figure:	5

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Photo 7: View of unstable channel and adjacent pastureland within Site 4.

Photo 8: View of bank erosion and poor riparian buffer within Site 4.

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Site Photographs
Potential On-Site Mitigation - Site 4
Monroe Connector/Bypass
Union County, North Carolina

Project:	ET09028.00
Date:	Jan 2010
Drwn/Chkd:	JMB/SPP
Photo Plate:	4

ATKINS

To: Christy Shumate, North Carolina Turnpike Authority

From: Michael Gloden, Atkins

Date: November 16, 2011

Re: On-Site Mitigation Feasibility Assessment – Monroe Connector/Bypass (STIP No. R-3329/R-2559)

Condition 'p' of the Section 404 permit (SAW-2009-00876) issued to the North Carolina Turnpike Authority (NCTA) for construction of the Monroe Connector-Bypass states:

> *p. Prior to commencing any work on the project, as defined by special condition (e), above, the permittee shall provide a final mitigation plan, as approved by the District Engineer, for any on-site mitigation proposed by the permittee, or, in the event on-site mitigation opportunities are found to be not available to the permittee, he shall provide documentation of this to the District Engineer prior to commencing any work on the project.*

Four on-site mitigation opportunities for the Monroe Connector/Bypass Project were previously identified by Environmental Services Incorporated (ESI) and summarized in the memo titled "Review for Potential On-Site Mitigation" dated February 12, 2010. Atkins North America Inc. (Atkins) subsequently reviewed the four sites and concurs with the ESI findings that the sites offer stream mitigation opportunities within and nearby to the Alternative D Study corridor. This memo documents landowner interest in voluntary mitigation opportunities and an evaluation of mitigation feasibility.

Landowner Contact

Atkins contacted landowners of each site (Sites 1-4, Figure 1) in order to determine their interest in participating in a mitigation project on their land. Contact information was derived from recently obtained parcel data available from Union County. Landowners of each site were sent a letter (attached) explaining the opportunity and asked to return their response regarding participation in an enclosed postage paid envelope. Of the eight landowners contacted four responded favorably, one was not interested, and three did not respond. Landowner responses are attached to this memo and summarized in the following table.

Mitigation Site	PIN	Owner	Mailing Address	Response
Site 1	M7081003, K7081003	Vance Adam Sherin et al. - Heirs	7216 Oak Spring Road Indian Trail, NC 28079	Not Interested
	07081002	Vance Adam Sherin et al. - Heirs	7403 Stinson Hartis Road Indian Trail, NC 28079	Not Interested
	K7078011	MI Homes of Charlotte LLC	9335 Harris Corners Pky (Suite 100) Charlotte, NC 28269	Interested
	0708012C	Kathleen Bowden	3725 Morning Star Drive Matthews, NC 28105	No Response
Site 2	07027033A	Franklin W. Howey, Jr.	PO Box 429 Monroe, NC 28111	No Response
	07027033 90	Carlton Tyson et al. – Trustee	PB Box 748 Monroe, NC 28111	Interested

Mitigation Site	PIN	Owner	Mailing Address	Response
Site 3	08303014	Billy F Aycoth, Sr. – Trustee	4548 Seacrest Shortcut Road Monroe, NC 28110	No Response
	08273001	Thomas Ray and Judy H. Poplin	3310 Poplin Road Monroe, NC 28110	Interested*
Site 4	02211024H	Thomas E. and Sarah H. Traywick	PO Box 131 Wingate, NC 28174	Interested
	02211024G	NCDOT	206 Charter Street Albemarle, NC 28001	N/A

*Initial response has changed since the landowner entered into an option to purchase agreement with a private mitigation banker.

Mitigation Feasibility

Atkins determined mitigation feasibility by considering landowner interest and performing a field review and screening procedure for each site. The field review was conducted to update and verify information provided by ESI and consisted of a qualitative assessment of mitigation potential and a review for site constraints. The screening procedure was performed for viable sites and included a review of protected species and significant natural areas documented by the N.C. Natural Heritage Program (NHP), a review of cultural and archeological resources within or adjacent to the sites as documented in the Draft and Final Environmental Impact Statement (DEIS and FEIS), and a review of environmental records from an Environmental Data Resources (EDR) report. The mitigation feasibility of each site is discussed in detail below.

Site 1: Not Feasible for Mitigation

Site 1 is located along Oak Spring Road between Stevens Mill Road and Stinson Hartis Road in western Union County (Figure 2). The Site consists of five tax parcels, of which only one is owned by a landowner who responded favorably to participating in a mitigation project. The tax parcels are color-coded on Figure 2 to indicate each landowner's response. The stream within Site 1 previously identified for enhancement potential (S008c) is approximately 2000 linear feet in length and located on or adjacent to the property boundary that divides the five tax parcels. Stream mitigation guidelines (USACE 2003) require a 50-foot riparian buffer along both stream banks which necessitates participation from all five landowners of Site 1. The one interested landowner (PIN K7078011) only includes a portion of the total stream length within the site and does not have ownership of both sides of the stream. **Due to lack of landowner interest necessary to provide the required buffer on each side of the stream, Site 1 is deemed not feasible.**

Site 2: Not Feasible for Mitigation

Site 2 is located north of the intersection of Rocky River Road and Secrest Shortcut Road (Figure 3). The site consists of two tax parcels, of which only one is owned by a landowner who responded favorably to participating in a mitigation project. The tax parcels are color-coded on Figure 3 to indicate each landowner's response. Site 2 is crossed by the Monroe Connector-Bypass project alignment as indicated by the permitted construction limits (plus 40-feet) shown on Figure 3. Mitigation opportunities previously identified within the Site include stream enhancement along S047 (located along the

property boundary between the two tax parcels), S056c (located within the parcel that did not respond), and S055 (located within the tax parcel with mitigation interest by the owner). Total stream length is approximately 2,940 linear feet (excluding the portion within the construction limits). The Site also includes riparian wetland WX822. Due to lack of landowner interest on parcel 0727033A, stream S047 is no longer feasible for mitigation. Stream S056c is also no longer feasible for mitigation since participation by both landowners is necessary to allow for the required 50-foot riparian buffer along both stream banks. A field review of the site for mitigation opportunities along the remaining resources (stream S055 and wetland WX822) determined that an existing sewer easement is located adjacent to the eastern stream bank. The sewer easement follows the entire length of stream S055 and encompasses a large portion of wetland WX822. Sewer easements require routine maintenance and therefore preclude the establishment of the required 50-ft riparian buffer. **Due to lack of landowner interest, site constraints from an existing sewer easement, and the crossing of the streams by the Monroe Connector-Bypass, Site 2 is deemed not feasible.**

Site 3: Not Available for Mitigation

Site 3 is located along Poplin Road, north of the intersection with Secrest Shortcut Road. The mitigation opportunity was previously identified to include stream enhancement along approximately 4,225 linear feet of stream. **Site 3 is no longer available for on-site mitigation by NCTA because the landowners have signed an option to purchase agreement with a private mitigation banker.**

Site 4: Potentially Feasible for Mitigation

Site 4 is located along Forest Hill School Road, southeast of the intersection with Phifer Road, and is adjacent to the Monroe Connector-Bypass project alignment (Figure 4). The site consists of two tax parcels, one of which is owned by a landowner who responded favorably to participating in a mitigation project, and the second tax parcel is owned by NCDOT. The site includes approximately 1,000 linear feet of an intermittent stream (S161b) located between the Monroe Connector-Bypass mainline and an exit ramp to Forest Hill School Road. Final design drawings for the Monroe Connector-Bypass show that S161b will be culverted at each end and stormwater drainage from the new road will be diverted into the stream at two locations. Mitigation opportunities on the site include stream enhancement (level 2) on S161b with potential for implementing additional best management practices (BMP) to treat stormwater. Stream enhancement activities that may be appropriate for the site include sloping stream banks for stabilization (when necessary), planting an appropriate riparian buffer, livestock exclusion, and stormwater treatment. This project would require the purchase of approximately 2.3 acres of property to provide a 50-foot buffer on each side of the stream. In addition, the purchase of an additional 2.7 acres of property located between S161b and the Monroe Connector- Bypass is recommended. Purchase of this property would preclude the potential of a stream crossing to provide access and would provide a buffer between the project and road. **Stream enhancement level 2 of approximately 1,000 feet of stream channel with a mitigation multiplier of 2.5 will result in 400 stream mitigation units from Site 4.** (Multiplier of 2.5 is used because S161b is an intermittent stream).

The results of the environmental screening for Site 4 include the following:

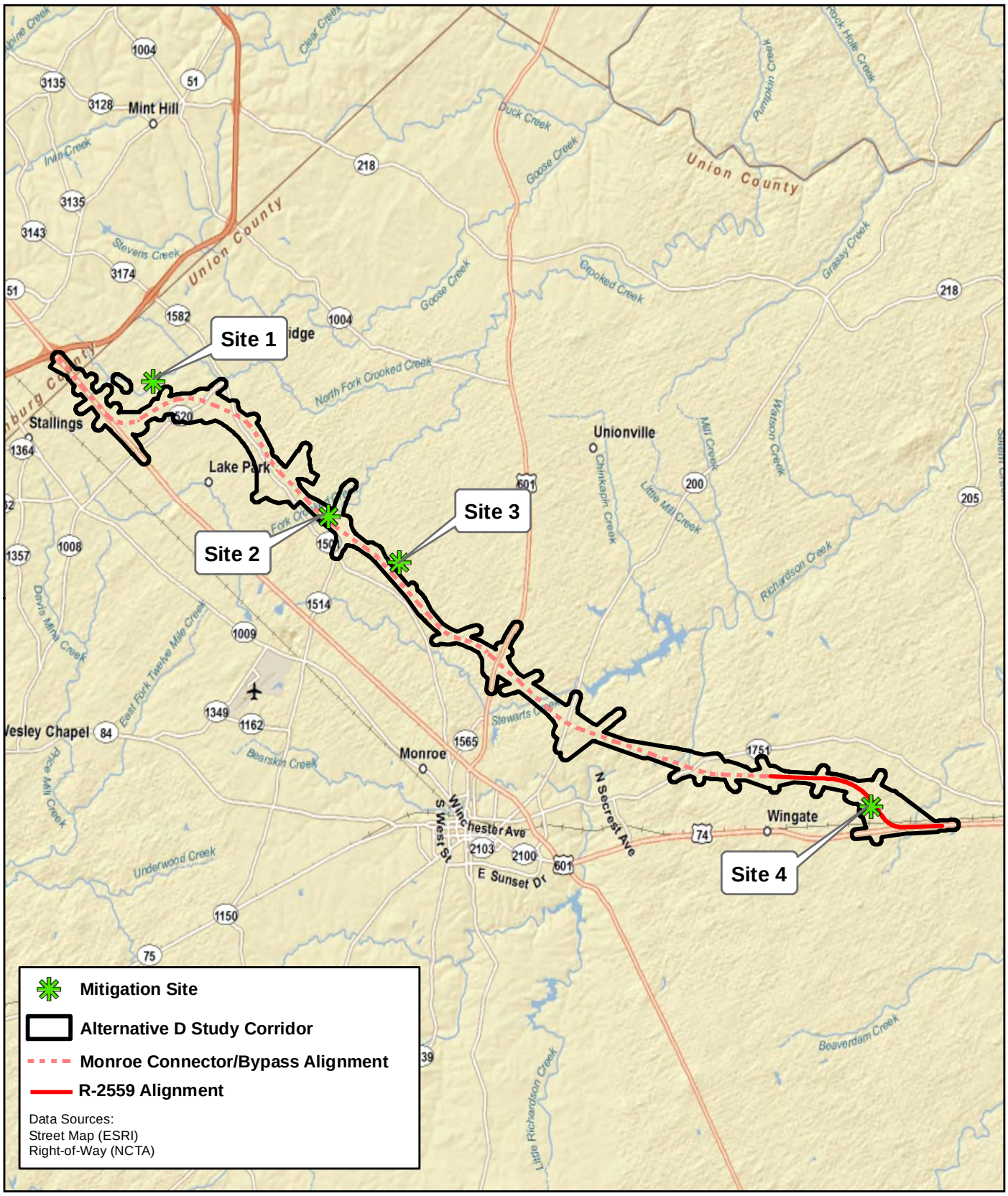
- Surveys for historic archeological resources, architectural resources, and other cultural resources were completed for the DEIS (with updates in the FEIS) within the design alternative that includes Site 4. The survey did not find any cultural resources located within or adjacent to the site that would prevent the implementation of a stream mitigation project.
- Surveys for protected species were also performed for the DEIS (with updates in the FEIS) within the design alternative that includes Site 4 and no occurrences of any protected species were identified.
- A recent review of the NHP database indicates that no managed areas, significant natural heritage areas, or element occurrences are located within or adjacent to the site.
- A transaction screen map and report was obtained from EDR to identify potential environmental constraints within the Site. The report includes environmental risk records and locations of known environmental records such as hazardous waste sites, underground storage tanks, water wells, oil and gas pipelines, and transmission lines. Site 4 was not listed on any available databases searched by EDR and no known environmental records were found.
- Field investigations identified no historic architectural or archaeological resources, utility easements, or structures that would prevent the implementation of a stream mitigation project.

Recommendation:

As described above, Sites 1 and 3 are not feasible due to the lack of landowner interest or inability to acquire the site. Site 2 is not feasible due to lack of landowner interest and site constraints. Although Site 4 does provide potential for stream mitigation, Atkins does not recommend this site as mitigation for the following reasons:

1. relatively small size of the project (1000 linear feet)
2. S161b will be culverted at both ends of the project
3. potential impacts associated with stormwater discharges

Atkins believes that this analysis of the four on-site mitigation opportunities provides sufficient documentation that these sites are not feasible as compensatory mitigation. Upon review and approval of this document by the NCTA Atkins will prepare a letter to the USACE-Wilmington District, District Engineer for NCTA signature transmitting these findings.



NORTH CAROLINA Turnpike Authority

MONROE CONNECTOR/BYPASS

STIP PROJECT NO. R-3329/R-2559

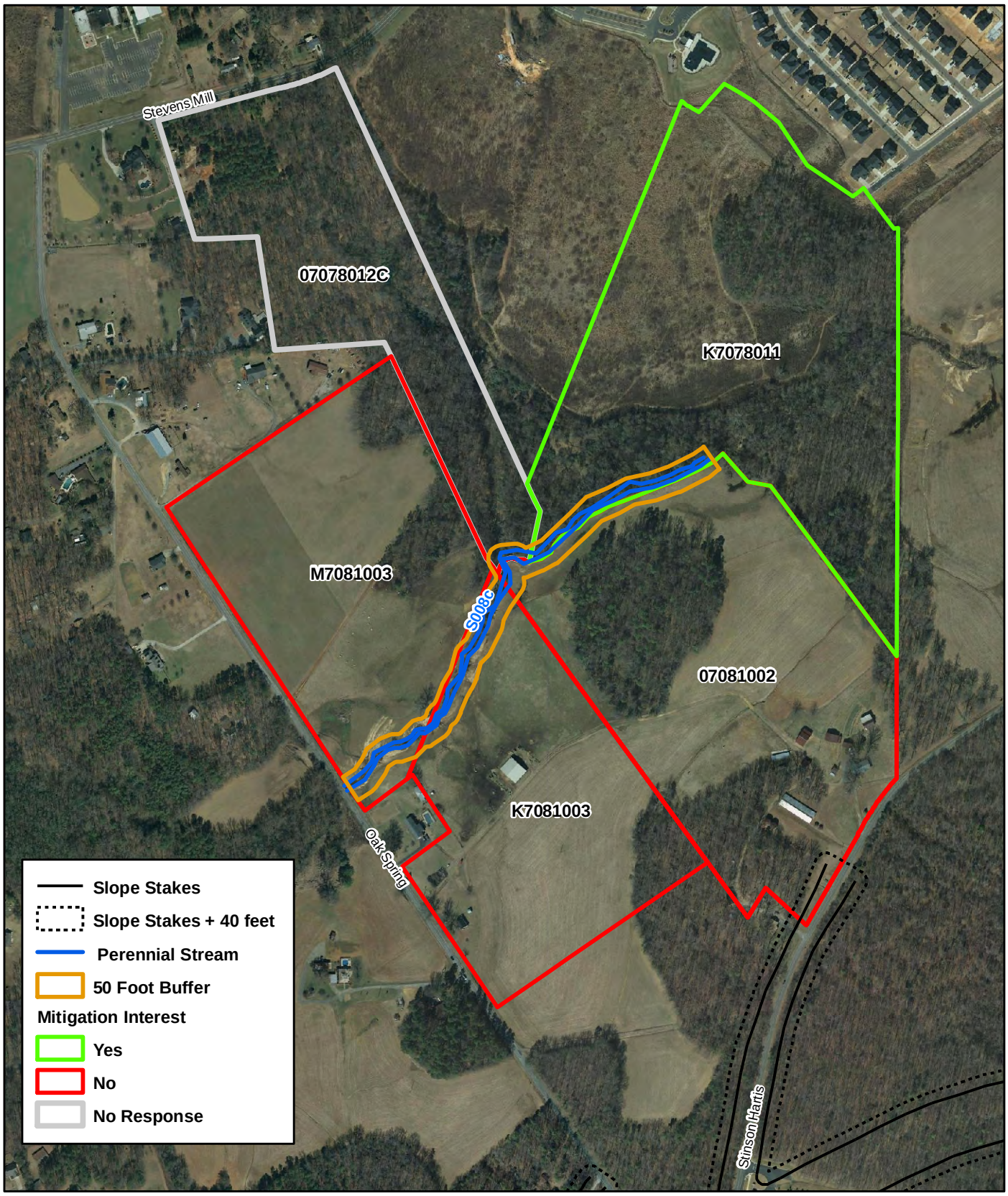
Union County

2.5 1.25 0 2.5 Miles

Map Printed November 2011.

MITIGATION SITE LOCATIONS

Figure 1



NORTH CAROLINA Turnpike Authority

MONROE CONNECTOR/BYPASS

STIP PROJECT NO. R-3329/R-2559

Union County

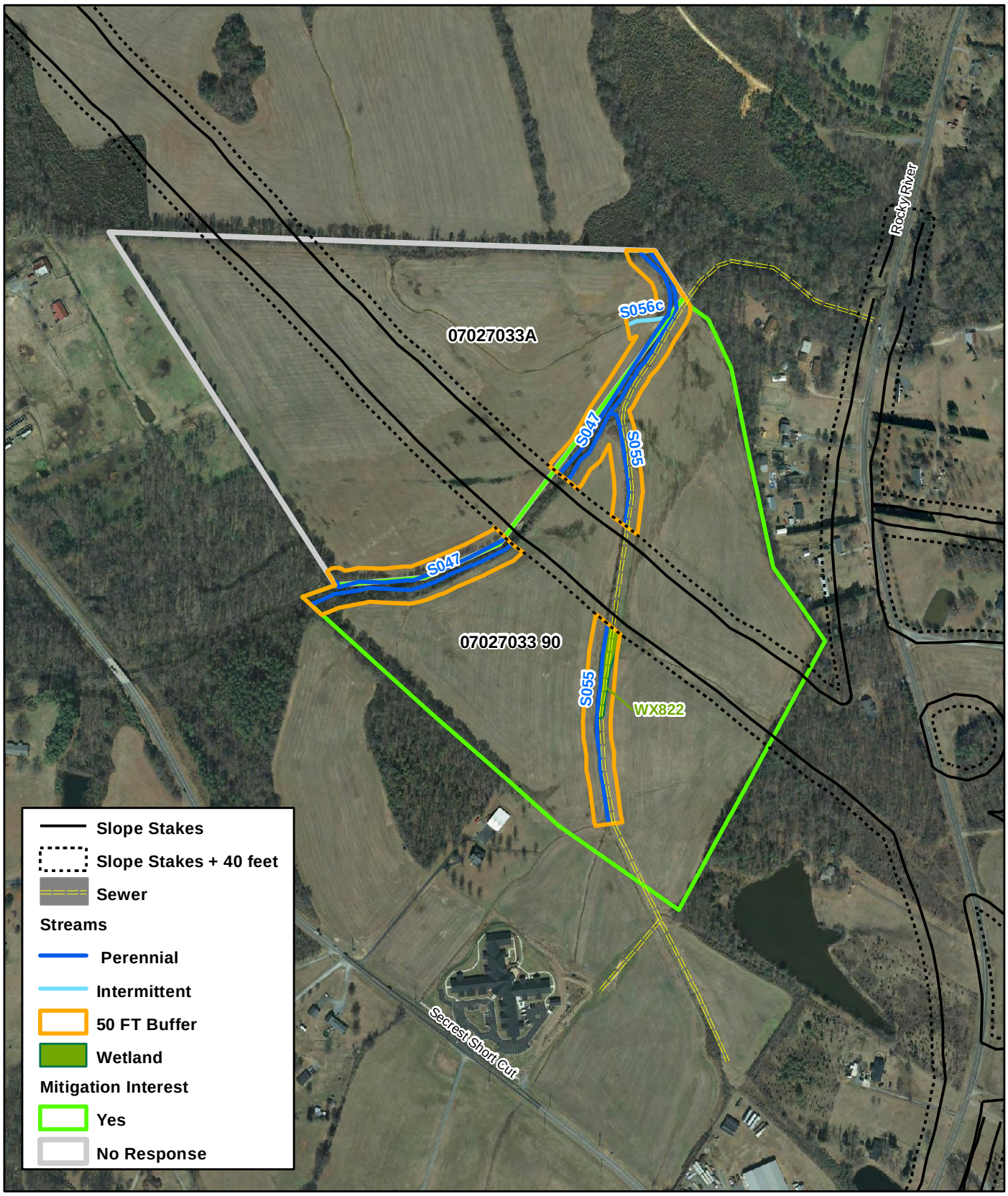
500 250 0 500 Feet

Map Printed November 2011.

N

ON-SITE MITIGATION: SITE 1

Figure 2



NORTH CAROLINA Turnpike Authority

MONROE CONNECTOR/BYPASS

STIP PROJECT NO. R-3329/R-2559

Union County

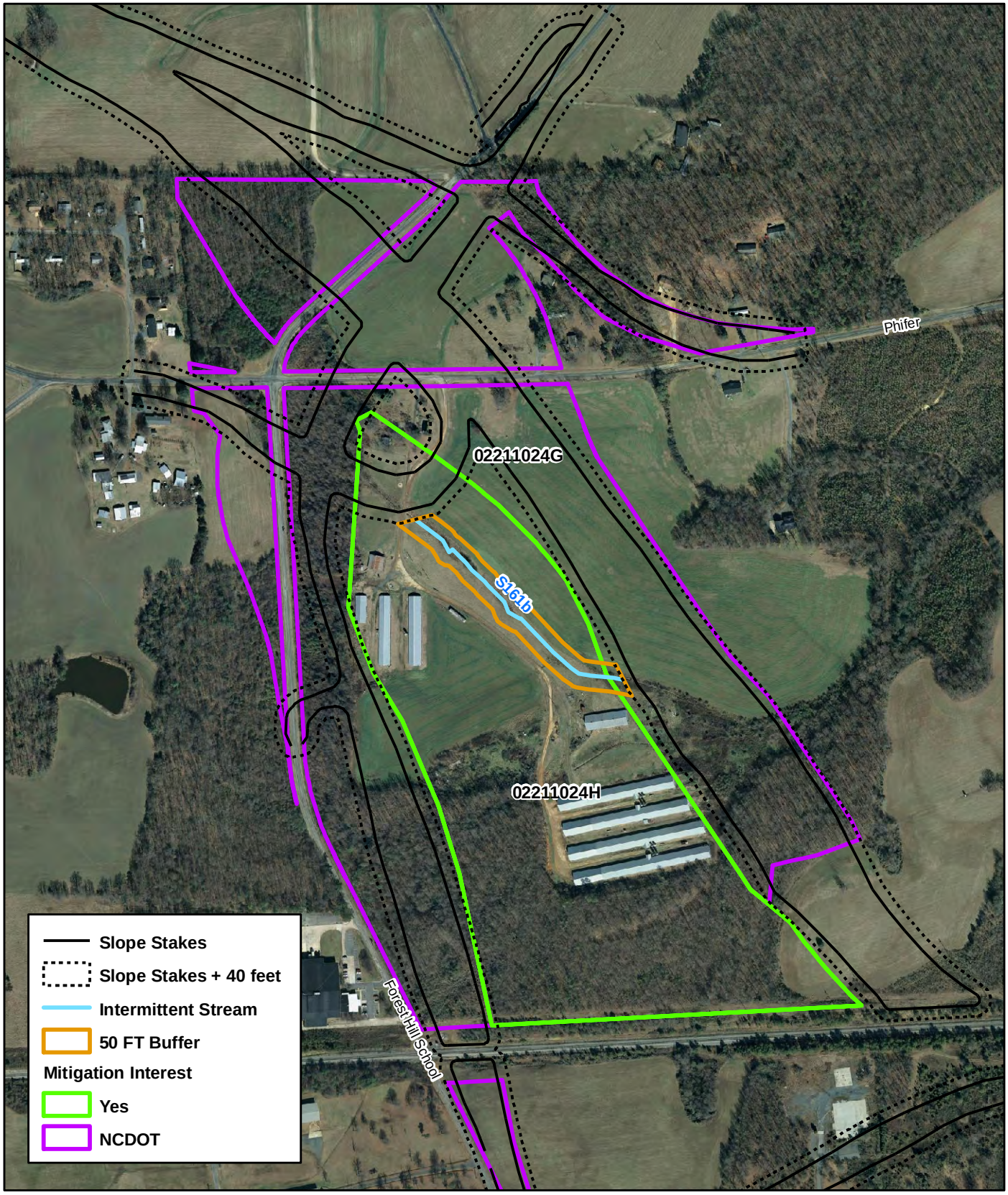
500 250 0 500 Feet

Map Printed November 2011.

N

ON-SITE MITIGATION: SITE 2

Figure 3



NORTH CAROLINA Turnpike Authority

MONROE CONNECTOR/BYPASS

STIP PROJECT NO. R-3329/R-2559

Union County

500 250 0 500 Feet

Map Printed November 2011.

N

ON-SITE MITIGATION: SITE 4

Figure 4

The NCEEP sites that provided the mitigation credits for the Monroe Connector Bypass under USACE 404 permit #2009-00876, and NCDWR 401 permit #2002-0672, are listed in the table below. Credits for the 46,166 mitigation units for warm water streams, and 16.2 mitigation units for wetlands, needed within the Yadkin CU 03040105, are an amalgamation of restoration, enhancement, creation, and preservation from these sites. Site locations and additional information can be found at:

http://portal.ncdenr.org/web/eep/interactive-mapping

Site Instituted	Mitigation Site Utilized	IMS ID#	Project Phase
9/18/2009	Little Buffalo Creek Stream Mit. Site	94147	Construction
7/28/2004	Beaver Dam-Drowning Creek II (Rankin Tract)	92164	Long Term Mgmt
4/11/2006	Helms	172	Monitoring Year 4
7/22/2003	Back Creek	17	Long Term Mgmt
6/28/2006	Big Cedar Creek	92532	Monitoring Year 5
9/27/2004	Lone Mountain 2 -Phase Two	92171	Long Term Mgmt
6/8/2006	Suther	370	Monitoring Year 3
6/30/2010	UT to Town Creek	94648	Construction
9/24/2009	Scaly Bark Creek Mitigation Site	94148	Monitoring Year 3
4/11/2005	Dutch Buffalo Creek Walker	92116	Long Term Mgmt
4/15/2005	Dutch Buffalo Creek Wickliff	92117	Long Term Mgmt
7/7/2005	Little River Cochran	92113	Long Term Mgmt
5/11/2005	Barnes Creek Grissom	92106	Long Term Mgmt
12/20/2004	Bishop Tract-Canal Branch	92162	Long Term Mgmt
1/31/2006	Uwharrie River Bingham	92108	Long Term Mgmt
10/9/2007	Uwharrie River Cochran	92109	Long Term Mgmt
2/1/2004	Lambert Tract-Uwharrie River Bluff	92160	Long Term Mgmt
1/23/2006	Drowning Creek IP Forest Investments	92121	Long Term Mgmt
7/7/2006	601 North Property	92546	Long Term Mgmt
6/30/2010	Buffalo Flats Restoration Site	94647	Monitoring Year 2
7/21/2006	Stricker Branch	92556	Close Out
7/18/2006	601 West Property	92545	Long Term Mgmt

http://portal.ncdenr.org/web/eep/interactive-mapping

NC Department of Transportation
1514 Mail Service Center
Raleigh, NC 27699-1514

Phone: *919-733-3624 x354*
Fax: *919-733-9247*
Internet: *www.ncdot.org*

Warrant: 2967460

ENVIRONMENTAL BANC & EXCHANGE
10055 RED RUN BLVD, STE 130
OWINGS MILL MD 21117

Payment No.: **2001675228**
Warrant Date: **10/05/2010**
Vendor No.: **17096**

Page: **1 of 1**

Invoice Number	Invoice Date	DOT Tracking # / Remarks	PO/Contract #	Gross Invoice Amount*	Discount	Net Amount*
HS-PH1-1	08/04/2010	5200916126	6300025121	150,000.00	0.00	150,000.00
		Check Total.....				**$150,000.00**
		DETACH FROM CHECK AND KEEP FOR YOUR RECORDS		Cashed 10/13/10		

* Includes unplanned freight, if applicable

NC Department of Transportation
1514 Mail Service Center
Raleigh, NC 27699-1514

66-1059
531

Warrant **2967460**
Date 10/05/2010
Void after One Year

PAY TO THE ORDER OF

$ 150,000.00

($> > > > 150,000.00)

ENVIRONMENTAL BANC & EXCHANGE
10055 RED RUN BLVD, STE 130
OWINGS MILL MD 21117

&%1B$(10100XA

Mark L. Foster
Chief Financial Officer

State Treasurer, Raleigh, North Carolina
Payable at Par Through Federal Reserve System

O2967460O T053110594T 5V000V601O

INVOICE

5200916126

North Carolina Turnpike Authority
Attn: Leslie Schuck
5400 Glenwood Avenue, Suite 400
Raleigh, NC 27612

August 4, 2010
Invoice - HS-PH1-1
Job - 711-SC02-065
GL - 02-902-711-430065

#63-25121

V-17096

Carolina Heelsplitter Conservation Bank:

	Units	Cost Per Unit	Invoice Amount
Item 1 - Carolina Heelsplitter Mussel Credits	25 0000	$ 6,000 00	$ 150,000 00
TOTALS			$ 150,000 00

Kindly submit a check in the amount of **$150,000.00** for **25 0000 Carolina Heelsplitter Mussel Credits**

Please make check payable to

Environmental Banc & Exchange, LLC
10055 Red Run Blvd., Ste. 130
Owings Mills, MD 21117

ok Dwj

559100003.

Gaston 34922 1.TA1 0
Monroe 34533 1 TA1 150,000.00
Triangle Pkwy 39942 1.TA1 0
Cape Fear 40114 1 TA1 0
Mid Currituck 34470 1.TA1 0
Western Wake 35520.1 TA1 0

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

BEVERLY EAVES PERDUE
GOVERNOR

EUGENE A. CONTI, JR.
SECRETARY

REQUEST FOR COMMODITY/SERVICE PROCUREMENT

V-17096.

DATE: August 12, 2010

(Choose One)

TO: State Purchase & Contract Office ☒
Statewide IT Procurement Office ☐

FROM: Eugene A. Conti, Jr.
NCDOT Secretary

THRU: NCDOT Using Agency: North Carolina Turnpike Authority

Requestor: Steve DeWitt

Requested Commodity/Service: Carolina Heelsplitter Mussel Credits – 25 credits @ $6,000 each

Justification of Procurement: We have received the approval the US Department of the Interior Fish and Wildlife Service for our proposed conservation measures with regards to the Monroe connector/Bypass project – please see attached letter.

Source of Funding: Monroe Connector/Bypass – 34533.1 TA1

Requested Amount: $ 150,000.00

Comments: _____

OK
GV
8Sept10

MAILING ADDRESS:
NC DEPARTMENT OF TRANSPORTATION
PURCHASING SECTION
1510 MAIL SERVICE CENTER
RALEIGH, NC 27699-1510

TELEPHONE: 919 733-7101
FAX 919-733-8743

WEBSITE: WWW.NCDOT.GOV

LOCATION:
401 OBERLIN ROAD
SUITE 250
RALEIGH, NC 27605

STATE OF NORTH CAROLINA
TURNPIKE AUTHORITY

BEVERLY E PERDUE
GOVERNOR

1578 MAIL SERVICE CENTER, RALEIGH, N C 27699-1578

DAVID W. JOYNER
EXECUTIVE DIRECTOR

Memorandum

To: File

From: Christy Shumate, AICP – NCTA-GEC

Subject: Conservation Measures for Carolina Heelsplitter Related to the Monroe Connector/Bypass Project

Date: May 25, 2010

The purpose of this memo is to document NCTA's decision process with regards to proposed conservation measures for the federally-endangered Carolina heelsplitter related to the Monroe Connector/Bypass project.

During preparation of the Biological Assessment, NCTA, FHWA, and consultants discussed proposing conservation measures to support the "May Affect, Not Likely to Adversely Affect" conclusion for the Carolina heelsplitter. Conservation measures considered included:

- Limitations on construction-related activities within the Goose Creek and Sixmile Creek watersheds.
- Stormwater improvement projects in the Goose Creek watershed.

A draft Biological Assessment was submitted to USFWS for informal review and discussion on April 19, 2010. No conservation measures were proposed in the draft document. NCTA opted not to propose anything, but instead discuss with USFWS following their review of the draft document. USFWS provided comments on the draft Biological Assessment via email on May 11, 2010. These included the following comment:

> *"Based on the conclusion on page 62, specifically, "... levels of uncertainty inherent in ICE analyses, a "No Effect" determination cannot be concluded". Given the current status of the Carolina heelsplitter and its habitat within the Goose, Duck and Sixmile Creek watersheds, any effects resulting from these uncertainties could be significant to the Carolina heelsplitter. Also, Section 7(a)(1) of the Endangered Species Act requires federal agencies to go beyond just avoiding or minimizing adverse effects to federally-listed species by utilizing their authorities to further the purposes of the Act by carrying programs for the conservation of listed species. Accordingly, we believe that some form of conservation for heelsplitter should be considered to address this uncertainty. We would be happy to meet to discuss conservation banking opportunities or other possibilities for conservation."*

In a phone conversation with USFWS representatives (Marella Buncick, Alan Ratzclaff, John Fridell) on May 14, 2010 at 1:00 PM, USFWS indicated their preferred conservation measure would be a monetary contribution to the Carolina Heelsplitter Conservation Bank. The mitigation bank is located in the Flat Creek watershed in Lancaster County, South Carolina and is managed by EBX. This watershed contains the most viable population of heelsplitter mussels. A monetary contribution could be used to

NORTH CAROLINA TURNPIKE AUTHORITY
TELEPHONE 919-571-3000 FAX 919-571-3015

acquire additional easements within the watershed or for restoration or research within the existing bank. USFWS did not indicate an appropriate amount for this contribution.

Bruce Ellis, NCDOT-NEU, in a phone conversation on May 17, 2010, noted that NCDOT would support a monetary contribution to the Conservation Bank. Although the bank is out of state, it offers the best protection for the species as a whole. Mr. Ellis also stated that NCDOT has been funding water quality monitoring gauges in Goose and Waxhaw Creeks through a contract with USGS. The contract expires in June 2010, and Mr. Ellis suggested that the NCTA renew this contract as part of the Monroe Connector/Bypass project. He estimated the cost to be approximately $10,000-12,000 per year for 5 years for a total of $50,000-60,000.

In determining an appropriate amount for a monetary contribution to the Conservation Bank, NCTA considered direct and indirect impacts in Goose and Sixmile Creek watersheds from the project, direct impacts in other watersheds, average land value in Lancaster County, South Carolina, and the Bank's credit pricing schedule, as follows:

- The project does not have direct impacts in Goose Creek or Sixmile Creek watersheds. Based on Baker's Indirect and Cumulative Effects Quantitative Analysis (April 2010), the project does not contribute indirect effects to these watersheds.
- The project would result in approximately 23,083 linear feet of stream impacts (10,353 linear feet perennial and 12,729 linear feet intermittent) and 8.1 acres of wetlands.
- Average cost of undeveloped land in Lancaster County, South Carolina was estimated based on a web search of acreage for sale (see summary in Attachment). This cost is estimated to be $4,530 per acre.
- The Conservation Bank offers credits for impacts to riparian buffers and impervious surface creation. The price per credit is $6,000 (see Attachment).

The following assumptions were used to determine a reasonable number of credits that the project might require (if in a protected watershed). These assumptions were used to provide an estimate of an appropriate monetary contribution only – the project does not require purchase of any credits. Based on the anticipated direct impacts of the project (see assumptions in Attachment), approximately 25 credits would be appropriate. At a cost of $6,000, this would result in a total contribution of $150,000 to the Bank.

The Biological Assessment with request for concurrence on its biological conclusions was submitted to USFWS on May 25, 2010 for informal consultation under Section 7 of the Endangered Species Act. A response is expected from USFWS by June 30, 2010. The Biological Assessment included the following conservation measures to further ensure a conservative approach to the analysis of the project's impacts on this species and its habitat. (Section 8.6):

- if any construction staging, storage, refueling, borrow pit or spoil areas are to occur in the Goose Creek and Sixmile Creek watersheds, the NCTA will coordinate with the NCDOT DEO, USFWS, and the contractor to develop BMPs for each site to avoid and minimize the potential for adverse effects. Additionally, NCTA will follow NCDOT's Design Standards in Sensitive Watersheds for implementing erosion and sediment control BMPs along the entire project.
- NCTA is proposing to renew the funding of the USGS monitoring station at the US 601 crossing of Goose Creek in Union County.
- NCTA is proposing to provide funding to the Carolina Heelsplitter Conservation Bank in the Flat Creek watershed in Lancaster County, South Carolina in the amount of $150,000 to support ongoing research and surveying efforts, as well as protect, manage, and monitor land in the conservation bank.

ATTACHMENT

Current land prices in Lancaster County, South Carolina (May 2010) based on real estate listings (http://www.landwatch.com/South_Carolina_land_for_sale/Lancaster_County)

Acres	Asking Price	Avg Cost/Acre
140 @	399000 =	$2850
2.1 @	19,500 =	$9285
23.7 @	105000 =	$4430
76 @	201400 =	$2650
107 @	262150 =	$2450
1 @	8000 =	$8000
99 @	262350 =	$2650
3 @	4000 =	$1333
19 @	79000 =	$4158
5.2 @	39000 =	$7500

AVERAGE = $4,530/ac

Conservation Bank Credits

FWS Mitigation Credit Requirements per Acre	Credit:Impact Ratios Perennial	Intermittent
0-50' buffer encroachment	10 1	5 1
50'-100' buffer encroachment	5.1	2 1
100'-200' buffer encroachment	2.1	N/A
impervious surface creation	1 75·1	N/A

Using 5:1 ratio for perennial streams and assuming an average width of 10 feet:
10,353 feet x 10 feet / 43560 sf/ac x 5 = 11.5 credits

Using 2:1 ratio for intermittent streams and assuming an average width of 10 feet:
12,729 feet x 10 feet / 43560 sf/ac x 2 = 5.5 credits

Using 1:1 ratio for wetlands
8 ac = 8 credits

TOTAL = 25 credits

Environmental Banc & Exchange

OUR WORK

The Carolina Heelsplitter Conservation Bank

The Carolina Heelsplitter Conservation Bank is dedicated to preserving, enhancing, and restoring key parcels of land in target watersheds with viable populations of the Federally Endangered Carolina heelsplitter mussel. The Bank offers a creative, landscape scale solution to the preservation and recovery of this rare and endangered mussel species.

The service area of the Bank includes watersheds with known populations of the Carolina heelsplitter mussel in North and South Carolina. Credits may be purchased from the Bank and used to offset mitigation requirements associated with the Carolina heelsplitter mussel with the approval of federal, state and/or local agencies.

Regulatory considerations

A landowner or developer may need to mitigate for direct or indirect impacts to the Carolina heelsplitter mussel, or associated habitat, if one of the following applies to the project:

- Section 7 and Section 10 of the Endangered Species Act provides the U.S. Fish & Wildlife Service jurisdiction on projects which involve Federal monies, projects requiring a Federal permit, (such as a 404 permit from the U.S. Army Corp of Engineers), or projects covered by a Habitat Conservation Plan
- For projects in South Carolina within the Six Mile Creek watershed, Lancaster County Ordinance #963 (amended version of Ordinance #901) specifies mitigation requirements for the creation of impervious surface and/or impacts to riparian buffers.
- Situations where a project sponsor desires to eliminate the potential for liability from future impacts through a consultation with the U.S. Fish & Wildlife Service.
- State, county or local regulations and/or ordinances which may require mitigation for projects located in watersheds with known Carolina heelsplitter populations.

To discuss how the Bank can assist you in meeting your compensatory requirements, please contact Randy Wilgis, randy@ebxusa.com
803-432-4890 (ofc)
410-236-5123 (cell)

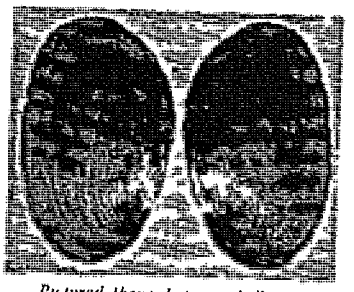
We are glad to share our experiences in working out collaborative Heelsplitter mitigation solutions between local governments, regulatory agencies, and developers. Contact Randy Wilgis, randy@ebxusa.com

The Carolina Heelsplitter Mussel is Unique and Rare

- Historically, the Carolina heelsplitter was estimated to have a distribution covering much of the Piedmont sections of the Savannah, Santee-Cooper, and Pee Dee river basins.
- Today the endemic Carolina heelsplitter mussel species is limited to a small area of the Piedmont within North and South Carolina,

with small populations remaining in only 10 creek or headwater river watersheds.

- Habitat destruction due to silviculture, development, and agriculture has reduced and fragmented habitat.
- The Carolina heelsplitter historically served an important function in maintaining water quality in North and South Carolina It was also an important component within aquatic food webs.



Pictured Above: Exterior shell of the Carolina Heelsplitter

Conservation Bank Property is High-Quality Habitat

The initial phase of the Carolina Heelsplitter Conservation Bank encompasses approximately 810 acres of land and is situated adjacent to the Forty Acre Rock Heritage Preserve in Lancaster County. This property is located within the Flat Creek watershed, which has one of the most viable populations of the Carolina heelsplitter in the Carolinas. The Bank includes approximately 400 acres of riparian buffers which protect three major tributaries feeding into Flat Creek, and 25 acres of high quality wetlands The Bank will incorporate a trust fund to support the ongoing research and surveying efforts to provide long term protection and re-establishment of the endangered Carolina heelsplitter, along with an endowment fund to protect, manage and monitor the land in perpetuity.

Carolina Heelsplitter Credit Purchasing Process

Credit calculation ratios for projects in the Six Mile Creek watershed in Lancaster County, SC can be found in County Ordinance #963. Per the ordinance, credits need to be acquired prior to release of the grading permit.

If your project is in North Carolina or in South Carolina outside of the Six Mile Creek watershed, the Bank will have a service area approved by U.S. Fish & Wildlife Service encompassing all of North and South Carolina but the use of credits from the Bank is subject to approval by state and local regulatory agencies.

To discuss how the Carolina Heelsplitter Conservation Bank can assist you in meeting your Carolina heelsplitter compensatory requirements, please contact Randy Wilgis with the Environmental Banc & Exchange. Randy can be reached at:

803-432-4890 (ofc)
410-236-5123 (cell)
randy@ebxusa.com

APPENDIX D
ERRATA

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APPENDIX D – DRAFT SUPPLEMENTAL FINAL ENVIRONMENTAL IMPACT STATEMENT ERRATA

Appendix D includes corrections and clarifications to the November 2013 *Draft Supplemental Final Environmental Impact Statement* (EIS).

SECTION 1 – PURPOSE AND NEED

In Section 1.1.1 of the *Draft Supplemental Final EIS* (Evaluation of Need for Proposed Action), the second full paragraph on page 1-2 states that "…NCDOT designated the US 74 corridor as a Strategic Highway Corridor (SHC) and it is also designated as part of the North Carolina Intrastate System. Consistent with local planning documents, these state designations call for this corridor to serve high-speed regional travel." As footnoted in Section 1.1.1 of this *Final Supplemental Final EIS*, the North Carolina Intrastate System (defined in NC General Statutes 136-179) was repealed in July 2013 by NC Session Law 2013-183 as part of the Strategic Prioritization Funding Plan for Transportation Investments. This footnote should also have been included in Section 1.1.1, Section 1.1.2, and Section 1.2.3 of the *Draft Supplemental Final EIS*.

In Section 1.1.2 of the *Draft Supplemental Final EIS*, the stated purpose of the project is to "improve mobility and capacity within the project study area by providing a facility for the US 74 corridor from near I-485 in Mecklenburg County to between the towns of Wingate and Marshville in Union County that allows for high-speed regional travel consistent with the designations of the North Carolina SHC program and the North Carolina Intrastate System, while maintaining access to properties along existing US 74." A note should have been included here to acknowledge that the North Carolina Intrastate System was repealed. This has been corrected with the addition of a reference to footnote #2 in Section 1.1.2 of this *Final Supplemental Final EIS*.

The North Carolina Intrastate System is also referenced in Section 1.2.3 of the *Draft Supplemental Final EIS*, Transportation and Land Use Plans, which states that the proposed action is included in local plans "in a manner that is consistent with the SHC and North Carolina Intrastate System visions for the corridor." This sentence should have been revised to remove the reference to the North Carolina Intrastate System since this designation was repealed prior to publication of the *Draft Supplemental Final EIS*.

The change in legislation does not change the substantive statements of the project purpose and need, nor does it affect the alternatives screening process. Although the Intrastate System legislation was repealed, high-speed travel is still designated for the corridor in the NC SHC program. Therefore, the removal of the Intrastate System designation does not affect the purpose or the need for the project as presented in Section 1 of the *Draft Supplemental Final EIS*. Because the purpose and need for the project does not change, the alternatives screening process described in Section 2 of the *Draft Supplemental Final EIS* therefore remains valid.

SECTION 1.1.1 – EVALUATION OF NEED FOR PROPOSED ACTION

The language in the second paragraph of Section 1.1.1 of the *Draft Supplemental Final EIS* should have been updated to reflect the fact that although Union County has continued to be *one of* the fastest growing counties in the state since 2010, it is not *the* fastest. In addition, this paragraph noted that Union County is the only county adjacent to Mecklenburg County that

does not have a high-speed interstate-type facility connecting it to Mecklenburg County. This statement fails to acknowledge that Lincoln County, NC and Lancaster County, SC share a small portion of their borders with Mecklenburg County but do not have high-speed interstate-type facilities connecting them with Mecklenburg County.

The corrected paragraph is as follows:

> US 74 is the major east-west route connecting the Charlotte region, a major population center and freight distribution point, to the North Carolina Coast and the port at Wilmington (North Carolina's largest port). In addition, US 74 is the primary transportation connection between Union County, the fastest growing county in North Carolina between 2000 and 2010, and Mecklenburg County/City of Charlotte, the economic hub of the region. Although Union County is one of the fastest growing count~~y~~ies in the State, it is the only county ~~adjacent to~~ having a major border with Mecklenburg County that does not have a high-speed interstate-type facility connecting it to Mecklenburg County.

It should also be noted that the statement about Union County not having a high-speed interstate-type facility connecting it to Mecklenburg County was included for the purpose of showing that growth in Union County is all the more notable because it occurred without such a facility. The statement was not an attempt to add equity among counties as another need for the project.

SECTION 1.2.4 – ROADWAY CONDITIONS AND OPERATIONS

Table 1-2 and Table 1-3 of the *Draft Supplemental Final EIS* present peak hour travel speeds along US 74 based on a review on INRIX data. Some of the travel speeds presented in the tables were incorrect due to an error in the spreadsheet calculation used to determine weighted average speeds. The travel speeds shown on Exhibits 1-1, 1-2, and 1-3 of the *Draft Supplemental Final EIS* are correct. Corrected Tables 1-2 and 1-3 are provided below.

CORRECTED TABLE 1-2: Peak Hour Speeds Along US 74 Eastbound (2011, 2012, August 2013)

Approx. Length (miles)	Eastbound US 74 Segments (from west to east)	Speed Limit (mph)	Weighted Avg Speed Limit to Match INRIX Segments (mph)	2011 Peak Hour Avg Speed (mph)		2012 Peak Hour Avg Speed (mph)		August 2013 Peak Hour Avg Speed (mph)	
				Lunch	PM	Lunch	PM	Lunch	PM
8.2	I-485 to Fowler Secrest Road (SR 1754)	55	55	~~46~~45	~~40~~42	~~45~~46	~~40~~42	~~45~~46	40
5.5	Fowler Secrest Road to US 601 (Pageland Hwy) (*easternmost intersection of US 74 and US 601 east of Monroe*)	45	45	35	38	~~37~~36	~~39~~38	~~38~~37	~~38~~34
3.0	US 601 (Pageland Hwy) to east of Presson Road	55	46	~~47~~48	~~46~~47	48	47	49	48
0.2	East of Presson Road to Wingate City Limit	45							
1.4	Wingate City Limit to Old Highway 74 (SR 1740)	35							
0.7	Old Highway 74 (SR 1740) to Olde Country Lane	45							
1.5	Olde Country Lane to 0.3 mile west of Marshville Town Limit	55							
0.3	0.3 miles west of Marshville Town Limit to Marshville Town Limit	45							
2.5	Within Marshville Town Limit	35							
23.3	**Corridor Weighted Average Speed (mph)**		**49**	**44**	**~~42~~43**	**~~44~~45**	**43**	**~~45~~46**	**~~43~~42**
Comparison - Average Travel Speeds to Speed Limits									
I-485 to Fowler Secrest Road (SR 1754)			-9 to -15 mph below speed limit						
Fowler Secrest Road to US 601 (Pageland Hwy)			~~-6~~7 to ~~-10~~11 mph below speed limit						
US 601 (Pageland Hwy) to within Marshville			+3 to ~~0~~+1 mph about/slightly above speed limit						
OVERALL CORRIDOR			**~~-4~~3 to -7 mph below speed limit**						

Source: INRIX, Inc.

CORRECTED TABLE 1-3: Peak Hour Speeds Along US 74 Westbound (2011, 2012, August 2013)

Approx. Length (miles)	Eastbound US 74 Segments (from east to west)	Speed Limit (mph)	Weighted Avg Speed Limit to Match INRIX Segments (mph)	2011 Peak Hour Avg Speed (mph)		2012 Peak Hour Avg Speed (mph)		August 2013 Peak Hour Avg Speed (mph)	
				AM	PM	AM	PM	AM	PM
2.5	Within Marshville Town Limit	35	46	~~37~~46	~~38~~46	~~38~~47	~~39~~47	~~40~~48	~~41~~47
0.3	0.3 miles west of Marshville Town Limit to Marshville Town Limit	45							
1.5	Olde Country Lane to 0.3 mile west of Marshville Town Limit	55							
0.7	Old Highway 74 (SR 1740) to Olde Country Lane	45							
1.4	Wingate City Limit to Old Highway 74 (SR 1740)	35							
0.2	East of Presson Road to Wingate City Limit	45							
3.0	US 601 (Pageland Highway) to east of Presson Road	55							
5.5	Fowler Secrest Road to US 601 (Pageland Highway)	45	45	38	~~37~~35	~~39~~38	~~39~~38	~~39~~40	~~36~~33
8.2	I-485 to Fowler Secrest Road (SR 1754)	55	55	~~38~~41	~~43~~40	~~41~~43	~~44~~40	~~40~~43	~~42~~39
23.3	**Corridor Weighted Average Speed (mph)**		**49**	**~~37~~42**	**~~39~~41**	**~~39~~44**	**~~41~~42**	**~~40~~44**	**~~40~~41**

Comparison - Average Travel Speeds to Speed Limits		
Within Marshville to US 601 (Pageland Hwy)	~~-5~~+2 to ~~-9~~0 mph	~~below~~equal to/slightly above speed limit
US 601 (Pageland Hwy) to Fowler Secrest Road	~~-6~~5 to ~~-9~~12 mph	below speed limit
Fowler Secrest Road to I-485	-1~~1~~2 to -1~~7~~6 mph	below speed limit
OVERALL CORRIDOR	**~~-8~~5 to ~~-12~~8 mph**	**below speed limit**

Source: INRIX, Inc.

The corrected travel speeds shown in the tables above do not change any of the findings of the *Draft Supplemental Final EIS*. Eastbound US 74 weighted average travel speeds range from 42-46 mph (3-7 mph below weighted average speed limit), and westbound US 74 weighted average travel speeds range from 41-44 mph (5-8 mph below weighted average speed limit). All speeds along the corridor are still below the desired 50 miles per hour (mph).

In addition, the travel speed information presented in Section 1.2.4 of the *Draft Supplemental Final EIS* has been updated in Section 2.1 of the *Final Supplemental Final EIS* to include analysis of INRIX data from all of 2013, which was not available at the time of publication of the *Draft Supplemental Final EIS*. Review of the 2013 INRIX data confirms that the average peak hour travel speeds along US 74 are below 50 mph for all segments in both directions.

SECTION 3 – PREFERRED ALTERNATIVE

SECTION 3.3.3 – AVOIDANCE AND MINIMIZATION OF IMPACTS TO WATERS OF THE US

Table 3-2 of the *Draft Supplemental Final EIS* includes a column titled "Stream Impacts Requiring Mitigation." As described in Note 2 at the bottom of the table, mitigation requirements were based on the assumption that all perennial stream impacts require mitigation as well as any impacts to intermittent streams with NCDWQ stream ratings greater than 26. This table was originally included in the *Final EIS* for estimation purposes since final decisions with respect to mitigation had not been made by the regulatory agencies at that time. Following publication of the *Final EIS*, an acceptance letter was received from the NC Ecosystem Enhancement Program (EEP) dated June 24, 2010 (see Appendix C of this *Final Supplemental Final EIS*). The letter states that the EEP will provide compensatory mitigation for unavoidable stream impacts up to 23,083 linear feet. Therefore, the stream impacts requiring mitigation presented in Table 3-2 of the *Draft Supplemental Final EIS* should have been equivalent to the total stream impacts. This change would similarly affect all Detailed Study Alternatives (DSA). The following is a corrected Table 3-2:

TABLE 3-2: Changes in Jurisdictional Resource Impacts Since the Draft EIS

Impacts[1]	Perennial Streams (linear ft)	Intermittent Streams (linear ft)	Total Streams (linear ft)	Wetlands (acres)	Ponds (acres)	Stream Impacts Requiring Mitigation[2]
Impacts Reported in Draft EIS for DSA D	9,794	12,269	22,063	8.1	2.6	22,063~~12,550~~
Impacts for Preferred Alternative (no service roads)	9,205	12,389	21,594	8.0	3.1	21,594~~11,975~~
Add Service Road Impacts	+1,148	+341	+1,489	+0.1	+0.0	+1,489~~+1,260~~
TOTAL IMPACTS FOR PREFERRED ALTERNATIVE	10,353	12,729	23,083	8.1	3.1	23,083~~13,235~~
Change from Draft EIS to Preferred	+559	+460	+1,020	0	+0.5	+1,020~~+685~~

Source: *Natural Resources State Technical Report for the Monroe Connector/Bypass* (ESI, December 2008) with updated y-line and service road information provided October 2009.
Notes: [1]Impacts calculated based on slope stake limits plus a 40-foot buffer. [2]Based on assumption that all ~~perennial~~ stream impacts require mitigation ~~as well as any impacts to intermittent streams with NCDWQ stream ratings greater than 26~~.

SECTION 3.3.4 – COST ESTIMATES FOR THE PREFERRED ALTERNATIVE

The estimated environmental mitigation costs ($11.3 to $11.9 million) presented in Table 3-3 of the *Draft Supplemental Final EIS* were incorrect. The mitigation costs were calculated based on a 2:1 ratio for the intermittent streams, but did not include costs for mitigation of impacts to perennial streams. The mitigation costs should also have included mitigation for perennial streams at a 2:1 ratio. Corrected mitigation costs ($16.9 million) are provided in Table 2-1 of the *Final Supplemental Final EIS* and are based on the actual environmental mitigation costs paid for the project.

It should be noted that the cost estimates for the Preferred Alternative presented in Section 3.3.4 of the *Draft Supplemental Final EIS* ($898.0 million) were based on simply inflating the cost

estimates presented in Section 2.3.4 of the *Final EIS* ($802.0 million) to reflect a delay in the project opening date from December 2014 to October 2018. Following publication of the *Draft Supplemental Final EIS*, NCDOT made adjustments to the cost estimates to reflect the design-build price proposal as well as actual costs paid to date for the project to develop an updated estimate of project costs. As stated in Section 2.4 of the *Final Supplemental Final EIS*, the updated total project cost is $838.6 million with an 70 percent confidence level (70 percent probability the cost will be less than or equal to this cost).

SECTION 3.4 – SUMMARY OF IMPACTS FROM THE PREFERRED ALTERNATIVE

The fourth bullet in the bulleted list of conclusions summarized from the updated quantitative ICE analysis presented on page 3-18 of the *Draft Supplemental Final EIS* contains an incorrect number. The following is the corrected bullet:

- The indirect land use effects are modest, totaling about ~~2,300~~ 2,100 acres of additional development, an increase of less than 2 percent over the No-Build Scenario and an increase in development of about 1 percent of the total land area within the study area.

The indirect land use effects were reported correctly on page 71 (Section 5.3) of the *Indirect and Cumulative Effects Quantitative Analysis Update* (ICE Update) (Michael Baker Engineering, Inc., November 2013). However, in the conclusions on page 90 (Section 5.10) and in the Executive Summary on page ix (Section E.7), the incorrect acreage (2,300) was reported. The conclusions from the ICE Update were repeated in part in Section 3.4 of the *Draft Supplemental Final EIS*, and therefore the incorrect acreage was inadvertently reported in the *Draft Supplemental Final EIS*. The error in the ICE Update was typographic in nature and resulted from a failure to update numbers in all sections of the text during the final rounds of updating the report. All data reported in the tables in the ICE Update is accurate and the typographic error does not affect the conclusions regarding impacts.

APPENDIX E

TECHNICAL MEMORANDA

E-1. INRIX US 74 Corridor Travel Speeds Memo (April 2014)

E-2. Traffic Forecast Memo (May 2014)

E-3. Review of New CRTPO Socioeconomic Projections (May 2014)

E-4. Review of the report titled*, Review of Traffic Forecasting: Monroe Connector/Bypass Draft Supplemental Final EIS*, *November 2013,* prepared by The Hartgen Group for the Southern Environmental Law Center

E-5. Appold Letter (May 29, 1013)

E-6. MUMPO letter to Kym Hunter (April 16, 2013)

E-7. FHWA Conformity Determination for CRTPO 2040 MTP (May 2, 2014)

E-8. FHWA Memos

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APPENDIX E-1

INRIX US 74 Corridor Travel Speeds Memo (April 2014)

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

Draft Memorandum

To: Jennifer Harris, PE

From: Bradley Reynolds, PE, PTOE

Subject: INRIX US 74 Corridor Travel Speeds

Date: April 1, 2014

Project #: R-3329, R-2559

NORTH CAROLINA PROFESSIONAL SEAL 34318 ENGINEER BRADLEY REYNOLDS

4-1-14

At the request of the North Carolina Turnpike Authority (NCTA), HNTB evaluated historical travel speeds along the US 74 corridor using INRIX data for the same corridor limits and time periods. This memorandum describes the INRIX data and uses this data to compare historical travel speed conditions along US 74.

Travel Time Corridor

The US 74 corridor was evaluated from I-485 west of Stallings Road to Elm Street in Marshville. The corridor is approximately 22.5 miles in length and consists of 30 signalized intersections. The travel time study corridor is shown on **Figures 1-6**.

INRIX Data

INRIX provides real-time, historical and predictive traffic flow information based on collected data. For the purposes of this analysis, INRIX data was collected for US 74 eastbound and westbound for all of 2011, 2012, and 2013 (January 1st thru December 31st) for each Tuesday, Wednesday and Thursday for 24-hour periods separated into 1-hour intervals. Each of the three years of INRIX data was compiled to determine average travel speeds throughout an entire 24-hour period for weekday conditions during AM, lunch, and PM peak and off-peak conditions.

Review of INRIX Data

The field collected INRIX data demonstrates the inability to achieve a 50 mph operating speed along the studied corridor during peak traffic periods under existing conditions.

Table 1 compares the eastbound average operating speed during the AM, lunch and PM peak hours for 2011, 2012, and 2013 to the posted speed limit. In order for the speed limit segments to match up with the data segments provided by INRIX, a weighted average based on distance was calculated for the posted speed limits between US-601 (Pageland Highway) and the final 35 mph segment within the Marshville town limit. **Table 1** shows that the corridor segment from I-485 to US-601 (Pageland Highway) operates significantly below the posted speed. The segment from within the Marshville town limit to US-601 (Pageland Highway) operates at or slightly above the posted speed limit. Overall, corridor travel speeds are limited to less than 50 mph.

Table 2 compares the westbound average operating speed during the AM, lunch and PM peak hours for 2011, 2012, and 2013 to the posted speed limit. In order for the speed limit segments to match up with the data segments provided by INRIX, a weighted average based on distance had to be calculated for the posted speed limits between US-601 (Pageland Highway) and the final 35 mph

segment within the Marshville town limit. **Table 2** shows that the entire westbound corridor operates significantly below the posted speed. **Figures 1-6** display the average operating speeds for US 74 eastbound and westbound for AM, lunch and PM peak hours in 2013. **Tables 3-5** show INRIX average speed data along the US 74 eastbound and westbound corridor per segment and 24-hour period for 2011, 2012 and 2013.

Conclusions

The INRIX data demonstrate that localized spot improvements along the US 74 corridor over the last few years have not improved the overall corridor travel speeds. In fact, the average corridor travel speeds have remained relatively constant from 2011 to 2012 to 2013, within +/- 1 to 2 mph. The US 74 facility still experiences congestion during peak periods of the day, and the corridor does not currently operate as a high-speed facility (average speed of 50 mph or greater).

Based on the review of INRIX data, at no time during the day are US 74 average corridor speeds equal to or exceeding 50 mph. US 74 corridor average hourly travel speeds, during peak and off-peak conditions throughout a 24-hour period over a three-year period from January 1st, 2011 to December 31st, 2013, are limited to less than 50 mph. This data includes off-peak periods, free-flow conditions with very little to no congestion, and recent US 74 improvements along the corridor.

Table 1. US 74 Eastbound Peak Period Speeds

Apprx. Segment Length (miles)	Eastbound US 74 Segment from West to East	Speed Limit (mph)	Wtd. Speed Limit to match INRIX (mph)	2011 Peak Hour Speed (mph)			2012 Peak Hour Speed (mph)			2013 Peak Hour Speed (mph)		
				AM	Lunch	PM	AM	Lunch	PM	AM	Lunch	PM
8.2	I-485 to Fowler Secrest Road (SR 1754)	55	55	45	45	42	48	46	42	47	46	41
5.5	Fowler Secrest Road to US 601 (Pageland Highway)	45	45	39	35	38	41	36	38	40	37	35
3	US 601 (Pageland Highway) to east of Presson Road	55	46	48	48	47	48	48	47	49	48	47
0.2	East of Presson Road to Wingate City Limit	45										
1.4	Wingate City Limit to Old Highway 74 (SR 1740)	35										
0.7	Old Highway 74 (SR 1740) to Olde Country Lane	45										
1.5	Olde Country Lane to 0.3 mile west of Marshville Town Limit	55										
0.3	0.3 miles west of Marshville Town Limit to Marshville Town Limit	45										
2.5	Within Marshville Town Limit	35										
23.3	Corridor Weighted Average Speed	49	49	45	44	43	47	45	43	46	45	42

Table 2. US 74 Westbound Peak Period Speeds

Apprx. Segment Length (miles)	Westbound US 74 Segment from East to West	Speed Limit (mph)	Wtd. Speed Limit to match INRIX (mph)	2011 Peak Hour Speed (mph)			2012 Peak Hour Speed (mph)			2013 Peak Hour Speed (mph)		
				AM	Lunch	PM	AM	Lunch	PM	AM	Lunch	PM
2.5	Within Marshville Town Limit	35	46	46	46	46	47	47	47	47	47	47
0.3	0.3 miles west of Marshville Town Limit to Marshville Town Limit	45										
1.5	Olde Country Lane to 0.3 mile west of Marshville Town Limit	55										
0.7	Old Highway 74 (SR 1740) to Olde Country Lane	45										
1.4	Wingate City Limit to Old Highway 74 (SR 1740)	35										
0.2	East of Presson Road to Wingate City Limit	45										
3	US 601 (Pageland Highway) to east of Presson Road	55										
5.5	Fowler Secrest Road to US 601 (Pageland Highway)	45	45	38	35	35	38	35	38	39	36	35
8.2	I-485 to Fowler Secrest Road (SR 1754)	55	55	41	43	40	43	45	40	41	44	39
23.3	Corridor Weighted Average Speed	49	49	42	43	41	44	44	42	43	44	41

Figure 1. US 74 Eastbound 2013 AM Peak Period Speeds

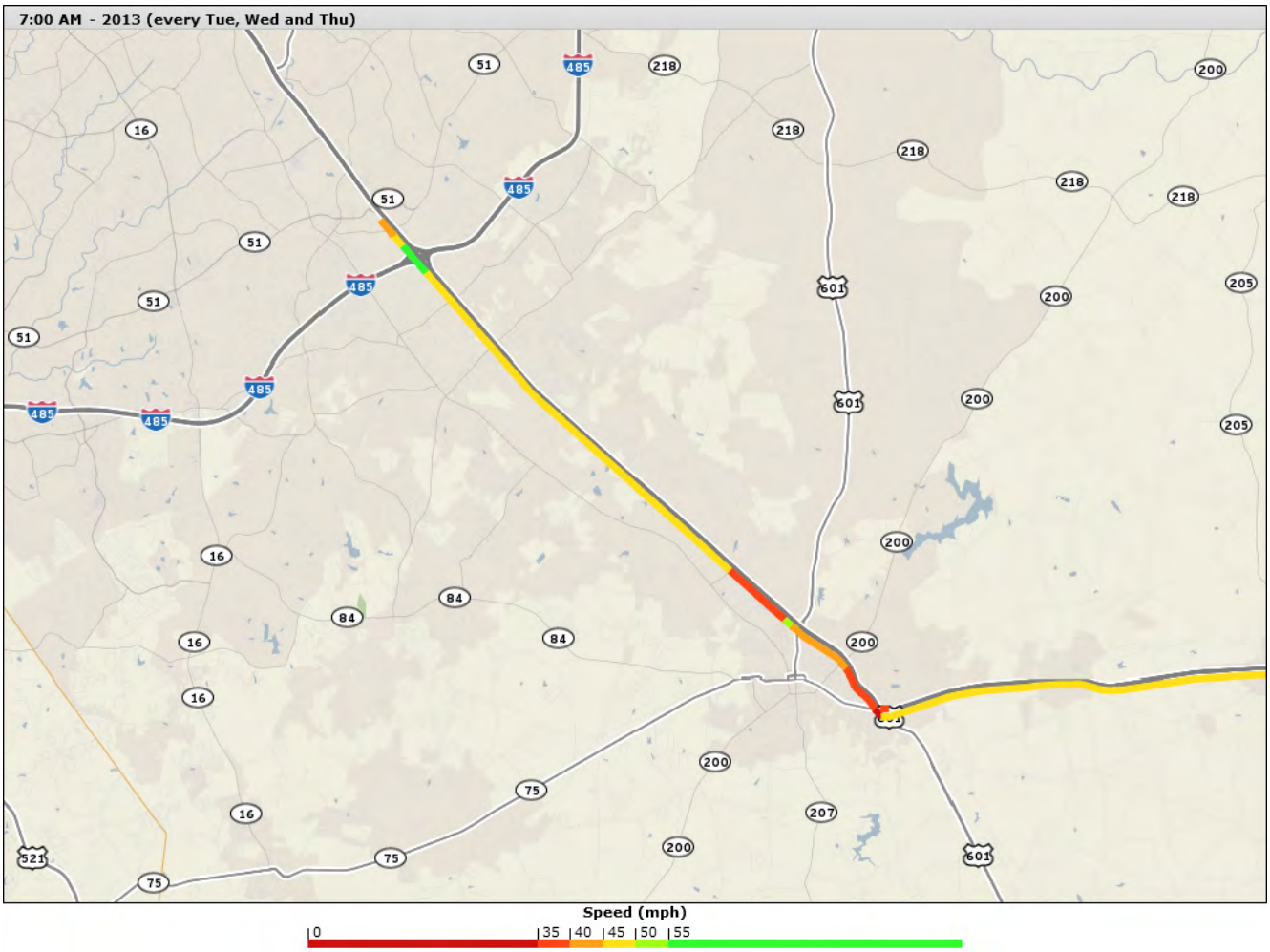

Figure 2. US 74 Eastbound 2013 Lunch Peak Period Speeds

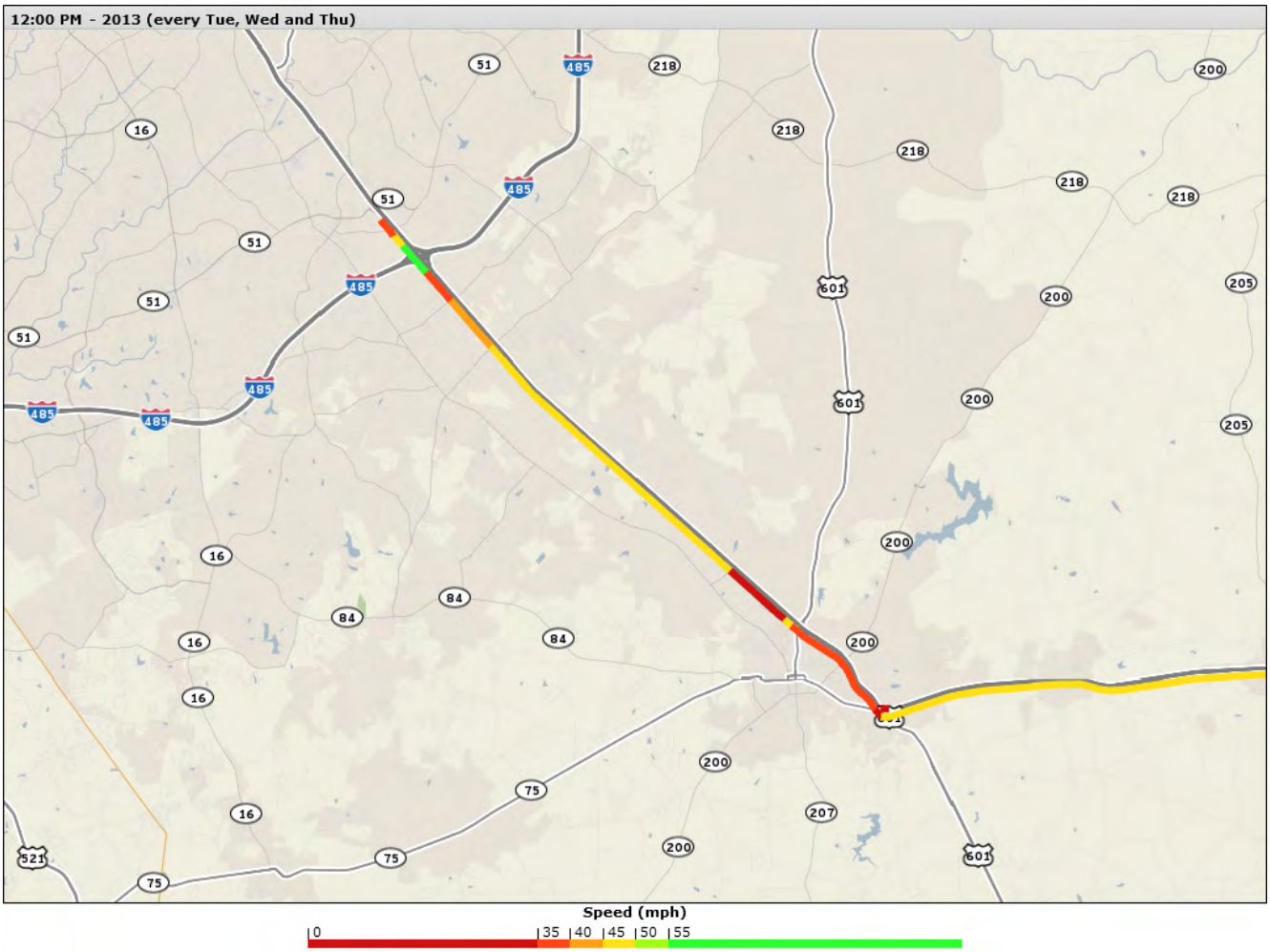

Figure 3. US 74 Eastbound 2013 PM Peak Period Speeds

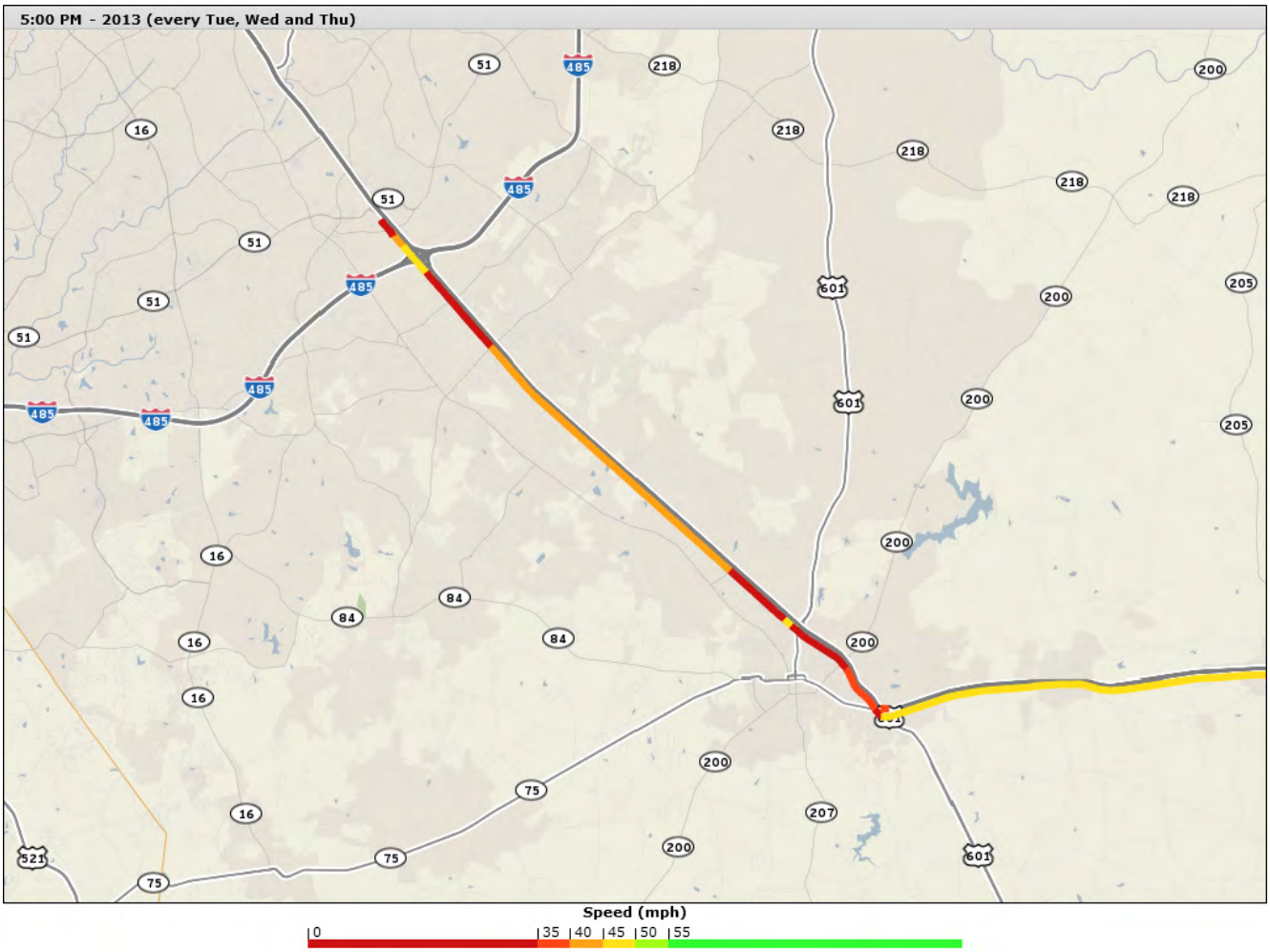

Figure 4. US 74 Westbound 2013 AM Peak Period Speeds

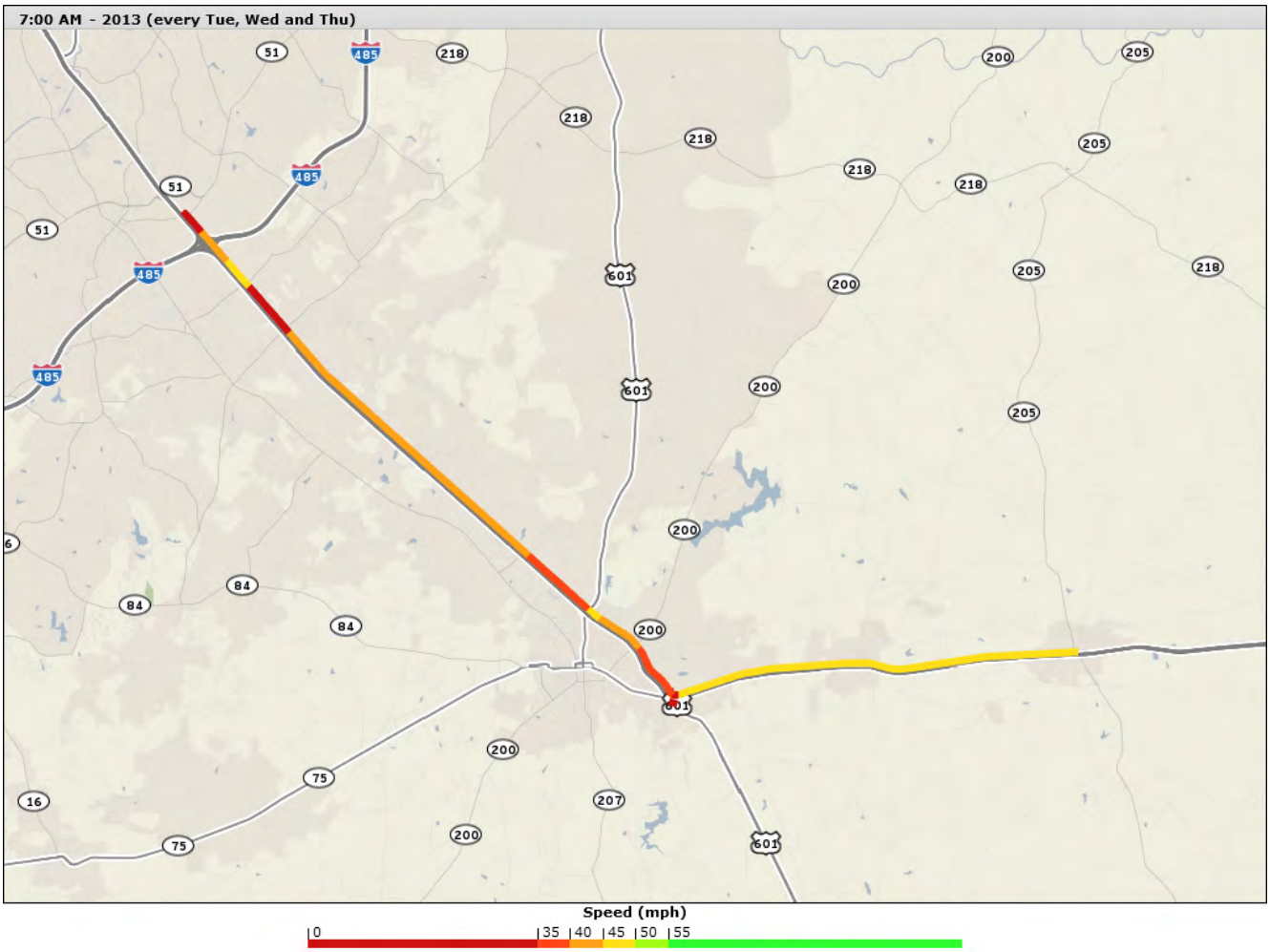

Figure 5. US 74 Westbound 2013 Lunch Peak Period Speeds

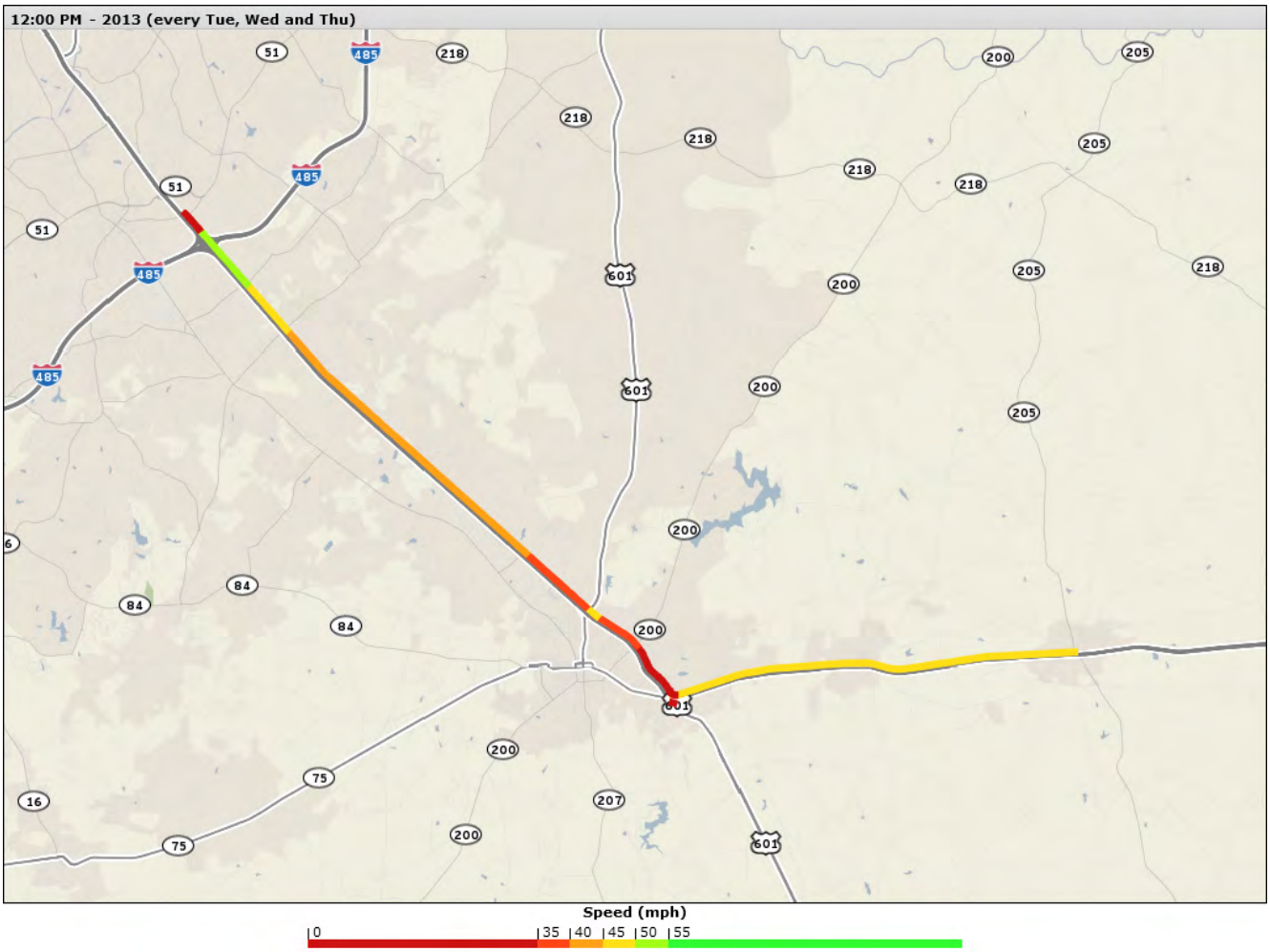

Figure 6. US 74 Westbound 2013 PM Peak Period Speeds

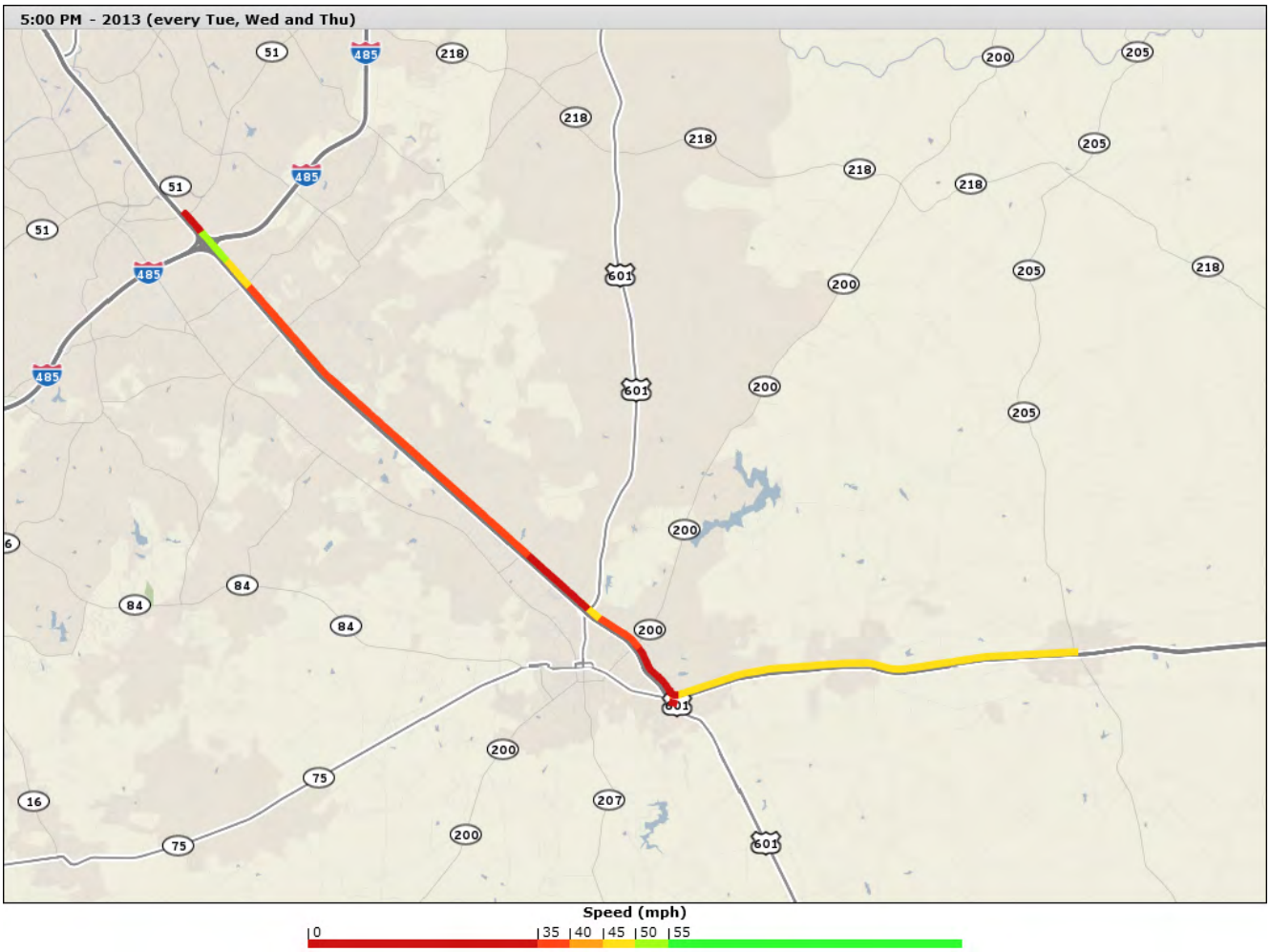

Table 3 - US 74 Corridor INRIX Average Speed Data

2011, Tuesday - Thursday

Average Speed for US 74 from I-485 to NC 205 (Elm St.)
Eastbound US 74 Corridor Average Speed

TMC CODE	SEGMENT NAME	LENGTH (MILES)	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
125+07488	NC-205/Elm St	8.54	49	49	49	49	49	48	48	48	48	48	48	48	48	47	47	47	47	47	47	47	47	47	48	49
125P05822	US-601/Pageland Hwy	0.02	36	37	36	37	38	36	33	33	32	30	29	29	28	27	27	33	35	36	35	33	32	32	35	36
125+05822	US-601/Pageland Hwy	0.12	35	35	35	36	37	34	32	32	32	29	28	27	26	26	26	32	34	35	34	32	32	31	33	34
125+07487	E Franklin St	1.21	40	40	41	41	41	39	38	38	38	38	38	37	36	36	36	38	40	40	40	40	37	36	39	40
125+07486	NC-200/Morgan Mill Rd	1.11	42	42	42	43	43	42	40	38	38	40	41	40	38	38	39	38	39	38	37	38	37	38	41	41
125P05821	US-601/NC-200/Concord Hwy/Skyway Dr	0.35	49	50	50	50	50	50	50	50	50	51	51	50	50	50	50	50	50	50	50	49	49	49	49	49
125+05821	US-601/NC-200/Concord Hwy/Skyway Dr	1.58	43	44	44	44	44	43	41	38	36	35	34	32	29	28	30	33	34	33	34	35	37	37	41	42
125+05820	Roland Dr	6.86	49	49	49	49	49	48	46	43	43	47	48	46	45	45	45	46	46	45	45	45	45	45	47	48
125+05819	Indian Trail Fairview Rd	1.27	51	52	52	52	52	51	48	46	45	47	46	46	45	44	44	40	38	36	36	42	46	46	49	50
125+05818	Stallings Rd	0.75	52	52	52	52	53	51	48	46	44	41	40	39	38	37	36	32	28	20	28	39	46	48	51	52
125P05817	I-485	0.76	56	56	56	56	56	56	57	57	57	57	57	57	56	56	56	56	55	52	54	54	55	54	56	56
125+05817	I-485	0.44	47	48	48	48	49	47	47	48	46	46	47	47	46	45	45	46	46	44	45	44	44	45	47	48
125+05816	Matthews Mint Hill Rd	0.26	45	46	45	45	46	44	43	42	41	41	42	41	39	39	38	38	37	34	38	38	40	41	44	45
	Avg speed US-601 to NC 205		49	49	49	49	49	48	48	48	48	48	48	48	48	47	47	47	47	47	47	47	47	47	48	49
	Avg speed I-485 to Fowler Secrest		50	50	50	50	50	49	47	45	44	47	48	46	45	45	45	45	44	42	43	45	46	46	48	49
	Avg speed Fowler Secrest to US-601		42	43	43	43	43	42	40	39	38	38	38	37	35	34	35	37	38	38	38	38	38	38	41	42
	Average US 74 EB Corridor Speed (mph)		48	48	48	48	48	47	46	45	45	46	46	45	44	44	44	44	44	43	44	44	45	45	47	48

Average Speed for US 74 from NC 205 (Elm St.) to I-485
Westbound US 74 Corridor Average Speed

TMC CODE	SEGMENT NAME	LENGTH (MILES)	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
125-05816	Matthews Mint Hill Rd	0.43	44	44	46	44	46	44	39	24	24	31	34	32	29	31	32	32	32	31	33	36	38	39	44	44
125N05817	I-485	0.91	55	55	55	55	55	55	54	44	44	54	55	55	55	55	55	55	55	54	54	53	53	53	55	55
125-05817	I-485	0.61	50	50	50	50	50	51	49	44	45	49	49	49	48	49	49	48	48	46	48	47	47	47	49	49
125-05818	Stallings Rd	1.26	48	48	48	49	49	48	44	32	40	45	46	46	45	45	45	44	43	38	42	44	45	45	47	48
125-05819	Indian Trail Fairview Rd	6.86	49	49	49	49	49	49	45	43	44	45	45	44	42	43	42	41	40	39	41	44	44	45	47	48
125-05820	Roland Dr	1.66	44	44	44	44	44	44	42	37	36	39	40	38	36	36	37	35	35	34	35	38	38	38	42	44
125N05821	US-601/NC-200/Concord Hwy/Skyway Dr	0.30	48	48	48	48	49	49	49	49	48	49	49	48	48	48	49	48	48	48	48	48	48	47	48	48
125-05821	US-601/NC-200/Concord Hwy/Skyway Dr	1.07	42	42	42	42	42	43	42	41	40	40	40	39	38	39	39	39	39	39	40	41	39	38	41	42
125-07486	NC-200/Morgan Mill Rd	1.22	39	39	40	40	40	39	37	36	36	34	33	32	30	32	31	31	32	32	35	38	36	37	38	39
125-07487	E Franklin St	0.11	28	28	28	28	31	29	27	28	26	22	21	20	20	20	20	21	21	22	24	25	25	25	27	27
125N05822	US-601/Pageland Hwy	0.01	28	27	27	27	31	28	26	27	24	24	23	23	22	22	23	23	24	24	26	26	25	25	26	26
125-05822	US-601/Pageland Hwy	8.55	47	47	47	47	48	47	46	46	45	46	47	46	46	47	46	46	46	46	46	47	46	46	47	47
	Avg speed Marshville to US-601 intersection		47	47	47	47	48	47	46	46	45	46	47	46	46	47	46	46	46	46	46	47	46	46	47	47
	Avg speed US-601 to Roland Dr		42	42	42	42	42	42	41	38	38	38	38	37	35	36	36	35	36	35	37	39	38	38	41	42
	Avg speed Roland to Matthews Mint Hill		49	49	49	49	49	49	46	41	43	45	46	45	43	44	44	43	42	40	42	45	45	46	48	49
	Average US 74 WB Corridor Speed (mph)		47	47	47	47	48	47	45	42	43	44	45	44	43	44	43	43	42	41	43	44	44	44	46	47

Table 4 - US 74 Corridor INRIX Average Speed Data
2012, Tuesday - Thursday

Average Speed for US 74 from I-485 to NC 205 (Elm St.)
Eastbound US 74 Corridor Average Speed

TMC CODE	SEGMENT NAME	LENGTH (MILES)	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
125+07488	NC-205/Elm St	8.54	49	49	49	49	49	49	49	48	48	49	49	49	48	48	48	47	47	47	47	48	48	48	49	49
125P05822	US-601/Pageland Hwy	0.02	39	39	39	39	39	37	35	33	32	32	30	29	28	28	28	34	36	36	35	35	33	34	38	38
125+05822	US-601/Pageland Hwy	0.12	37	37	37	37	37	35	34	32	33	30	29	28	27	26	26	33	36	35	34	34	33	32	35	35
125+07487	E Franklin St	1.21	41	41	41	42	42	41	42	39	38	39	39	38	37	36	37	39	41	40	40	41	39	37	40	40
125+07486	NC-200/Morgan Mill Rd	1.11	42	43	43	43	44	44	44	41	40	42	43	42	40	39	40	38	38	37	37	38	38	39	41	41
125P05821	US-601/NC-200/Concord Hwy/Skyway Dr	0.35	50	50	50	50	50	51	51	51	51	52	51	51	51	50	51	51	51	50	50	49	49	49	50	50
125+05821	US-601/NC-200/Concord Hwy/Skyway Dr	1.58	44	45	45	45	45	43	42	42	40	36	35	33	30	30	32	35	36	35	36	38	39	38	42	43
125+05820	Roland Dr	6.86	49	49	49	49	49	49	48	47	47	49	49	48	46	46	46	47	47	46	46	46	46	46	48	48
125+05819	Indian Trail Fairview Rd	1.27	52	52	52	52	52	52	50	49	48	48	47	46	45	44	44	40	36	33	36	41	47	47	50	51
125+05818	Stallings Rd	0.75	53	53	53	53	53	52	49	47	46	40	38	38	37	35	35	30	25	18	24	35	46	48	51	52
125P05817	I-485	0.76	56	56	56	56	57	56	57	58	58	57	57	57	57	57	57	57	54	50	54	54	55	55	56	56
125+05817	I-485	0.44	50	50	50	50	50	48	48	48	47	47	47	46	46	46	45	47	46	44	46	45	46	46	49	49
125+05816	Matthews Mint Hill Rd	0.26	48	48	48	48	48	46	44	43	42	40	39	38	37	36	35	38	36	31	37	39	41	42	47	47
	Avg speed US-601 to NC 205		49	49	49	49	49	49	49	48	48	49	49	49	48	48	48	47	47	47	47	48	48	48	49	49
	Avg speed I-485 to Fowler Secrest		50	50	50	50	50	50	49	48	48	49	48	47	46	46	45	45	44	42	44	45	47	47	49	49
	Avg speed Fowler Secrest to US-601		43	44	44	44	44	43	43	41	40	39	39	38	36	35	37	38	39	38	38	40	39	39	42	42
	Average US 74 EB Corridor Speed (mph)		48	48	48	49	49	48	48	47	46	47	47	46	45	45	45	45	44	43	44	45	46	46	48	48

Average Speed for US 74 from NC 205 (Elm St.) to I-485
Westbound US 74 Corridor Average Speed

TMC CODE	SEGMENT NAME	LENGTH (MILES)	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
125-05816	Matthews Mint Hill Rd	0.43	48	48	50	48	48	47	42	25	27	33	36	34	30	32	33	32	32	31	33	38	41	41	47	48
125N05817	I-485	0.91	55	55	56	55	55	56	56	47	49	56	57	56	56	56	56	56	56	55	55	54	54	54	55	55
125-05817	I-485	0.61	51	51	51	51	52	52	50	47	49	50	51	51	50	50	50	50	49	47	48	47	48	48	50	51
125-05818	Stallings Rd	1.26	49	50	50	50	51	51	45	36	40	47	49	48	47	47	46	45	44	38	41	44	46	46	48	49
125-05819	Indian Trail Fairview Rd	6.86	49	49	49	49	49	49	47	45	45	46	47	45	43	42	42	41	41	39	41	44	44	45	47	48
125-05820	Roland Dr	1.66	45	45	45	45	45	45	43	36	34	39	40	38	36	36	37	38	39	38	37	38	38	39	43	44
125N05821	US-601/NC-200/Concord Hwy/Skyway Dr	0.30	49	49	49	49	49	50	50	49	49	49	49	49	49	49	49	49	49	49	49	49	48	48	49	49
125-05821	US-601/NC-200/Concord Hwy/Skyway Dr	1.07	42	43	43	43	44	45	45	42	41	40	39	39	38	38	38	40	41	41	41	42	41	39	42	42
125-07486	NC-200/Morgan Mill Rd	1.22	40	40	41	41	41	42	40	37	36	33	32	30	29	30	29	32	33	33	37	39	38	36	39	39
125-07487	E Franklin St	0.11	32	31	32	32	32	31	29	29	26	23	23	21	21	20	21	22	23	23	25	27	27	26	30	31
125N05822	US-601/Pageland Hwy	0.01	33	33	33	34	33	30	28	28	25	24	24	23	23	22	23	25	25	26	28	29	29	28	32	33
125-05822	US-601/Pageland Hwy	8.55	47	47	47	48	48	48	47	47	46	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47
	Avg speed Marshville to US-601 intersection		47	47	47	48	48	48	47	47	46	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47
	Avg speed US-601 to Roland Dr		43	43	43	43	44	44	43	38	37	38	38	36	35	35	35	37	38	38	39	40	39	38	42	42
	Avg speed Roland to Matthews Mint Hill		50	50	50	50	50	50	48	43	44	47	48	46	45	44	44	43	43	40	42	45	45	46	48	49
	Average US 74 WB Corridor Speed (mph)		47	47	48	48	48	48	46	44	44	45	46	45	44	43	43	43	43	42	43	45	45	45	46	47

Table 5 - US 74 Corridor INRIX Average Speed Data
2013, Tuesday - Thursday

Average Speed for US 74 from I-485 to NC 205 (Elm St.)
Eastbound US 74 Corridor Average Speed

TMC CODE	SEGMENT NAME	LENGTH (MILES)	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
125+07488	NC-205/Elm St	8.54	49	49	49	49	50	49	49	49	48	49	49	48	48	48	48	47	48	47	48	48	48	48	49	49
125P05822	US-601/Pageland Hwy	0.02	41	41	41	41	41	39	38	36	36	34	35	34	33	33	33	36	36	36	37	36	37	36	39	40
125+05822	US-601/Pageland Hwy	0.12	39	39	39	40	39	38	37	35	35	32	31	30	30	29	29	33	34	34	35	35	35	34	36	37
125+07487	E Franklin St	1.21	42	43	42	43	43	43	42	39	38	40	40	40	39	39	39	37	38	37	40	43	41	38	41	41
125+07486	NC-200/Morgan Mill Rd	1.11	43	44	44	44	45	45	44	41	40	42	42	41	39	40	40	35	34	34	37	39	40	39	42	43
125P05821	US-601/NC-200/Concord Hwy/Skyway Dr	0.35	51	50	50	51	51	51	51	51	50	50	50	50	49	49	50	50	49	49	50	49	50	49	50	50
125+05821	US-601/NC-200/Concord Hwy/Skyway Dr	1.58	43	43	44	44	44	43	41	39	37	36	36	34	32	31	32	30	30	30	32	37	38	36	40	41
125+05820	Roland Dr	6.86	49	50	50	50	50	50	48	46	47	48	48	47	46	45	46	46	45	44	46	45	46	46	48	48
125+05819	Indian Trail Fairview Rd	1.27	52	52	52	53	52	52	48	48	48	48	47	46	45	44	43	40	35	33	35	39	46	46	50	51
125+05818	Stallings Rd	0.75	52	52	52	53	52	52	48	45	46	40	37	37	35	34	33	29	23	19	23	32	45	47	50	51
125P05817	I-485	0.76	56	56	56	56	57	56	57	56	57	57	57	57	56	56	56	56	53	50	53	53	55	55	56	56
125+05817	I-485	0.44	49	49	49	49	49	48	48	48	48	48	48	47	46	46	46	47	46	44	46	45	46	46	48	49
125+05816	Matthews Mint Hill Rd	0.26	47	47	47	46	46	44	43	40	41	39	40	39	36	36	35	35	34	30	36	37	39	41	45	46
	Avg speed US-601 to NC 205		49	49	49	49	50	49	49	49	48	49	49	48	48	48	48	47	48	47	48	48	48	48	49	49
	Avg speed I-485 to Fowler Secrest		50	51	51	51	51	51	49	47	48	48	48	47	46	45	45	45	43	41	43	44	46	47	49	49
	Avg speed Fowler Secrest to US-601		43	44	44	44	44	44	43	40	39	40	40	39	37	37	37	35	35	35	37	40	40	38	41	42
	Average US 74 EB Corridor Speed (mph)		48	49	49	49	49	49	48	46	46	47	47	46	45	44	45	44	43	42	44	45	46	46	48	48

Average Speed for US 74 from NC 205 (Elm St.) to I-485
Westbound US 74 Corridor Average Speed

TMC CODE	SEGMENT NAME	LENGTH (MILES)	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
125-05816	Matthews Mint Hill Rd	0.43	47	47	47	48	48	46	41	25	25	32	36	34	29	31	32	32	32	30	31	37	40	41	46	47
125N05817	I-485	0.91	56	55	55	56	56	56	54	42	42	55	56	56	55	55	56	55	55	54	54	54	54	54	55	56
125-05817	I-485	0.61	52	52	52	53	53	53	49	47	48	50	51	51	50	50	50	50	49	47	47	47	49	48	51	51
125-05818	Stallings Rd	1.26	50	50	51	52	52	51	43	33	38	47	49	48	47	47	47	45	43	36	38	44	46	46	49	50
125-05819	Indian Trail Fairview Rd	6.86	48	49	49	49	49	49	46	43	45	46	46	45	42	42	41	40	40	37	40	44	45	44	47	48
125-05820	Roland Dr	1.66	44	44	45	45	45	45	45	37	35	38	39	37	36	36	36	33	34	33	34	37	37	38	42	43
125N05821	US-601/NC-200/Concord Hwy/Skyway Dr	0.30	49	49	49	49	50	50	51	50	49	49	49	49	48	49	49	49	49	48	49	49	49	48	49	49
125-05821	US-601/NC-200/Concord Hwy/Skyway Dr	1.07	44	44	44	44	45	45	45	43	42	40	40	39	38	38	38	38	38	38	41	42	41	40	42	43
125-07486	NC-200/Morgan Mill Rd	1.22	40	41	41	41	41	42	41	37	35	34	34	34	33	33	33	34	34	34	36	38	37	37	39	40
125-07487	E Franklin St	0.11	36	36	37	36	37	36	34	30	28	29	29	28	27	27	27	27	27	28	28	31	31	31	35	36
125N05822	US-601/Pageland Hwy	0.01	36	36	37	36	37	36	33	30	29	31	31	30	29	29	29	30	31	31	31	33	33	32	35	36
125-05822	US-601/Pageland Hwy	8.55	48	48	48	48	49	48	48	47	46	47	47	47	47	47	47	47	47	47	47	48	47	47	48	48
	Avg speed Marshville to US-601 intersection		48	48	48	48	49	48	48	47	46	47	47	47	47	47	47	47	47	47	47	48	47	47	48	48
	Avg speed US-601 to Roland Dr		43	43	44	44	44	44	44	39	38	38	38	37	36	36	36	35	36	35	37	39	39	39	41	42
	Avg speed Roland to Matthews Mint Hill		49	50	50	50	50	50	46	41	43	47	47	46	44	44	43	42	42	39	41	45	46	45	48	49
	Average US 74 WB Corridor Speed (mph)		48	48	48	48	49	48	47	43	43	45	45	45	44	44	43	43	43	41	43	45	45	45	47	47

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APPENDIX E-2

Traffic Forecast Memo (May 2014)

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

Final Memorandum

To: Jennifer Harris, PE

From: Spencer Franklin, PE, PTOE

Subject: Monroe Connector/Bypass Traffic Forecast Summary

Date: May 1, 2014

Project #: R-3329, R-2559

NORTH CAROLINA PROFESSIONAL SEAL 028657 ENGINEER SPENCER T. FRANKLIN

Spencer Franklin
5-1-14

This memo supersedes the memo dated November 8, 2013 by incorporating newly available MRM14v1.0 output provided by CRTPO (Charlotte Regional Transportation Planning Organization formerly MUMPO). The newly available information is considered in Questions 2, 3, and 4 below and shown in Tables 5, 7, and 9. Ultimately, the conclusions from the original memo dated November 8, 2013 remain unchanged with the consideration of the MRM14v1.0 output.

At the request of the North Carolina Turnpike Authority (NCTA), HNTB prepared this traffic forecast summary memorandum for the purpose of answering the following six questions:

1. What traffic forecasts were developed during the Monroe Connector/Bypass project development process and what were they used for?
2. Are the current No-Build traffic forecasts still valid for the purpose they were used?
3. Are the current Build traffic forecasts still valid for the purpose they were used?
4. How would the Monroe Connector/Bypass affect traffic volumes on the US 74 corridor?
5. How could changes in socioeconomic data affect the traffic forecast for the Monroe Connector/Bypass project?
6. How could changes in socioeconomic data related to indirect and cumulative effects affect the traffic forecast for the Monroe Connector/Bypass project?

This memorandum summarizes the traffic forecasts and references historical traffic data, socioeconomic data and Metrolina Regional Model (MRM) data developed throughout the Monroe Connector/Bypass project development process to aid in answering the questions above.

1. What traffic forecasts were developed during the Monroe Connector/Bypass project development process and what were they used for?

Table 1, on the following page, provides a listing and description of each traffic forecast and traffic and revenue study developed during the Monroe Connector/Bypass project development process. Following the table are descriptions of the use(s) of each forecast or study.

Table 1 – Summary of Monroe Connector/Bypass Project Traffic Forecasts

	Document Name	Prepared By, Date	Forecast Years	Forecast Scenarios	Model Version and SE Data	Used in NEPA Documents
Traffic Forecasts						
A	*Traffic Forecast for the No-Build Alternatives for NCDOT State TIP Project No. R-3329 and NCDOT State TIP Project No. R-2559, Monroe Connector/Bypass Study*	Martin/Alexiou/Bryson (MAB), June 2008	2007, 2030	2007 & 2030 No-Build	MRM05 and 2005 SE data (SE_*Year*_taz2934)	Yes
B	*Technical Memorandum for TIP Projects R-2559 & R-3329 US74 Upgrade Scenario*	Wilbur Smith Associates (WSA), June 2008	2035	2035 Upgrade Existing Build Non-Toll & Toll	MRM06 and 2005 SE data (SE_*Year*_taz2934)	Yes
C	*Traffic Forecast for TIP Projects R-3329 & R-2559 Monroe Connector/Bypass*	WSA, September 2008	2008, 2035	2008 & 2035 No-Build, Build Non-Toll & Build Toll	MRM06 and 2005 SE data (SE_*Year*_taz2934)	Yes
Traffic Forecast Interpolations, Extrapolations and Redistributions						
D	*Monroe Connector/Bypass Alternative 3A 2013 AADT Build Toll Scenario*	HNTB, January 2009	2013	2013 Build Toll	MRM06 and 2005 SE data (SE_*Year*_taz2934).	No
E	*2035 Build Toll Forecast, Segment 2 (Alternative 3A)*	HNTB, July 2009	2035	2035 Build Toll	MRM06 and 2005 SE data (SE_*Year*_taz2934).	Yes
F	*NCDOT STIP Project R-3329 & R-2559 Revised Monroe Connector Bypass No-Build Traffic Forecast Memorandum*	HNTB, March 2010	2008, 2035	2008 & 2035 No-Build	MRM06 and 2005 SE data (SE_*Year*_taz2934).	Yes
G	*Monroe Connector / Bypass Year 2025 Build Toll Alternative 3A Traffic Volume Projections*	HNTB, August 2010	2025	2025 Build Toll	MRM06 and 2005 SE data (SE_*Year*_taz2934).	No
Traffic & Revenue Studies						
H	*Monroe Connector/Bypass 2009 Update to Preliminary Study*	WSA, April 2009	2014 thru 2054	2014 thru 2054 Build Toll	Modified MRM06 and modified 2008 Interim SE data (SE_*Year*_081119_MUMPO_interim)	No
I	*Proposed Monroe Connector/Bypass Comprehensive Traffic and Revenue Study, Final Report*	WSA, October 2010	2015 thru 2055	2015 thru 2055 Build Toll	Modified MRM06 and modified 2008 Interim SE data (SE_*Year*_081119_MUMPO_interim)	No

For reference, **Table 2** and **Table 3** provide an estimated daily traffic volume comparison, by segment, of the No-Build and Build traffic forecasts, respectively, prepared during the Monroe Connector/Bypass project development process.

1.1 Traffic Forecasts

Project-Level traffic forecasts were developed for No-Build, Improve Existing, and Build scenarios. These forecasts are based on data including, but not limited to, traffic counts, historic travel trends, the MUMPO Long-Range Transportation Plan (LRTP), the MRM, and existing road network operations. It is important to note that the forecasts are not based solely on any single data source but are based on the review, comparison, and synthesis of different sources of data. These individual data sources are not intended to be traffic forecasts and do not include the level of detail ultimately developed in the traffic forecast. For example, the MRM does not include all the roadways within the study area. Therefore, those roadways are included in the traffic forecast through analyzing traffic counts or other available data sources. Another example of source data are Annual Average Daily Traffic (AADT) volumes, which are developed by annualizing traffic counts collected at one point in time. The following list describes the uses of each traffic forecast developed in the project development process:

A. *Traffic Forecast for the No-Build Alternatives for NCDOT State TIP Project No. R-3329 and NCDOT State TIP Project No. R-2559, Monroe Connector/Bypass Study*

This forecast is used in the Draft Environmental Impact Statement (EIS) as follows:

- *Existing and Year 2030 No-Build Traffic Operations Technical Memorandum,* completed in March 2008
- Considered as part of the technical analysis that went into the development of the Draft EIS

This forecast is used in the Final EIS as follows:

- Considered as part of the technical analysis that went into the development of the Final EIS

Ultimately this document was updated by the *NCDOT STIP Project R-3329 & R-2559 Revised Monroe Connector Bypass No-Build Traffic Forecast Memorandum* (**Table 1, F**).

B. *Technical Memorandum for TIP Projects R-2559 & R-3329 US 74 Upgrade Scenario*

This forecast is used in the Draft EIS as follows:

- *STIP Projects R-3329/R-2559 Upgrade Existing US 74 Alternatives Study*, completed in March 2009
- Considered as part of the technical analysis that went into the development of the Draft EIS

C. *Traffic Forecast for TIP Projects R-3329 & R-2559 Monroe Connector/Bypass*

This forecast is used in the Draft EIS as follows:

- *Final Air Quality Technical Memorandum for the Monroe Connector Bypass* completed in February 2009
- *Final Traffic Noise Technical Memorandum* completed in March 2009
- *Year 2035 Build Traffic Operations Technical Memorandum* completed in February 2009
- Considered as part of the technical analysis that went into the development of the Draft EIS

This forecast is used in the Final EIS as follows:

- Considered as part of the technical analysis that went into the development of the Final EIS

The No-Build forecast was ultimately updated in the document *NCDOT STIP Project R-3329 & R-2559 Revised Monroe Connector Bypass No-Build Traffic Forecast Memorandum* (**Table 1, F**). Additional discussion is included in **Attachment A** (*Monroe Bypass No-Build Traffic Forecast Summary Memorandum*).

1.2 Traffic Forecast Interpolations, Extrapolations or Redistributions

Traffic forecast interpolations, extrapolations, or redistributions of the original traffic forecasts were developed to state, analyze, or confirm traffic forecast volumes for conditions or years not included in the initial traffic forecasts. This approach uses the original accepted forecasts and base data assumptions to mathematically calculate traffic estimates and redistributions of traffic for conditions not included or known at the time of the initial forecast. This methodology is appropriate because the differences being considered do not change the original forecast, assumptions, methodology or base data. The interpolation and extrapolation process is a method for developing new data points for years not considered in the base forecast but within the range of volumes established by the base forecast. The redistribution process was used to evaluate a minor change in the frontage road configuration at the western terminus of the project. Examples of these differences include different interchange forms and service road connection points. The geometric differences analyzed were minor to the point of not changing the base forecast assumptions or data. The following list describes each traffic forecast's uses and the interpolations, extrapolations, or redistributions necessary for that forecast:

D. *Monroe Connector/Bypass Alternative 3A 2013 AADT Build Toll Scenario*

This 2013 Build Forecast was developed to represent the opening year traffic volumes for inclusion on the April 2009 Monroe Connector/Bypass public hearing maps. This forecast was developed through interpolation of the 2008 and 2035 Build forecasts from the *Traffic Forecast for TIP Projects R-3329 & R-2559 Monroe Connector/Bypass* (**Table 1, C**).

E. *2035 Build Toll Forecast, Segment 2 (Alternative 3A)*

This 2035 Build forecast redistributed forecasted volumes from the *Traffic Forecast for TIP Projects R-3329 & R-2559 Monroe Connector/Bypass* (**Table 1, C**) to account for a minor change in the frontage road configuration at the western terminus of the project.

This forecast is used in the Final EIS as follows:

- *Final Addendum to Year 2035 Build Traffic Operations Technical Memorandum* completed in November 2009
- *Addendum Final Traffic Noise Technical Memorandum* completed in February 2010
- Considered as part of the technical analysis that went into the development of Final EIS

F. *NCDOT STIP Project R-3329 & R-2559 Revised Monroe Connector Bypass No-Build Traffic Forecast Memorandum*

This forecast was used to confirm the Draft EIS analysis of existing and design year no-build conditions and is referenced in the Final EIS Errata. The updated 2008 and 2035 No-Build forecasts were prepared due to No-Build forecast discrepancies in the *Traffic Forecast for TIP Projects R-3329 & R-2559 Monroe Connector/Bypass* (**Table 1, C**). Additional discussion is included in **Attachment A** (*Monroe Bypass No-Build Traffic Forecast Summary Memorandum*).

G. *Monroe Connector / Bypass Year 2025 Build Toll Alternative 3A Traffic Volume Projections*

This forecast was provided to the Design-Build teams during construction procurement. The Design-Build teams were given an option of designing the project to the 2035 traffic forecast volumes and phase constructing the project based on the 2025 year traffic forecast volumes. Ultimately, the Design-Build teams did not choose the option of phase constructing using the 2025 year traffic forecast volumes.

1.3 Traffic and Revenue Studies

A Traffic and Revenue Study is a revenue forecast. The purpose of a Traffic and Revenue Study is to analyze the potential project revenue associated with the proposed toll road. Therefore, these studies are developed as part of the project financing efforts and are developed differently than a project level traffic forecast. Two of the major differences in a Traffic and Revenue Study are the socioeconomic data used and the travel demand model used. The project level forecasts are based on the socioeconomic data and the travel demand model as developed and approved by the Metropolitan Planning Organization (MPO) and other data as described in Section 1.1. The Traffic and Revenue Study uses socioeconomic data developed by an independent economist. The Traffic and Revenue Study modifies the travel demand model including the traffic analysis zone structure, link properties, link connections, and value of time assumptions. The following list describes the uses of the Traffic and Revenue Studies developed during the project development process:

H. *Monroe Connector/Bypass 2009 Update to Preliminary Study*

This preliminary traffic and revenue forecast is an update to the *Monroe Connector Preliminary Traffic and Revenue Study* issued in October 2006. These traffic and revenue forecasts were developed to support the project financing efforts. The *Monroe Connector/Bypass 2009 Update to Preliminary Study* (**Table 1, H**) is referenced in the Final EIS.

I. *Proposed Monroe Connector/Bypass Comprehensive Traffic and Revenue Study, Final Report*

This final traffic and revenue forecast was developed to support the project financing efforts and was not used in any analysis to support the project level traffic forecast. (Note: A Draft Final Report was issued in August 2010). **Table 4** list Monroe/Connector Bypass estimated 2015, 2020 and 2030 weekday traffic volumes.

2. Are the current No-Build traffic forecasts still valid for the purpose they were used?

The current 2008 and 2035 No-Build forecast from the document *NCDOT STIP Project R-3329 & R-2559 Revised Monroe Connector Bypass No-Build Traffic Forecast Memorandum* (**Table 1, F**) was used to confirm the analysis of 2007 existing and 2030 design year no-build conditions used in the Draft EIS. The analysis was confirmed by quantitatively demonstrating 2035 forecast volumes were higher than 2030 No-Build volumes and qualitatively concluding US 74 operations would worsen with higher 2035 No-Build forecast volumes.

To determine if the current No-Build traffic forecast is still valid, it is necessary to reasonably determine if an updated No-Build forecast is expected to have lower, equal or higher forecast volumes. If forecast volumes are expected to be equal to or higher than the current No-Build forecast used in the 2007 existing and 2030 design year analysis, then it is reasonable to conclude an updated No-Build forecast would not change the conclusions in the Draft EIS. The following information was used to validate the 2007/2030 No-Build traffic forecasts:

- 2012 NCDOT Annual Average Daily Traffic (AADT) volumes,
- Metrolina Regional Travel Demand Model, MRM11v1.1,
- Metrolina Regional Travel Demand Model, MRM14v1.0 output data provided by CRTPO,
- 2009 socioeconomic (SE) data,
- Existing US 74 corridor travel time runs,
- Current 2008 and 2035 No-Build forecasts.

Based on a meeting with NCDOT Transportation Planning Branch (TPB) on March 21, 2013 and the document *Guidelines to Determine When to Request an Updated Traffic Forecast*[1] (NCDOT TPB, February 24, 2009), the current No-Build traffic forecasts meet the guidelines that indicate the existing forecast is valid and an updated forecast is not warranted. All of these guidelines are met since no new alternatives have been identified, the current let date of the project is less than the Future Forecast Year plus 20 years, the study area is not experiencing growth not previously considered in the forecast, and the traffic forecast is not five years older than the Base Year.

2.1 <u>2012 NCDOT AADT Volumes</u>

Existing traffic volumes are a primary factor in determining base year forecast volumes, such as were used for the 2007 No-Build forecast. For this reason, 2007 and 2012 NCDOT AADT's were compared along the US 74 corridor to determine if an updated base year traffic forecast would be expected to have higher volumes than the current 2007 No-Build forecasts. Over the five year period from 2007 to 2012, average volumes along the US 74 corridor cumulatively grew approximately zero percent, based on available AADT data. Based on historical AADT growth trends, it is reasonable to conclude that an updated base year forecast (i.e. 2013) would generally be equal to the 2007 No-Build Forecast. 2007 and 2012 NCDOT AADT volumes are listed in **Table 5**.

It is appropriate to compare cumulative corridor changes in terms of vehicle miles traveled (VMT) and individual segment volume and percent changes. Individual segment traffic volumes include higher degrees of variability inherent in specific traffic

[1] https://connect.ncdot.gov/projects/planning/Pages/ProjectLevelTrafficForecasting.aspx

data base on the placement of traffic counting equipment, daily, monthly and seasonal variations in data collection, weather and other factors. Corridor VMT considers the entire corridor, volumes and distance of each corridor segment and calculates VMT based on multiplying daily segment volumes times segment length. For the purposes of this memo, comparing overall corridor VMT and percent changes is more appropriate in identifying general trends in traffic patterns. Monroe Connector/Bypass and US 74 segment distances used to calculate VMT for all tables are shown on **Table 7**.

2.2 Comparison of 2030 No-Build MRM05v1.0 to 2035 No-Build MRM11v1.1 Model Data

The Metrolina Regional Travel Demand Model, referred to as the MRM, is the primary tool for evaluating existing and future travel in the Metrolina Region at the planning level. For project-level traffic forecasting, the MRM is just one tool and associated raw model outputs are just one piece of data used in the forecasting process. The MRM is continually updated through the Metrolina Region planning process. The initial No-Build traffic forecast (**Table 1, A**) was prepared using MRM05v1.0. Since then three model versions have been developed, in order of release date: MRM06, MRM08 and MRM11. MRM11v1.1 was used for the purpose of evaluating the traffic forecasting process used to develop the initial No-Build traffic forecast (**Table 1, A**). This model version includes all the projects as shown in the 2035 Long Range Transportation Plan. A 2035 No-Build MRM11v1.1 model was developed by removing the Monroe Connector/Bypass links.

The raw travel demand model daily volume assignment for the 2030 No-Build forecast (**Table 1, A**), based on the MRM05v1.0 and 2005 SE data, was compared to 2035 No-Build raw model daily volume assignment from the MRM11v1.1. The 2009 SE data was used to evaluate how changes in raw model output data may affect an updated future year No-Build traffic forecast. Raw model output is an important factor in developing traffic forecasts by, but not limited to, determining growth rates from base year to future year scenarios, traffic volume orders of magnitude, volume trends along facilities and future year volumes for new location facilities. Based on a comparison of cumulative 2030 to 2035 No-Build raw model daily volumes along the US 74 corridor, the 2035 No-Build increases 17 percent over the five year period, corresponding to a three percent annual growth rate. Raw model daily assignment volumes range from 23,000 to 70,300 and 21,200 to 101,600 for 2030 MRM05v1.0 with 2005 SE data to 2035 MRM11v1.1 with 2009 SE data, respectively. Based on this comparison, an updated future year No-Build forecast (i.e. 2035) would reasonably be expected to have volumes equal to or greater than the 2030 No-Build forecast. Thus, an updated No-Build traffic forecast would not change the conclusions in the Draft EIS. **Table 5** lists raw model daily volume assignment and VMT percent change for both scenarios.

2.3 Comparison of No-Build Scenario Model Data from 2030 MRM06v1.1 to 2030 and 2040 MRM14v1.0

As previously stated, MRM14v1.0 output was provided by CRTPO (formerly MUMPO), which is compared and summarized in **Sections 2.3 and 2.4**.

The raw model daily volume assignment data from a run of 2030 MRM05v1.0 was compared to a model run using the 2030 and 2040 MRM14v1.0 (with 2013 SE data). It is important to note that the No-Build model scenarios do not include the Monroe Connector/Bypass.

Along the existing US 74 corridor, there is some variability between the 2030 MRM05v1.0 and the 2030 and 2040 MRM14v1.0 model results, with a general trend of

higher daily assignment in MRM14v1.0 along the western portion of US 74 and lower daily assignment along the eastern portion. When comparing the 2030 MRM05v1.0 and the 2030 MRM14v1.0 model results, the cumulative VMT changes equate to a 4 percent decrease along the US 74 corridor with 8 of the 31 total segments having higher volumes. When comparing the 2030 MRM05v1.0 and the 2040 MRM14v1.0 model results, the cumulative VMT changes equate to a 3 percent increase along the US 74 corridor with 20 of the 31 total segments having higher volumes. Overall corridor VMT results indicate that both the 2030 and 2040 MRM14v1.0 model results show substantial growth when compared with the existing NCDOT AADT traffic volumes along US 74.

Overall corridor VMT results indicate that, even with an updated model network (MRM14v1.0) and SE data (2013), the Monroe Connector/Bypass is still generally attracting similar levels of demand as MRM05v1.0 and 2005 SE data used in the 2030 No-Build forecast. It is reasonable to conclude that the 2040 MRM14v1.0 assigns similar magnitudes of raw travel demand model daily volume assignment to the US 74 compared to MRM05v1.0. Thus, an updated No-Build traffic forecast would not change the conclusions in the Draft EIS. **Table 5** lists raw model daily volume assignment and VMT percent change for each scenario.

2.4 Comparison of 2030 and 2040 No-Build Scenario Model Data from MRM14v1.0

No-Build Scenario model data was compared between 2030 and 2040 MRM14v1.0 model runs. These results are shown in **Table 5**. The data between the two model runs is based on 2013 SE data and shows a high degree of consistency. All 2040 segment daily traffic assignments exceed the 2030 MRM14v1.0 results. On the existing US 74 facility, volumes increase from approximately 1 percent to 10 percent between the 2030 and 2040 model runs. Overall, cumulative VMT changes equate to a 7 percent increase along the US 74 corridor.

The conclusion that can reasonably be drawn from this data is that traffic volumes are expected to increase on the US 74 corridor between the 2030 and 2040 time periods. Thus, 2040 No-Build Scenario forecast results might reasonably also be expected to demonstrate increases in traffic volumes along US 74, further substantiating the viability of and need for the project.

2.5 US 74 Corridor Travel Time Runs

The US 74 corridor from I-485 to Elm Street in Marshville is approximately 22.5 miles in length and includes 30 signalized intersections, multiple unsignalized intersections, and multiple driveway access points. 2012 NCDOT AADT volumes range from 23,000 to 57,000 and are projected to increase to a new range from 31,600 to 89,100 based on 2035 No-Build forecast volumes (**Table 1, F**). This means that 2012 NCDOT AADT volumes would increase in the range of 9,800 to 33,300 vehicles per day (vpd) (or between 20 percent to 81 percent) along the US 74 corridor. See **Table 6** for the comparison of 2012 NCDOT AADT and 2035 No-Build forecast volumes. This growth in US 74 traffic volumes will negatively impact corridor operations by increasing congestion, reducing travel speeds, and increasing travel times. 2013 existing travel time runs were collected in March 2013 along the US 74 corridor. Per the *US 74 Corridor Travel Time Comparison* memorandum (HNTB, October 24, 2013), "US 74 average corridor travel speeds are limited to less than 50 mph, even during off-peak periods and free-flow conditions with very little to no congestion". These travel time runs reflect existing conditions and account for all US 74 highway improvements implemented

between 2007 and the present. The 2013 travel time runs verify that US 74 does not operate as a high speed facility.

Based on 2012 NCDOT AADT's, MRM11v1.1 (with 2009 socioeconomic data), and MRM14v1.0 (with 2013 socioeconomic data), an updated base year and future year forecast would reasonably be expected to have equal to or higher forecast volumes than the current no-build forecasts used in the analysis of existing and design year no-build conditions. In addition, 2013 existing travel time runs along the US 74 corridor verify US 74 does not operate as a high speed facility. Comparison of 2035 No-Build traffic volume increases to 2012 AADT's also realistically demonstrate that additional future congestion will continue to decrease operating speeds along the US 74 corridor, further impairing the ability to provide high speed mobility. Therefore, it is reasonable to conclude that updated No-Build forecasts would not change the conclusions in the Draft EIS. Based on this assessment of all available information, the current No-Build traffic forecasts are still valid for the purpose they were used.

3. Are the current Build traffic forecasts still valid for the purpose they were used?

The Build forecast used in the project level forecasted traffic is titled *Traffic Forecast for TIP Projects R-3329 & R-2559 Monroe Connector/Bypass* (**Table 1, C**) and contained 2008 and 2035 Build Scenario data. This forecast utilized the Metrolina Regional Travel Demand Model, MRM06v1.1, and 2005 socioeconomic (SE) data. The validity of the 2035 Build forecasts were assessed by comparing the 2030 MRM06v1.1 raw model daily volume assignment with 2030 and 2035 Build raw model daily volume assignments utilizing MRM11v1.1 and 2009 SE data and 2035 and 2040 Build raw model daily volume assignments utilizing MRM14v1.0 and 2013 SE data.

The regional model, such as the Metrolina Regional Model, is used as a tool in the development of traffic forecasts and raw model daily volumes are just one of the many pieces of data used to develop traffic forecast volumes. It is important to note that a travel demand model (TDM) is not an exact measure of existing or future traffic volumes but is a tool to generally measure impacts of growth and development and help forecast travel characteristics at the planning-level. The TDM employs a mathematical approach to understanding how changes in land use, population, and area employment will impact the transportation system. The Metrolina Regional Model encompasses multiple counties in two states and was developed and calibrated as a tool to evaluate existing and future travel demands on a regional basis. Raw model volumes for specific roadway links can be extracted from the regional model but inherently have levels of variability compared to existing and traffic forecast volumes. The accuracy of raw model volumes to existing and future conditions is based on a variety of factors: existing and future roadway network detail, calibration parameters, accuracy of future land use, population, area employment estimates, and other factors. Therefore, it is not appropriate to directly compare raw model daily volumes to balanced traffic forecast volumes. General comparisons of raw model daily volumes from the Build Scenario models can be used as validation of the results from previous Build Scenario forecasts, since those forecasts use model results as one of the factors in developing the forecast.

Based on a meeting with NCDOT Transportation Planning Branch (TPB) on March 21, 2013 and the document *Guidelines to Determine When to Request an Updated Traffic Forecast* [2] (NCDOT TPB, February 24, 2009), the current Build traffic forecasts meet the guidelines

that indicate the existing forecast is valid and an updated forecast is not warranted. All of these guidelines are met since no new alternatives have been identified, the current let date of the project is less than the Future Forecast Year plus 20 years, the study area is not experiencing growth not previously considered in the forecast, and the traffic forecast is not five years older than the Base Year.

The following three comparisons can be made to address the current validity of the previous Build Scenario traffic forecast results. Comparative results are shown in **Table 7**.

3.1 Comparison of 2030 Build Scenario Model Data from MRM06v1.1 to MRM11v1.1

Since the 2035 WSA Build Scenario forecast (**Table 1, C**) was developed with the use of the (then current) 2030 MRM06v1.1 (with 2005 SE data), the raw model daily volume assignment data from a run of MRM06v1.1 was compared to a model run using the MRM11v1.1 (with 2009 SE data). It is important to note that both model scenarios included the Monroe Connector/Bypass. For the new location Monroe Connector/Bypass facility, MRM11v1.1 assigns higher traffic (8 percent to 30 percent) to the western portion of the Bypass than MRM06v1.1. Conversely, MRM11v1.1 has lower projected daily assignments (9 percent to 27 percent decreases from MRM06v1.1) in the central and eastern portions of the project. Along the existing US 74 corridor, there is some variability between the two model results, with a general trend of higher daily assignment in MRM11v1.1 (29 of 31 segments have higher volumes). In many cases, -Y- Line model volumes (the route intersecting the Monroe Connector/Bypass) are lower in MRM11v1.1 than MRM06v1.1. However, direct comparisons of individual -Y- Line volumes directly north and south of the Monroe Bypass includes too much individual variability to provide reasonable comparisons.

For raw model assignment, it is appropriate to consider cumulative changes on the corridor in terms of vehicle miles traveled (VMT) and changes on individual segments, as previously discussed in **Section 2.1**. Examining corridor VMT presents overall and regional traffic differences that more appropriately account for the inherent variability of individual links based on different segment lengths, characteristics, loading points and the impact of centroid connectors within the model. Potential reasons for variability along individual segments are different socioeconomic growth assumptions, different model networks and link characteristics, and different model methodologies for trip distribution and assignment. To compare -Y- Line VMT, a segment distance of 0.5 miles for each -Y- Line north and south of the Monroe Connector/Bypass was determined to account for ramp offsets, laneage tie-ins and grade changes. By using the same segment distance for all -Y- Lines, all facility segments were calculated similarly to determine VMT. Based on the overall corridor, cumulative VMT changes equate to a 7 percent decrease along the Monroe Connector/Bypass, a 19 percent increase along the US 74 corridor and a 24 percent decrease cumulatively for -Y- Line locations.

Overall corridor VMT results indicate that, even with an updated model network (MRM11v1.1), SE data (2009), and methodology, the Monroe Connector/Bypass is still generally attracting similar levels of demand as MRM06v1.1 and 2005 SE data used in the 2030 Build forecast. In addition, the updated model is predicting more demand for the existing US 74 corridor. Thus, it is reasonable to conclude that the MRM11v1.1 assigns similar magnitudes of raw travel demand model daily volume assignment to the Monroe Connector/Bypass and US 74 compared to MRM06v1.1.

[2] https://connect.ncdot.gov/projects/planning/Pages/ProjectLevelTrafficForecasting.aspx

3.2 Comparison of 2030 and 2035 Build Scenario Model Data from MRM11v1.1

The next necessary comparison is to compare Build Scenario model data from the 2030 MRM11v1.1 model to results from a 2035 MRM11v1.1 model run. This comparison was made using the methodology previously described in **Section 2.2**. These results are shown in **Table 7**. The data between the two model runs is based on the same set of 2009 SE data, and shows a high degree of consistency. All 2035 segment daily traffic assignments exceed the 2030 MRM11v1.1 results. On the new location Monroe Connector/Bypass facility, volumes increase from 7 percent to 11 percent and are expected to range between 21,600 and 67,400 in 2035. On the existing US 74 facility, volumes increase from 5 percent to 15 percent between the 2030 and 2035 model runs. Individual -Y- Line facilities show increases between 4 percent and 57 percent between 2030 and 2035 model runs. Overall, cumulative VMT changes equate to a 9 percent increase along the Monroe Connector/Bypass, a 7 percent increase along the US 74 corridor and a 7 percent increase cumulatively for -Y- Line locations. These increases are not expected to impact the interchange footprints for the Monroe Connector/Bypass facility.

The conclusion that can reasonably be drawn from this data is that traffic volumes are expected to increase for all study area facilities between the 2030 and 2035 time periods. Thus, 2030 Build Scenario forecast results might reasonably also be expected to demonstrate increases in traffic volumes along the Monroe Connector/Bypass Facility, existing US 74, and project study area -Y- Lines. This would further substantiate the viability of and need for the project.

3.3 Comparison of 2035 Build MRM11v1.1 to 2030 Build MRM06v1.1 Model Data used in the Build Scenario Traffic Forecast

As a final comparison, the 2035 MRM11v1.1 daily traffic assignment data was compared to the original 2030 MRM06v1.1 data used in the development of the 2030 Build Scenario forecasts. Along the new Monroe Connector facility, 2035 MRM11v1.1 assignments are higher than 2030 MRM06v1.1 data on the western portion of the project, but are still less (between 1 percent and 19 percent smaller) than the 2030 MRM06v1.1 data on the eastern portion of the project. US 74 corridor results are higher (for 30 of 31 segments) and have a greater variance range (3 percent to 90 percent increases) for the 2035 MRM11v1.1 results compared to the 2030 MRM06v1.1 results. -Y- Line data results have six segments showing increased daily assignment, seven segments showing decreased assignment, and one segment unchanged between 2035 data and 2030 data. Based on the overall corridor, cumulative VMT changes equate to a 1 percent increase along the Monroe Connector/Bypass, a 27 percent increase along the US 74 corridor and an 18 percent decrease cumulatively for -Y- Line locations. Similar to assessments made previously, potential reasons for the variability include the different SE data sets, different model networks and network characteristics, and model assignment methodologies employed in the two MRM versions. Even with the variability of the results, the overall trend along the new location facility shows consistently increasing volumes from east to west between the two model data sets. The model run comparison also shows the potential traffic volume growth between 2030 and 2035 along existing US 74 even with the Monroe Connector facility. It is reasonable to conclude that a traffic forecast for the Build Scenario that utilizes the latest MRM11v1.1 network and 2009 SE data in a similar manner to which they were employed for the 2008 and 2035 Build Scenario forecast would produce results that are to the same magnitude, if not greater (based on the data examined in these three comparisons), than

the original 2008 and 2035 Build Scenario forecast data. Comparative results are shown in **Table 7**.

The differences between MRM06v1.1 and MRM11v1.1 raw model daily volume assignment, and the current Build traffic forecasts indicate that the magnitude of traffic along the Monroe Connector/Bypass and US 74 would still show the need for the project, and benefits to the existing US 74 corridor from the project, as currently supported by the Build forecast utilized in the project development process.

3.4 Comparison of 2030 Build Scenario Model Data from MRM06v1.1 to MRM14v1.0

As previously stated, Build MRM14v1.0 output was provided by CRTPO (formerly MUMPO), which is compared and summarized in **Sections 3.4, 3.5, and 3.6**.

The raw model daily volume assignment data from a run of MRM06v1.1 was compared to a model run using the MRM14v1.0 (with 2013 SE data). It is important to note that both model scenarios included the Monroe Connector/Bypass. For the new location Monroe Connector/Bypass facility, MRM14v1.0 assigns higher traffic (4 percent to 32 percent) to the western portion of the Bypass than MRM06v1.1. Conversely, MRM14v1.0 has lower projected daily assignments (13 percent to 38 percent decreases from MRM06v1.1) in the central and eastern portions of the project. Along the existing US 74 corridor, there is some variability between the two model results, with a general trend of higher daily assignment in MRM14v1.0 along the western portion of US 74 and lower daily assignment along the eastern portion (15 of 31 total segments have higher volumes). In many cases, -Y- Line model volumes (the route intersecting the Monroe Connector/Bypass) are lower in MRM14v1.0 than MRM06v1.1. However, direct comparisons of individual -Y- Line volumes directly north and south of the Monroe Bypass includes too much individual variability to provide reasonable comparisons.

Based on the overall corridor, cumulative VMT changes equate to a 12 percent decrease along the Monroe Connector/Bypass, a 4 percent increase along the US 74 corridor and a 29 percent decrease cumulatively for -Y- Line locations.

Overall corridor VMT results indicate that, even with an updated model network (MRM14v1.0), SE data (2013), and methodology, the Monroe Connector/Bypass is still generally attracting similar levels of demand as MRM06v1.1 and 2005 SE data used in the 2030 Build forecast. In addition, the updated model is predicting more demand for the existing US 74 corridor. Thus, it is reasonable to conclude that the MRM14v1.0 assigns similar magnitudes of raw travel demand model daily volume assignment to the Monroe Connector/Bypass and US 74 compared to MRM06v1.1.

3.5 Comparison of 2030 and 2040 Build Scenario Model Data from MRM14v1.0

The next necessary comparison is to compare Build Scenario model data from the 2030 MRM14v1.0 model to results from a 2040 MRM14v1.0 model run. This comparison was made using the methodology previously described in **Section 2.2**. These results are shown in **Table 7**. The data between the two model runs is based on the same set of 2013 SE data, and shows a high degree of consistency. All 2040 segment daily traffic assignments exceed the 2030 MRM14v1.0 results. On the new location Monroe Connector/Bypass facility, volumes increase from 3 percent to 14 percent and are expected to range between 21,300 and 64,800 in 2040. On the existing US 74 facility, volumes increase from approximately zero percent to 13 percent between the 2030 and 2040 model runs. Individual -Y- Line facilities show increases between 3 percent and 21

percent between 2030 and 2040 model runs. Overall, cumulative VMT changes equate to a 10 percent increase along the Monroe Connector/Bypass, a 8 percent increase along the US 74 corridor and a 13 percent increase cumulatively for -Y- Line locations. These increases are not expected to impact the interchange footprints for the Monroe Connector/Bypass facility.

The conclusion that can reasonably be drawn from this data is that traffic volumes are expected to increase for all study area facilities between the 2030 and 2040 time periods. Thus, 2030 Build Scenario forecast results might reasonably also be expected to demonstrate increases in traffic volumes along the Monroe Connector/Bypass Facility, existing US 74, and project study area -Y- Lines. This would further substantiate the viability of and need for the project

3.6 Comparison of 2040 Build MRM14v1.0 to 2030 Build MRM06v1.1 Model Data used in the Build Scenario Traffic Forecast

As a final comparison, the 2040 MRM14v1.0 daily traffic assignment data was compared to the original 2030 MRM06v1.1 data used in the development of the 2030 Build Scenario forecasts. Along the new Monroe Connector facility, 2040 MRM14v1.0 assignments are higher than 2030 MRM06v1.1 data on the western portion of the project, but are still less (between 2 percent and 30 percent smaller) than the 2030 MRM06v1.1 data on the eastern portion of the project. US 74 corridor results are generally higher on the western portion of the corridor and generally lower on the eastern portion and have a greater variance range (31 percent decrease to 55 percent increase) for the 2040 MRM14v1.0 results compared to the 2030 MRM06v1.1 results. -Y- Line data results have three segments showing increased daily assignment and nine segments showing decreased assignment between 2040 data and 2030 data. Volumes on Forest Hills School Road north and south of the proposed Monroe Bypass were not included in the MRM14v1.0 output provided by CRTPO. Based on the overall corridor, cumulative VMT changes equate to a 4 percent decrease along the Monroe Connector/Bypass, a 12 percent increase along the US 74 corridor and an 20 percent decrease cumulatively for -Y- Line locations. Similar to assessments made previously, potential reasons for the variability include the different SE data sets, different model networks and network characteristics, and model assignment methodologies employed in the two MRM versions. Even with the variability of the results, the overall trend along the new location facility shows consistently increasing volumes from east to west between the two model data sets. The model run comparison also shows the potential traffic volume growth along the western portion of existing US 74 and potential traffic volume decreases along eastern portions of existing US 74 between 2030 and 2040 even with the Monroe Connector facility. It is reasonable to conclude that a traffic forecast for the 2040 Build Scenario that utilizes the latest MRM14v1.0 network and 2013 SE data in a similar manner to which they were employed for the 2008 and 2035 Build Scenario forecast would produce results that are to the same magnitude, if not greater (based on the data examined in these three comparisons), than the original 2008 and 2035 Build Scenario forecast data and would further substantiate the viability of and need for the project. Comparative results are shown in **Table 7**.

4. How would the Monroe Connector/Bypass affect traffic volumes on the US 74 corridor?

Five separate scenarios were analyzed to assess the effects that the Monroe Connector/Bypass may have on projected traffic volumes on existing US 74.

4.1 Comparison of the Traffic Forecast Used in the NEPA Document

Table 8 compares data from the 2035 No-Build (**Table 1, F**) and 2035 Build (**Table 1, C**) Traffic Forecast Scenarios along the existing US 74 corridor. The results show a reduction in traffic along the corridor in the range of 600 to 34,200 vehicles per day from the No-Build to Build Scenario. This equates to a range of 1 percent to 54 percent, with an average reduction of 30 percent for overall corridor VMT.

4.2 Comparison of the 2030 MRM06v1.1 Model Results

Since the MRM06v1.1 (utilizing 2005 SE data) was used in the development of the 2008 WSA Traffic Forecast that is included in the NEPA documentation, comparisons of No-Build and Build 2030 raw model daily volume assignments are included in **Table 9**. The travel demand model is the primary source of making estimates of traffic diversion and network traffic flow changes to/from existing facilities onto a new alignment facility such as the Monroe Connector/Bypass. The only difference in the two travel demand models is the inclusion of the Monroe Connector/Bypass links.

As shown in **Table 9**, construction of the Monroe Connector/Bypass caused 2030 daily traffic assignments to reduce along US 74 in the range of 4,800 to 21,900 vehicles per day. This resulted in percentage reductions of 11 percent to 51 percent of daily traffic along the corridor from 2030 No-Build data, and an average percent reduction of 31 percent for the overall corridor VMT.

4.3 Comparison of the 2035 MRM11v1.1 Model Results

Utilizing the MRM11v1.1 travel demand model, with updated 2009 SE data and network information, a third comparison of No-Build/Build traffic volumes was made for the year 2035. The only difference in the two travel demand models is the inclusion of the Monroe Connector/Bypass links. As shown in **Table 9**, and similar to results in the previous two comparisons, 2035 daily traffic assignments along the existing US 74 corridor are reduced for every segment in the Build condition, with a range of 5,300 vpd to 25,100 vpd. The percentage of volume reduction is between 11 percent and 45 percent, with an average percent reduction of 19 percent for the overall corridor VMT.

4.4 Comparison of the 2030 MRM14v1.0 Model Results

Utilizing the MRM14v1.0 travel demand model, with updated 2013 SE data and network information, a fourth comparison of No-Build/Build traffic volumes was made for the year 2030. The only difference in the two travel demand models is the inclusion of the Monroe Connector/Bypass links. As shown in **Table 9**, and similar to results in the previous three comparisons, 2030 daily traffic assignments along the existing US 74 corridor are reduced for every segment in the Build condition, with a range of 7,000 vpd to 20,900 vpd. The percentage of volume reduction is between 14 percent and 57 percent, with an average percent reduction of 24 percent for the overall corridor VMT.

4.6 Comparison of the 2040 MRM14v1.0 Model Results

Utilizing the MRM14v1.0 travel demand model, with updated 2013 SE data and network information, a fifth comparison of No-Build/Build traffic volumes was made for the year 2040. The only difference in the two travel demand models is the inclusion of the Monroe Connector/Bypass links. As shown in **Table 9**, and similar to results in the previous four comparisons, 2040 daily traffic assignments along the existing US 74 corridor are reduced for every segment in the Build condition, with a range of 8,000 vpd to 18,800 vpd. The percentage of volume reduction is between 15 percent and 56 percent, with an average percent reduction of 24 percent for the overall corridor VMT.

Summarizing the five comparisons to forecast and travel demand model results made above, the Monroe Connector/Bypass is expected to reduce traffic volumes along the existing US 74 corridor for every corridor segment in the project study area in the Build condition. Some traffic on existing US 74 is expected to divert to the new facility, thus reducing congestion and improving traffic operations along the existing US 74 corridor with construction of the Monroe Connector/Bypass.

5. How could changes in socioeconomic data affect the traffic forecast for the Monroe Connector/Bypass project?

Various regional socioeconomic forecasting processes and updates have occurred over the last decade in association with updated versions of the Metrolina Regional Model. **Table 10** summarizes the various socioeconomic data, file name, model version and final forecast year. **Section 4.0** of the *Monroe Connector/Bypass Indirect and Cumulative Effects Technical Report (Baker, May 2013)* provides a detailed review of socioeconomic forecast data.

Table 10 – Metrolina Regional Model Socioeconomic (SE) Data Versions

SE Data (Forecast) Name	TAZ File Name	Associated Model Version	Final Forecast Year
2005 SE Data	SE_*Year*_taz2934	MRM05v1.0 MRM06v1.0 MRM06v1.1	2030
2008 SE Data	SE_*Year*_081024	MRM08v1.0	2035
2008 Interim Data	SE_*Year*_081119_MUMPO_interim	None	2035
2009 SE Data	SE_*Year*_091028	MRM09v1.0 MRM11v1.0 MRM11v1.1	2035
2013 SE Data*	LANDUSE_TAZ*YEAR*_131203	MRM14v1.0	2040

* Not available or included in *ICE Technical Report (Baker, May 2013)*.

The Metrolina Regional Model, MRM11v1.1, was used as the base model to evaluate raw model daily volume assignment for 2035 No-Build and Build conditions utilizing 2005, 2008 Interim and 2009 socioeconomic data. MRM05v1.0 and MRM06v1.1 were also utilized in their respective traffic forecasts, as previously listed in **Table 1**. MRM08v1.0 and MRM09v1.0 were not specifically utilized for traffic forecasts in the project development process. 2008 socioeconomic data was not evaluated or compared in this memorandum, since it was not used in any traffic forecast or traffic and revenue study. Referencing 2005 SE data raw model daily vehicles miles traveled (VMT) as the baseline, 2008 Interim and 2009 SE data VMT along the US 74 corridor increased 5 percent for the No-Build and 2 to 3

percent and 5 percent along the Monroe Bypass and US 74 for the Build, respectively. Changes in raw model daily vehicles miles traveled are to be expected and appropriate when comparing various socioeconomic data which are based on a variety of different information, assumptions, time periods and horizon years. This comparison shows that even while differences existing between various socioeconomic data, the resulting VMT are generally consistent (within 5 percent along US 74 for the No-Build and within 2 to 3 percent along the Monroe Bypass for the Build). **Table 11** lists raw model daily volume assignment for segments along the Monroe Connector/Bypass project and US 74 corridor for No-Build and Build conditions with 2005, 2008 Interim and 2009 SE data.

As of February 3, 2014, the MRM14v1.0 model and associated output was provided by CRTPO (formerly MUMPO). In an effort to consider all available information, this memo was revised to include a comparison of MRM14v1.0 raw model output for future Build scenarios as discussed in **Sections 3.4, 3.5, and 3.6**.

Based on a direct comparison of 2005 SE, 2008 Interim and 2009 SE data, the socioeconomic data sets have relatively similar volume assignments and corridor vehicle miles traveled within 2 to 3 percent and 5 percent for the Monroe Connector/Bypass and US 74 corridor, respectively. It is reasonable to conclude that the differences between the three sets of socioeconomic data would not substantially change the traffic forecast.

6. How could changes in the socioeconomic data related to indirect and cumulative effects affect the traffic forecast for the Monroe Connector/Bypass project?

Based on the *Monroe Connector/Bypass Indirect and Cumulative Effects Technical Report (Baker, May 2013)*, socioeconomic data was developed for a 2030 Build RPA (Recommended Preferred Alternative) scenario. This forecast of socioeconomic data is referenced as 2009 ICE data. The Metrolina Regional Model, MRM11v1.1, was run with one set of socioeconomic data (2009 SE data) for the 2030 No-Build scenario and two sets of socioeconomic data (2009 SE data and 2009 ICE data) for the 2030 Build scenario. The only difference between the two Build model runs was the change in socioeconomic data. The raw model daily volume assignment along the Monroe Connector/Bypass and US 74 corridor were compared for each model run (**Table 12**). Vehicle miles traveled (VMT) and vehicle hours traveled (VHT) were compared for each model run (**Table 13**).

The raw travel demand model daily volume assignment comparison between the two Build model runs shows little variability in the results (**Table 12**). When comparing the Monroe Connector/Bypass project links as a whole, the corridor VMT difference is less than five percent, with no individual link having a difference of greater than ten percent or 3,300 vehicles per day (vpd). When comparing the US 74 corridor as a whole, the daily bi-directional volume difference is less than three percent, with 24 out of 30 individual links having a difference of less than five percent or 2,800 vpd. The eastern terminus of the project, from E. Franklin Street to the Monroe Connector/Bypass terminus, projects daily bi-directional volume differences greater than ten percent or 1,800 vpd to 4,700 vpd.

The raw travel demand model daily volume assignment comparison between the No-Build and each of the two Build model runs shows the similar variability in the results (**Table 12**). When comparing the US 74 corridor as a whole, the daily bi-directional volume differences between the No-Build and the two Builds vary greatly. In the Build scenarios, all US 74 segment volumes are projected to decrease and corridor VMT decreases between 18 to 21 percent compared to the No-Build scenario. The raw travel demand model daily volume

assignment clearly shows that US 74 traffic volumes and corridor VMT is expected to be less with construction of the Monroe Connector/Bypass.

The VMT and VHT values were compared between Union County, Mecklenburg County, and the entire MRM11v1.1 model network (**Table 13**). The change in VMT and VHT in Union County is 3 percent and 4 percent, respectively, while changes in Mecklenburg County and across the MRM network are zero percent. Based on these minor network assignment changes between 2009 SE data and 2009 ICE data, it is reasonable to conclude the changes in SE data would not substantially change existing or future Build traffic forecast results.

Conclusions

1. **Question** – What traffic forecasts were developed during the Monroe Connector/Bypass project development process and what were they used for?

   Answer – Detailed listing of the traffic forecasts prepared during the Monroe Connector/Bypass project development process and uses are included on pages 1-5.

2. **Question** – Are the current No-Build traffic forecasts still valid for the purpose they were used?

   Answer – Yes. Based on the assessment of 2012 NCDOT AADT volumes, the Metrolina Regional Travel Demand Model, MRM11v1.1, utilizing 2009 socioeconomic data, 2030 and 2040 MRM14v1.0, utilizing 2013 socioeconomic data, existing US 74 corridor travel time runs, and current 2008 and 2035 No-Build forecast information, the No-Build traffic forecasts are still valid for the purposes they were used.

3. **Question** – Are the current Build traffic forecasts still valid for the purpose they were used?

   Answer – Yes. The differences between MRM06v1.1, MRM11v1.1 and MRM14v1.0 raw model daily volume assignment, and the Build traffic forecasts indicate that the magnitude of traffic along the Monroe Connector/Bypass and US 74 would still show the need for the project, and benefits to the existing US 74 corridor from the project, as currently supported by the Build forecast utilized in the project development process.

4. **Question** – How would the Monroe Connector/Bypass affect traffic volumes on the US 74 corridor?

   Answer – When comparing Build and No-Build Traffic Forecast Scenarios and 2030 MRM06v1.1, 2035 MRM11v1.1, 2030 and 2040 MRM14v1.0 raw model network assignment data, the Build volumes are lower than the No-Build for every segment along the US 74 corridor for the forecast results and model run results.

5. **Question** – How could changes in socioeconomic data affect the traffic forecast for the Monroe Connector/Bypass project?

   Answer – Based on a direct comparison of 2005 SE, 2008 Interim and 2009 SE data, the socioeconomic data sets have relatively similar volume assignments with cumulative corridor volumes within two percent and five percent for the Monroe Connector/Bypass and US 74 corridor, respectively. It is reasonable to conclude that the differences between the three sets of socioeconomic data would not substantially change the traffic forecast.

6. **Question** – How do changes in the socioeconomic data related to indirect and cumulative effects affect the traffic forecast for the Monroe Connector/Bypass project?

   Answer – Changes in SE data cause relatively minor changes in traffic volumes in the MRM model runs. Based on the comparison of 2030 Build MRM11v1.1 model runs using 2009 SE data and 2009 ICE SE data, the volume changes and percent changes are not substantial. The change in VMT and VHT in Union County is 3 percent and 4 percent respectively, while changes in Mecklenburg County and across the MRM network are approximately zero percent. These variations in raw model daily volume assignment will not affect the conclusions of the traffic forecasting development process.

Table 2 – US 74 Corridor No-Build Traffic Forecast Volumes

		Comparison Type	No-Build Traffic Forecast Volumes (Sec. 1)					
		Year	2007	2008	2008	2030	2035	2035
		Scenario	No-Build	No-Build	No-Build	No-Build	No-Build	No-Build
		Classification	Forecast	Forecast	Forecast Update	Forecast	Forecast	Forecast Update
	ID #	Source	MAB, June 2008	WSA, Sept. 2008	HNTB, March 2010	MAB, June 2008	WSA, Sept. 2008	HNTB, March 2010
US 74 Segments	1	I-485 to Stallings Rd	61,800	74,200	62,900	84,200	140,200	89,100
	2	Stallings Rd to Indian Trail Rd. North	60,000	72,000	60,900	81,600	134,300	86,300
	3	Indian Trail Rd. North to Unionville Indian Trail Rd. West	53,600	62,500	54,200	66,600	123,400	69,400
	4	Unionville Indian Trail Rd. West to Faith Church Rd.	51,800	63,300	52,500	68,600	123,500	72,300
	5	Faith Church Rd. to Sardis Church Rd.	53,800	63,800	54,300	65,400	124,500	67,900
	6	Sardis Church Rd. to Chambers Dr.	47,600	54,900	48,500	67,200	116,500	71,500
	7	Chambers Dr. to N. Rocky River Rd.	41,000	52,800	46,400	62,400	112,800	67,100
	8	N. Rocky River Rd. to Fowler Secrest Rd.	41,400	45,100	45,300	55,200	101,800	58,200
	9	Fowler Secrest Rd. to Rolling Hills Dr.	47,600	47,600	48,100	60,200	106,500	62,900
	10	Rolling Hills Dr. to Round Table Rd.	45,400	45,400	46,000	59,800	102,100	62,900
	11	Round Table Rd. to Williams Rd.	44,800	45,400	45,400	59,400	102,100	62,600
	12	Williams Rd. to Hanover Dr.	47,000	47,200	47,700	63,000	105,600	66,500
	13	Hanover Dr. to Dickerson Blvd.	58,200	57,600	58,700	69,600	121,300	72,100
	14	Dickerson Blvd. to Secrest Shortcut Rd.	56,600	56,000	56,700	59,200	110,700	59,800
	15	Secrest Shortcut Rd. to Secrest Shortcut Rd.	61,600	61,300	61,700	64,400	120,900	65,000
	16	Secrest Shortcut Rd. to Concord Ave.	61,600	61,300	61,700	64,400	120,900	65,000
	17	Concord Ave. to US 601	61,800	61,500	62,000	66,200	121,400	67,200
	18	US 601 to Stafford St.	58,200	57,000	58,800	71,800	116,200	74,800
	19	Stafford St. to Boyte St.	58,000	56,800	58,500	70,600	116,200	73,300
	20	Boyte St. to NC 200	56,400	56,100	56,900	67,400	115,300	69,800
	21	NC 200 to Walkup Ave.	49,600	48,500	50,200	63,800	95,300	66,900
	22	Walkup Ave. to S. Sutherland Ave.	42,600	42,000	43,100	54,800	87,300	57,500
	23	S. Sutherland Ave. to Venus St.	40,400	40,600	40,900	52,000	85,400	54,500
	24	Venus St. to E. Franklin St.	36,600	40,300	37,100	47,000	83,800	49,300
	25	E. Franklin St. to US 601 / N. Medical Center Campus	46,200	48,400	46,700	58,000	101,400	60,600
	26	US 601/Metro Medical Center Campus to S. Secrest Ave.	31,200	34,600	31,500	38,200	77,800	39,700
	27	S. Secrest Ave. to S. Bivens Rd.	29,600	33,400	30,000	39,000	75,300	41,000
	28	S. Bivens Rd. to Bivens St.	29,200	33,400	29,600	37,600	75,300	39,400
	29	Bivens St. to Austin Chaney Rd.	28,600	32,900	29,100	40,200	74,300	42,700
	30	Austin Chaney Rd. to Forest Hills School Rd. North	24,400	26,600	24,800	33,000	51,700	35,900
	31	Forest Hills School Rd. North to Marshville	19,400	22,700	19,800	29,400	44,200	31,600

Table 3 – Monroe Bypass Build Traffic Forecast Volumes

		Comparison Type	Build Traffic Forecast Volumes (Sec. 1)	
		Year	2008	2035
		Scenario	Build Toll	Build Toll
		Classification	Forecast	Forecast
Facility	ID #	Source	WSA, Sept. 2008	WSA Sept. 2008
US 74	1	I-485 to US 74 Frontage Road	73,400	115,000
US 74 / Monroe Bypass	2	US 74 Frontage Rd to US 74 / Monroe Bypass Split	71,900	95,600
Frontage Road	3	McKee Rd to Stallings Rd	n/a	19,500
Monroe Bypass Segments	1	US 74 to Indian Trail-Fairview Rd	17,500	48,200
	2	Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	18,200	51,200
	3	Unionville-Indian Trail Rd to Rocky River Rd	18,500	52,300
	4	Rocky River Rd to US 601	15,900	46,600
	5	US 601 to NC 200 (Morgan Mill Rd)	12,300	35,200
	6	NC 200 (Morgan Mill Rd) to Austin Chaney Rd	8,600	24,800
	7	Austin Chaney Rd to Forest Hills School Rd	8,400	19,600
	8	Forest Hills School Rd to US 74	8,400	16,400
US 74 Segments	2	Stallings Rd to Indian Trail Rd. North	56,400	67,400
	3	Indian Trail Rd. North to Unionville Indian Trail Rd. West	40,600	51,300
	4	Unionville Indian Trail Rd. West to Faith Church Rd.	41,400	51,400
	5	Faith Church Rd. to Sardis Church Rd.	41,900	52,400
	6	Sardis Church Rd. to Chambers Dr.	32,300	38,200
	7	Chambers Dr. to N. Rocky River Rd.	30,200	34,500
	8	N. Rocky River Rd. to Fowler Secrest Rd.	24,500	28,800
	9	Fowler Secrest Rd. to Rolling Hills Dr.	27,700	33,500
	10	Rolling Hills Dr. to Round Table Rd.	25,500	29,100
	11	Round Table Rd. to Williams Rd.	25,500	29,100
	12	Williams Rd. to Hanover Dr.	27,300	32,300
	13	Hanover Dr. to Dickerson Blvd.	37,700	48,000
	14	Dickerson Blvd. to Secrest Shortcut Rd.	36,100	37,400
	15	Secrest Shortcut Rd. to Secrest Shortcut Rd.	41,400	47,600
	16	Secrest Shortcut Rd. to Concord Ave.	41,400	47,600
	17	Concord Ave. to US 601	41,600	48,100
	18	US 601 to Stafford St.	42,600	57,200
	19	Stafford St. to Boyte St.	42,400	56,900
	20	Boyte St. to NC 200	41,600	56,000
	21	NC 200 to Walkup Ave.	40,000	54,500
	22	Walkup Ave. to S. Sutherland Ave.	33,500	46,500
	23	S. Sutherland Ave. to Venus St.	32,100	44,000
	24	Venus St. to E. Franklin St.	31,800	42,400
	25	E. Franklin St. to US 601 / N. Medical Center Campus	39,900	60,000
	26	US 601/Metro Medical Center Campus to S. Secrest Ave.	26,100	36,600
	27	S. Secrest Ave. to S. Bivens Rd.	24,900	34,100
	28	S. Bivens Rd. to Bivens St.	24,900	34,100
	29	Bivens St. to Austin Chaney Rd.	24,400	33,100
	30	Austin Chaney Rd. to Forest Hills School Rd. North	19,700	26,100
	31	Forest Hills School Rd. North to Monroe Bypass	13,700	20,700

Table 4 – Monroe Connector/Bypass Traffic and Revenue Estimated Traffic Volumes

		Comparison Type	Build Estimated Traffic Volumes (Sec. 1.3)		
		Year	2015	2020	2030
		Scenario	Build	Build	Build
		Model Version	MRM06	MRM06	MRM06
		Socioeconomic Data	2008 Interim	2008 Interim	2008 Interim
		Classification	Traffic & Revenue	Traffic & Revenue	Traffic & Revenue
Facility	ID #	Source	WSA, Oct. 2010	WSA, Oct. 2010	WSA, Oct. 2010
US 74	1	I-485 to US 74 Frontage Road	72,200	77,800	92,600
US 74 / Monroe Bypass	2	US 74 Frontage Rd to US 74 / Monroe Bypass Split	40,600	45,800	58,400
Frontage Road	3	McKee Rd to Stallings Rd	33,400	35,100	35,900
Monroe Bypass Segments	1	US 74 to Indian Trail-Fairview Rd	29,000	33,600	45,600
	2	Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	31,600	35,200	43,600
	3	Unionville-Indian Trail Rd to Rocky River Rd	29,200	32,400	40,200
	4	Rocky River Rd to US 601	25,800	28,400	35,600
	5	US 601 to NC 200 (Morgan Mill Rd)	24,600	27,200	32,800
	6	NC 200 (Morgan Mill Rd) to Austin Chaney Rd	15,200	17,200	22,600
	7	Austin Chaney Rd to Forest Hills School Rd	10,200	11,800	15,600
	8	Forest Hills School Rd to US 74	9,200	10,800	14,200

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Table 5 – US 74 Corridor AADT and No-Build Model Data Comparisons

		Comparison Type	NCDOT AADT (Sec. 2.1)		Raw Model Daily Volume (Sec. 2.2)		Raw Model Daily Volume (Sec. 2.3)	
		Year	2007	2012	2030	2035	2030	2040
		Scenario	n/a	n/a	No-Build	No-Build	No-Build	No-Build
		Model Version	n/a	n/a	MRM05	MRM11	MRM14	MRM14
		Socioeconomic Data	n/a	n/a	2005	2009	2013	2013
		Classification	AADT	AADT	Raw Model	Raw Model	Raw Model	Raw Model
	ID #	Source	NCDOT	NCDOT	Model	Model	Model	Model
US 74 Corridor Segments	1	I-485 to Stallings Rd	58,000*	57,000*	70,300*	101,600*	87,400*	90,300*
	2	Stallings Rd to Indian Trail Rd. North	53,000	53,000	65,600	90,300	81,600	81,100
	3	Indian Trail Rd. North to Unionville Indian Trail Rd. West	50,000	51,000	49,500	65,500	60,700	59,800
	4	Unionville Indian Trail Rd. West to Faith Church Rd.	49,000	48,000	54,000	66,400	60,100	61,200
	5	Faith Church Rd. to Sardis Church Rd.	n/a	n/a	58,100	56,900	54,500	59,400
	6	Sardis Church Rd. to Chambers Dr.	43,000	44,000	58,100	47,400	53,700	58,700
	7	Chambers Dr. to N. Rocky River Rd.	36,000	37,000	59,500	46,100	48,800	53,700
	8	N. Rocky River Rd. to Fowler Secrest Rd.	n/a	n/a	47,900	45,300	47,400	52,100
	9	Fowler Secrest Rd. to Rolling Hills Dr.	36,000	38,000	50,900	38,100	37,000	40,500
	10	Rolling Hills Dr. to Round Table Rd.	n/a	n/a	50,900	38,100	37,000	40,500
	11	Round Table Rd. to Williams Rd.	n/a	n/a	54,700	43,100	46,100	50,800
	12	Williams Rd. to Hanover Dr.	n/a	n/a	54,700	49,200	51,900	56,800
	13	Hanover Dr. to Dickerson Blvd.	n/a	n/a	54,700	49,200	51,900	56,800
	14	Dickerson Blvd. to Secrest Shortcut Rd.	47,000	50,000	40,000	66,400	56,600	61,200
	15	Secrest Shortcut Rd. to Secrest Shortcut Rd.	n/a	n/a	44,000	71,500	59,700	64,700
	16	Secrest Shortcut Rd. to Concord Ave.	n/a	n/a	44,000	71,500	59,700	64,700
	17	Concord Ave. to US 601	53,000	55,000	44,000	73,200	60,100	65,200
	18	US 601 to Stafford St.	54,000	51,000	57,400	69,300	56,900	61,500
	19	Stafford St. to Boyte St.	n/a	n/a	57,400	67,100	54,300	58,600
	20	Boyte St. to NC 200	52,000	50,000	53,100	66,400	52,500	56,800
	21	NC 200 to Walkup Ave.	47,000	47,000	54,100	68,200	49,900	54,400
	22	Walkup Ave. to S. Sutherland Ave.	38,000	33,000	54,100	66,800	49,500	53,800
	23	S. Sutherland Ave. to Venus St.	n/a	n/a	54,100	65,500	49,100	53,400
	24	Venus St. to E. Franklin St.	n/a	n/a	54,100	66,400	48,100	52,500
	25	E. Franklin St. to US 601 / N. Medical Center Campus	n/a	n/a	54,100	75,500	52,500	57,500
	26	US 601/Metro Medical Center Campus to S. Secrest Ave.	27,000	27,000	32,200	41,500	31,200	34,000
	27	S. Secrest Ave. to S. Bivens Rd.	25,000	24,000	35,000	48,300	32,800	35,900
	28	S. Bivens Rd. to Bivens St.	24,000	25,000	33,200	36,500	26,000	28,200
	29	Bivens St. to Austin Chaney Rd.	24,000	26,000	30,200	37,700	26,400	29,000
	30	Austin Chaney Rd. to Forest Hills School Rd. North	24,000	23,000	25,800	30,700	20,400	22,300
	31	Forest Hills School Rd. North to Marshville	n/a	n/a	23,000	21,200	14,800	16,100
		Corridor VMT	**706,610**	**710,230**	**876,001**	**965,940**	**842,066**	**900,960**
		% Change in VMT	**~0%**		**10%**		**7%**	
		% Change in VMT (2030 MRM05 to 2030 and 2040 MRM14)	**n/a**		**n/a**		**-4%**	**3%**
		VMT Annual Growth Rate	**~0%**		**2%**		**1%**	

* US 74 Corridor Segment ID #1 not included in US 74 corridor VMT calculations to provide consistent No-Build and Build corridor comparisons.

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Table 6 – US 74 Corridor AADT and No-Build Traffic Forecast Comparison

		Comparison Type	NCDOT AADT and No-Build Traffic Forecast Volumes (Sec. 2.4)			
		Year	2012	2035	Traffic Volume Increase from 2012 AADT to 2035 No-Build Forecast	Percent Volume Increase from 2012 AADT to 2035 No-Build Forecast
		Scenario	n/a	No-Build		
		Classification	AADT	Forecast Update		
	ID #	Source	NCDOT	HNTB, March 2010		
US 74 Segments	1	I-485 to Stallings Rd	57,000	89,100	**32,100**	**56%**
	2	Stallings Rd to Indian Trail Rd. North	53,000	86,300	**33,300**	**63%**
	3	Indian Trail Rd. North to Unionville Indian Trail Rd. West	51,000	69,400	**18,400**	**36%**
	4	Unionville Indian Trail Rd. West to Faith Church Rd.	48,000	72,300	**24,300**	**51%**
	5	Faith Church Rd. to Sardis Church Rd.	n/a	67,900	n/a	n/a
	6	Sardis Church Rd. to Chambers Dr.	44,000	71,500	**27,500**	**63%**
	7	Chambers Dr. to N. Rocky River Rd.	37,000	67,100	**30,100**	**81%**
	8	N. Rocky River Rd. to Fowler Secrest Rd.	n/a	58,200	n/a	n/a
	9	Fowler Secrest Rd. to Rolling Hills Dr.	38,000	62,900	**24,900**	**66%**
	10	Rolling Hills Dr. to Round Table Rd.	n/a	62,900	n/a	n/a
	11	Round Table Rd. to Williams Rd.	n/a	62,600	n/a	n/a
	12	Williams Rd. to Hanover Dr.	n/a	66,500	n/a	n/a
	13	Hanover Dr. to Dickerson Blvd.	n/a	72,100	n/a	n/a
	14	Dickerson Blvd. to Secrest Shortcut Rd.	50,000	59,800	**9,800**	**20%**
	15	Secrest Shortcut Rd. to Secrest Shortcut Rd.	n/a	65,000	n/a	n/a
	16	Secrest Shortcut Rd. to Concord Ave.	n/a	65,000	n/a	n/a
	17	Concord Ave. to US 601	55,000	67,200	**12,200**	**22%**
	18	US 601 to Stafford St.	51,000	74,800	**23,800**	**47%**
	19	Stafford St. to Boyte St.	n/a	73,300	n/a	n/a
	20	Boyte St. to NC 200	50,000	69,800	**19,800**	**40%**
	21	NC 200 to Walkup Ave.	47,000	66,900	**19,900**	**42%**
	22	Walkup Ave. to S. Sutherland Ave.	33,000	57,500	**24,500**	**74%**
	23	S. Sutherland Ave. to Venus St.	n/a	54,500	n/a	n/a
	24	Venus St. to E. Franklin St.	n/a	49,300	n/a	n/a
	25	E. Franklin St. to US 601 / N. Medical Center Campus	n/a	60,600	n/a	n/a
	26	US 601/Metro Medical Center Campus to S. Secrest Ave.	27,000	39,700	**12,700**	**47%**
	27	S. Secrest Ave. to S. Bivens Rd.	24,000	41,000	**17,000**	**71%**
	28	S. Bivens Rd. to Bivens St.	25,000	39,400	**14,400**	**58%**
	29	Bivens St. to Austin Chaney Rd.	26,000	42,700	**16,700**	**64%**
	30	Austin Chaney Rd. to Forest Hills School Rd. North	23,000	35,900	**12,900**	**56%**
	31	Forest Hills School Rd. North to Marshville	n/a	31,600	n/a	n/a

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Table 7 – 2030 and 2035 Build Model Data Comparisons

			Comparison Type	Travel Demand Model Raw Daily Volume Assignment					
			Year	2030	2030	Percent Change from 2030 MRM06 to 2030 MRM11 (Sec. 3.1)	2035	Percent Change from 2030 MRM06 to 2035 MRM11 (Sec. 3.3)	Percent Change from 2030 MRM11 to 2035 MRM11 (Sec. 3.2)
			Scenario	Build	Build		Build		
			Model Version	MRM06	MRM11		MRM11		
			Socioeconomic Data	2005	2009		2009		
			Classification	Raw Model	Raw Model		Raw Model		
Facility	ID #		Source	Model	Model		Model		
US 74	1	I-485 to US 74 Frontage Road	n/a	91,300	125,400	37%	134,000	47%	7%
US 74 / Monroe Bypass	2	US 74 Frontage Rd to US 74 / Monroe Bypass Split	n/a	89,800	109,500	22%	116,500	30%	6%
Frontage Road	3	McKee Rd to Stallings Rd	n/a	n/a	7,700	n/a	8,600	n/a	12%
			Distance (miles)						
Monroe Bypass Segments	1	US 74 to Indian Trail-Fairview Rd	2.24	47,900	62,500	30%	67,400	41%	8%
	2	Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	2.26	49,000	52,900	8%	56,800	16%	7%
	3	Unionville-Indian Trail Rd to Rocky River Rd	1.51	52,400	47,200	-10%	50,800	-3%	8%
	4	Rocky River Rd to US 601	3.77	48,300	44,100	-9%	47,700	-1%	8%
	5	US 601 to NC 200 (Morgan Mill Rd)	1.76	48,800	39,500	-19%	43,100	-12%	9%
	6	NC 200 (Morgan Mill Rd) to Austin Chaney Rd	4.06	44,600	32,500	-27%	36,000	-19%	11%
	7	Austin Chaney Rd to Forest Hills School Rd	1.79	25,900	22,600	-13%	24,800	-4%	10%
	8	Forest Hills School Rd to US 74	0.92	23,200	20,000	-14%	21,600	-7%	8%
		Corridor VMT and % Change in VMT		*813,920*	*757,407*	*-7%*	*822,161*	*1%*	*9%*
US 74 Segments	2	Stallings Rd / Monroe Bypass to Indian Trail Rd. North	1.27	47,200	61,400	30%	65,200	38%	6%
	3	Indian Trail Rd. North to Unionville Indian Trail Rd. West	0.68	37,500	48,200	29%	51,900	38%	8%
	4	Unionville Indian Trail Rd. West to Faith Church Rd.	0.80	35,700	50,100	40%	53,700	50%	7%
	5	Faith Church Rd. to Sardis Church Rd.	0.60	38,500	45,800	19%	48,200	25%	5%
	6	Sardis Church Rd. to Chambers Dr.	1.16	33,100	37,300	13%	39,800	20%	7%
	7	Chambers Dr. to N. Rocky River Rd.	1.37	34,900	35,800	3%	38,300	10%	7%
	8	N. Rocky River Rd. to Fowler Secrest Rd.	1.17	25,400	36,200	43%	38,400	51%	6%
	9	Fowler Secrest Rd. to Rolling Hills Dr.	0.78	25,400	29,400	16%	31,300	23%	6%
	10	Rolling Hills Dr. to Round Table Rd.	0.31	30,500	29,400	-4%	31,300	3%	6%
	11	Round Table Rd. to Williams Rd.	0.36	38,600	35,200	-9%	37,400	-3%	6%
	12	Williams Rd. to Hanover Dr.	0.22	38,600	41,600	8%	43,900	14%	6%
	13	Hanover Dr. to Dickerson Blvd.	0.32	38,600	41,600	8%	43,900	14%	6%
	14	Dickerson Blvd. to Secrest Shortcut Rd.	0.27	38,600	53,300	38%	56,700	47%	6%
	15	Secrest Shortcut Rd. to Secrest Shortcut Rd.	0.07	31,100	56,200	81%	59,200	90%	5%
	16	Secrest Shortcut Rd. to Concord Ave.	0.26	31,100	56,200	81%	59,200	90%	5%
	17	Concord Ave. to US 601	0.33	35,900	57,800	61%	60,900	70%	5%
	18	US 601 to Stafford St.	0.40	50,900	57,100	12%	60,400	19%	6%
	19	Stafford St. to Boyte St.	0.24	48,600	55,000	13%	57,500	18%	5%
	20	Boyte St. to NC 200	0.57	46,100	54,300	18%	57,500	25%	6%
	21	NC 200 to Walkup Ave.	0.23	44,900	55,200	23%	59,300	32%	7%
	22	Walkup Ave. to S. Sutherland Ave.	0.53	45,900	54,600	19%	58,000	26%	6%
	23	S. Sutherland Ave. to Venus St.	0.26	44,900	52,700	17%	56,100	25%	6%
	24	Venus St. to E. Franklin St.	0.19	45,000	53,100	18%	56,700	26%	7%
	25	E. Franklin St. to US 601 / N. Medical Center Campus	0.14	54,500	60,600	11%	65,200	20%	8%
	26	US 601/Metro Medical Ctr Campus to S. Secrest Ave.	1.30	26,700	30,400	14%	32,500	22%	7%
	27	S. Secrest Ave. to S. Bivens Rd.	0.38	31,100	37,000	19%	40,100	29%	8%
	28	S. Bivens Rd. to Bivens St.	1.94	24,800	26,000	5%	28,500	15%	10%
	29	Bivens St. to Austin Chaney Rd.	0.29	25,400	27,300	7%	30,000	18%	10%
	30	Austin Chaney Rd. to Forest Hills School Rd. North	2.00	18,400	19,800	8%	22,700	23%	15%
	31	Forest Hills School Rd. North to Monroe Connector/Bypass	0.50	10,300	10,600	3%	11,600	13%	9%
		Corridor VMT and % Change in VMT		*614,335*	*729,912*	*19%*	*782,051*	*27%*	*7%*
-Y- Lines	1	Indian Trail-Fairview Rd (North of Monroe Bypass)	0.50	17,000	21,500	26%	23,000	35%	7%
	2	Indian Trail-Fairview Rd (South of Monroe Bypass)	0.50	11,000	7,400	-33%	8,000	-27%	8%
	3	Unionville-Indian Trail Rd (North of Monroe Bypass)	0.50	15,000	14,000	-7%	15,000	0%	7%
	4	Unionville-Indian Trail Rd (South of Monroe Bypass)	0.50	21,000	12,800	-39%	14,100	-33%	10%
	5	Rocky River Rd (North of Monroe Bypass)	0.50	16,000	12,100	-24%	12,700	-21%	5%
	6	Rocky River Rd (South of Monroe Bypass)	0.50	14,000	17,800	27%	18,600	33%	4%
	7	US 601 (North of Monroe Bypass)	0.50	49,000	20,700	-58%	21,700	-56%	5%
	8	US 601 (South of Monroe Bypass)	0.50	43,000	18,000	-58%	18,800	-56%	4%
	9	NC 200 (Morgan Mill Rd) (North of Monroe Bypass)	0.50	19,000	14,700	-23%	16,100	-15%	10%
	10	NC 200 (Morgan Mill Rd) (South of Monroe Bypass)	0.50	12,000	18,500	54%	19,800	65%	7%
	11	Austin Chaney Rd (North of Monroe Bypass)	0.50	8,400	10,300	23%	11,400	36%	11%
	12	Austin Chaney Rd (South of Monroe Bypass)	0.50	14,000	14,000	0%	15,600	11%	11%
	13	Forest Hills School Rd (North of Monroe Bypass)	0.50	1,400	700	-50%	1,100	-21%	57%
	14	Forest Hills School Rd (South of Monroe Bypass)	0.50	1,600	2,100	31%	2,500	56%	19%
		Corridor VMT and % Change in VMT		*121,200*	*92,300*	*-24%*	*99,200*	*-18%*	*7%*

* US 74 Corridor Segment ID #1 not included in US 74 corridor VMT calculations to provide consistent No-Build and Build corridor comparisons.

Table 7 (cont.) – 2030 and 2040 Build Model Data Comparisons

			Comparison Type	Travel Demand Model Raw Daily Volume Assignment					
			Year	2030	2030	Percent Change from 2030 MRM06 to 2030 MRM14 (Sec. 3.4)	2040	Percent Change from 2030 MRM06 to 2040 MRM14 (Sec. 3.6)	Percent Change from 2030 MRM14 to 2040 MRM14 (Sec. 3.5)
			Scenario	Build	Build		Build		
			Model Version	MRM06	MRM14		MRM14		
			Socioeconomic Data	2005	2013		2013		
			Classification	Raw Model	Raw Model		Raw Model		
Facility	**ID #**		**Source**	**Model**	**Model**		**Model**		
US 74	1	I-485 to US 74 Frontage Road	n/a	91,300	118,300	30%	125,200	37%	6%
US 74 / Monroe Bypass	2	US 74 Frontage Rd to US 74 / Monroe Bypass Split	n/a	89,800	78,900	-12%	80,800	-10%	2%
Frontage Road	3	McKee Rd to Stallings Rd	n/a	n/a	17,400	n/a	21,500	n/a	24%
			Distance (miles)						
Monroe Bypass Segments	1	US 74 to Indian Trail-Fairview Rd	2.24	47,900	63,000	32%	64,800	35%	3%
	2	Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	2.26	49,000	50,900	4%	55,300	13%	9%
	3	Unionville-Indian Trail Rd to Rocky River Rd	1.51	52,400	47,800	-9%	53,200	2%	11%
	4	Rocky River Rd to US 601	3.77	48,300	41,800	-13%	47,200	-2%	13%
	5	US 601 to NC 200 (Morgan Mill Rd)	1.76	48,800	34,600	-29%	39,500	-19%	14%
	6	NC 200 (Morgan Mill Rd) to Austin Chaney Rd	4.06	44,600	27,800	-38%	31,400	-30%	13%
	7	Austin Chaney Rd to Forest Hills School Rd	1.79	25,900	19,600	-24%	21,300	-18%	9%
	8	Forest Hills School Rd to US 74	0.92	23,200	19,600	-16%	21,300	-8%	9%
		Corridor VMT and % Change in VMT		***813,920***	***712,798***	***-12%***	***783,133***	***-4%***	***10%***
US 74 Segments	2	Stallings Rd / Monroe Bypass to Indian Trail Rd. North	1.27	47,200	60,700	29%	62,300	32%	3%
	3	Indian Trail Rd. North to Unionville Indian Trail Rd. West	0.68	37,500	46,800	25%	46,900	25%	~0%
	4	Unionville Indian Trail Rd. West to Faith Church Rd.	0.80	35,700	48,700	36%	50,300	41%	3%
	5	Faith Church Rd. to Sardis Church Rd.	0.60	38,500	46,000	19%	50,200	30%	9%
	6	Sardis Church Rd. to Chambers Dr.	1.16	33,100	42,600	29%	46,000	39%	8%
	7	Chambers Dr. to N. Rocky River Rd.	1.37	34,900	37,500	7%	40,900	17%	9%
	8	N. Rocky River Rd. to Fowler Secrest Rd.	1.17	25,400	36,100	42%	39,400	55%	9%
	9	Fowler Secrest Rd. to Rolling Hills Dr.	0.78	25,400	26,100	3%	28,600	13%	10%
	10	Rolling Hills Dr. to Round Table Rd.	0.31	30,500	26,100	-14%	28,600	-6%	10%
	11	Round Table Rd. to Williams Rd.	0.36	38,600	35,400	-8%	39,100	1%	10%
	12	Williams Rd. to Hanover Dr.	0.22	38,600	41,800	8%	46,200	20%	11%
	13	Hanover Dr. to Dickerson Blvd.	0.32	38,600	41,800	8%	46,200	20%	11%
	14	Dickerson Blvd. to Secrest Shortcut Rd.	0.27	38,600	42,800	11%	46,500	20%	9%
	15	Secrest Shortcut Rd. to Secrest Shortcut Rd.	0.07	31,100	44,700	44%	48,000	54%	7%
	16	Secrest Shortcut Rd. to Concord Ave.	0.26	31,100	44,700	44%	48,000	54%	7%
	17	Concord Ave. to US 601	0.33	35,900	45,200	26%	48,500	35%	7%
	18	US 601 to Stafford St.	0.40	50,900	47,800	-6%	51,000	~0%	7%
	19	Stafford St. to Boyte St.	0.24	48,600	45,200	-7%	48,100	-1%	6%
	20	Boyte St. to NC 200	0.57	46,100	43,300	-6%	46,300	~0%	7%
	21	NC 200 to Walkup Ave.	0.23	44,900	42,300	-6%	45,800	2%	8%
	22	Walkup Ave. to S. Sutherland Ave.	0.53	45,900	42,500	-7%	45,800	~0%	8%
	23	S. Sutherland Ave. to Venus St.	0.26	44,900	40,500	-10%	43,800	-2%	8%
	24	Venus St. to E. Franklin St.	0.19	45,000	39,500	-12%	42,900	-5%	9%
	25	E. Franklin St. to US 601 / N. Medical Center Campus	0.14	54,500	43,100	-21%	47,200	-13%	10%
	26	US 601/Metro Medical Ctr Campus to S. Secrest Ave.	1.30	26,700	22,300	-16%	24,400	-9%	9%
	27	S. Secrest Ave. to S. Bivens Rd.	0.38	31,100	23,800	-23%	26,400	-15%	11%
	28	S. Bivens Rd. to Bivens St.	1.94	24,800	16,600	-33%	18,700	-25%	13%
	29	Bivens St. to Austin Chaney Rd.	0.29	25,400	17,900	-30%	20,300	-20%	13%
	30	Austin Chaney Rd. to Forest Hills School Rd. North	2.00	18,400	12,100	-34%	13,700	-26%	13%
	31	Forest Hills School Rd. North to Monroe Connector/Bypass	0.50	10,300	6,400	-38%	7,100	-31%	11%
		Corridor VMT and % Change in VMT		***614,335***	***637,290***	***4%***	***685,619***	***12%***	***8%***
-Y- Lines	1	Indian Trail-Fairview Rd (North of Monroe Bypass)	0.50	17,000	24,800	46%	29,100	71%	17%
	2	Indian Trail-Fairview Rd (South of Monroe Bypass)	0.50	11,000	7,400	-33%	8,700	-21%	18%
	3	Unionville-Indian Trail Rd (North of Monroe Bypass)	0.50	15,000	12,300	-18%	13,600	-9%	11%
	4	Unionville-Indian Trail Rd (South of Monroe Bypass)	0.50	21,000	13,300	-37%	15,500	-26%	17%
	5	Rocky River Rd (North of Monroe Bypass)	0.50	16,000	9,500	-41%	10,500	-34%	11%
	6	Rocky River Rd (South of Monroe Bypass)	0.50	14,000	17,300	24%	18,900	35%	9%
	7	US 601 (North of Monroe Bypass)	0.50	49,000	23,300	-52%	26,000	-47%	12%
	8	US 601 (South of Monroe Bypass)	0.50	43,000	23,200	-46%	25,600	-40%	10%
	9	NC 200 (Morgan Mill Rd) (North of Monroe Bypass)	0.50	19,000	10,700	-44%	11,000	-42%	3%
	10	NC 200 (Morgan Mill Rd) (South of Monroe Bypass)	0.50	12,000	17,300	44%	19,000	58%	10%
	11	Austin Chaney Rd (North of Monroe Bypass)	0.50	8,400	5,600	-33%	6,800	-19%	21%
	12	Austin Chaney Rd (South of Monroe Bypass)	0.50	14,000	8,500	-39%	10,200	-27%	20%
	13	Forest Hills School Rd (North of Monroe Bypass)	0.50	1,400	Volumes for this segment were not included in the MRM14 output provided CRTPO				
	14	Forest Hills School Rd (South of Monroe Bypass)	0.50	1,600	Volumes for this segment were not included in the MRM14 output provided CRTPO				
		Corridor VMT and % Change in VMT		***121,200***	***86,600***	***-29%***	***97,450***	***-20%***	***13%***

* US 74 Corridor Segment ID #1 not included in US 74 corridor VMT calculations to provide consistent No-Build and Build corridor comparisons.

Table 8 – Effects of the Monroe Connector/Bypass on US 74 Traffic Forecast Volumes

		Comparison Type	Traffic Forecast Volumes (Sec. 4.1)			
		Year	2035	2035	Traffic Volume Reduction Due to Build Scenario	Percent Volume Reduction on US 74 in Build Scenario
		Scenario	No-Build	Build Toll		
		Classification	Forecast Update	Forecast		
	ID #	Source	HNTB, March 2010	WSA Sept. 2008		
US 74 Segments	2	Stallings Rd to Indian Trail Rd. North	86,300	67,400	**-18,900**	**-22%**
	3	Indian Trail Rd. North to Unionville Indian Trail Rd. West	69,400	51,300	**-18,100**	**-26%**
	4	Unionville Indian Trail Rd. West to Faith Church Rd.	72,300	51,400	**-20,900**	**-29%**
	5	Faith Church Rd. to Sardis Church Rd.	67,900	52,400	**-15,500**	**-23%**
	6	Sardis Church Rd. to Chambers Dr.	71,500	38,200	**-33,300**	**-47%**
	7	Chambers Dr. to N. Rocky River Rd.	67,100	34,500	**-32,600**	**-49%**
	8	N. Rocky River Rd. to Fowler Secrest Rd.	58,200	28,800	**-29,400**	**-51%**
	9	Fowler Secrest Rd. to Rolling Hills Dr.	62,900	33,500	**-29,400**	**-47%**
	10	Rolling Hills Dr. to Round Table Rd.	62,900	29,100	**-33,800**	**-54%**
	11	Round Table Rd. to Williams Rd.	62,600	29,100	**-33,500**	**-54%**
	12	Williams Rd. to Hanover Dr.	66,500	32,300	**-34,200**	**-51%**
	13	Hanover Dr. to Dickerson Blvd.	72,100	48,000	**-24,100**	**-33%**
	14	Dickerson Blvd. to Secrest Shortcut Rd.	59,800	37,400	**-22,400**	**-37%**
	15	Secrest Shortcut Rd. to Secrest Shortcut Rd.	65,000	47,600	**-17,400**	**-27%**
	16	Secrest Shortcut Rd. to Concord Ave.	65,000	47,600	**-17,400**	**-27%**
	17	Concord Ave. to US 601	67,200	48,100	**-19,100**	**-28%**
	18	US 601 to Stafford St.	74,800	57,200	**-17,600**	**-24%**
	19	Stafford St. to Boyte St.	73,300	56,900	**-16,400**	**-22%**
	20	Boyte St. to NC 200	69,800	56,000	**-13,800**	**-20%**
	21	NC 200 to Walkup Ave.	66,900	54,500	**-12,400**	**-19%**
	22	Walkup Ave. to S. Sutherland Ave.	57,500	46,500	**-11,000**	**-19%**
	23	S. Sutherland Ave. to Venus St.	54,500	44,000	**-10,500**	**-19%**
	24	Venus St. to E. Franklin St.	49,300	42,400	**-6,900**	**-14%**
	25	E. Franklin St. to US 601 / N. Medical Center Campus	60,600	60,000	**-600**	**-1%**
	26	US 601/Metro Medical Center Campus to S. Secrest Ave.	39,700	36,600	**-3,100**	**-8%**
	27	S. Secrest Ave. to S. Bivens Rd.	41,000	34,100	**-6,900**	**-17%**
	28	S. Bivens Rd. to Bivens St.	39,400	34,100	**-5,300**	**-13%**
	29	Bivens St. to Austin Chaney Rd.	42,700	33,100	**-9,600**	**-22%**
	30	Austin Chaney Rd. to Forest Hills School Rd. North	35,900	26,100	**-9,800**	**-27%**
	31	Forest Hills School Rd. North to Marshville	31,600	20,700	**-10,900**	**-34%**
		Corridor VMT, VMT Reduction and % Change in VMT	***1,095,695***	***760,460***	***-335,235***	***-31%***

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Table 9 – Effects of the Monroe Connector/Bypass on US 74 Travel Demand Model Assignment

		Comparison Type	Travel Demand Model Raw Output Assignment							
		Year	2030	2030	Assignment Reduction Due to Build Scenario (Sec. 4.2)	Percent Reduction on US 74 in Build Scenario (Sec. 4.2)	2035	2035	Assignment Reduction Due to Build Scenario (Sec. 4.3)	Percent Reduction on US 74 in Build Scenario (Sec. 4.3)
		Scenario	No-Build	Build			No-Build	Build		
		Model Version	MRM06	MRM06			MRM11	MRM11		
		Socioeconomic Data	2005	2005			2009	2009		
		Classification	Raw Model	Raw Model			Raw Model	Raw Model		
	ID #	Source	Model	Model			Model	Model		
US 74 Segments	2	Stallings Rd / Monroe Bypass to Indian Trail Rd. North	62,600	47,200	**-15,400**	**-25%**	90,300	65,200	**-25,100**	**-28%**
	3	Indian Trail Rd. North to Unionville Indian Trail Rd. West	51,800	37,500	**-14,300**	**-28%**	65,500	51,900	**-13,600**	**-21%**
	4	Unionville Indian Trail Rd. West to Faith Church Rd.	49,600	35,700	**-13,900**	**-28%**	66,400	53,700	**-12,700**	**-19%**
	5	Faith Church Rd. to Sardis Church Rd.	51,000	38,500	**-12,500**	**-25%**	56,900	48,200	**-8,700**	**-15%**
	6	Sardis Church Rd. to Chambers Dr.	50,600	33,100	**-17,500**	**-35%**	47,400	39,800	**-7,600**	**-16%**
	7	Chambers Dr. to N. Rocky River Rd.	52,600	34,900	**-17,700**	**-34%**	46,100	38,300	**-7,800**	**-17%**
	8	N. Rocky River Rd. to Fowler Secrest Rd.	42,600	25,400	**-17,200**	**-40%**	45,300	38,400	**-6,900**	**-15%**
	9	Fowler Secrest Rd. to Rolling Hills Dr.	47,300	25,400	**-21,900**	**-46%**	38,100	31,300	**-6,800**	**-18%**
	10	Rolling Hills Dr. to Round Table Rd.	47,300	30,500	**-16,800**	**-36%**	38,100	31,300	**-6,800**	**-18%**
	11	Round Table Rd. to Williams Rd.	55,700	38,600	**-17,100**	**-31%**	43,100	37,400	**-5,700**	**-13%**
	12	Williams Rd. to Hanover Dr.	55,700	38,600	**-17,100**	**-31%**	49,200	43,900	**-5,300**	**-11%**
	13	Hanover Dr. to Dickerson Blvd.	55,700	38,600	**-17,100**	**-31%**	49,200	43,900	**-5,300**	**-11%**
	14	Dickerson Blvd. to Secrest Shortcut Rd.	43,400	38,600	**-4,800**	**-11%**	66,400	56,700	**-9,700**	**-15%**
	15	Secrest Shortcut Rd. to Secrest Shortcut Rd.	48,400	31,100	**-17,300**	**-36%**	71,500	59,200	**-12,300**	**-17%**
	16	Secrest Shortcut Rd. to Concord Ave.	48,400	31,100	**-17,300**	**-36%**	71,500	59,200	**-12,300**	**-17%**
	17	Concord Ave. to US 601	47,300	35,900	**-11,400**	**-24%**	73,200	60,900	**-12,300**	**-17%**
	18	US 601 to Stafford St.	61,700	50,900	**-10,800**	**-18%**	69,300	60,400	**-8,900**	**-13%**
	19	Stafford St. to Boyte St.	59,500	48,600	**-10,900**	**-18%**	67,100	57,500	**-9,600**	**-14%**
	20	Boyte St. to NC 200	57,100	46,100	**-11,000**	**-19%**	66,400	57,500	**-8,900**	**-13%**
	21	NC 200 to Walkup Ave.	56,200	44,900	**-11,300**	**-20%**	68,200	59,300	**-8,900**	**-13%**
	22	Walkup Ave. to S. Sutherland Ave.	57,000	45,900	**-11,100**	**-19%**	66,800	58,000	**-8,800**	**-13%**
	23	S. Sutherland Ave. to Venus St.	58,700	44,900	**-13,800**	**-24%**	65,500	56,100	**-9,400**	**-14%**
	24	Venus St. to E. Franklin St.	59,000	45,000	**-14,000**	**-24%**	66,400	56,700	**-9,700**	**-15%**
	25	E. Franklin St. to US 601 / N. Medical Center Campus	68,500	54,500	**-14,000**	**-20%**	75,500	65,200	**-10,300**	**-14%**
	26	US 601/Metro Medical Center Campus to S. Secrest Ave.	38,500	26,700	**-11,800**	**-31%**	41,500	32,500	**-9,000**	**-22%**
	27	S. Secrest Ave. to S. Bivens Rd.	41,600	31,100	**-10,500**	**-25%**	48,300	40,100	**-8,200**	**-17%**
	28	S. Bivens Rd. to Bivens St.	39,900	24,800	**-15,100**	**-38%**	36,500	28,500	**-8,000**	**-22%**
	29	Bivens St. to Austin Chaney Rd.	39,500	25,400	**-14,100**	**-36%**	37,700	30,000	**-7,700**	**-20%**
	30	Austin Chaney Rd. to Forest Hills School Rd. North	30,700	18,400	**-12,300**	**-40%**	30,700	22,700	**-8,000**	**-26%**
	31	Forest Hills School Rd. North to Monroe Connector/Bypass	21,200	10,300	**-10,900**	**-51%**	21,200	11,600	**-9,600**	**-45%**
		Corridor VMT, VMT Reduction and % Change in VMT	***888,016***	***614,335***	***-273,681***	***-31%***	***965,940***	***782,051***	***-183,889***	***-19%***

Table 9 (cont.) – Effects of the Monroe Connector/Bypass on US 74 Travel Demand Model Assignment

		Comparison Type	Travel Demand Model Raw Output Assignment							
		Year	2030	2030	Assignment Reduction Due to Build Scenario (Sec. 4.4)	Percent Reduction on US 74 in Build Scenario (Sec. 4.4)	2040	2040	Assignment Reduction Due to Build Scenario (Sec. 4.5)	Percent Reduction on US 74 in Build Scenario (Sec. 4.5)
		Scenario	No-Build	Build			No-Build	Build		
		Model Version	MRM 14	MRM 14			MRM 14	MRM 14		
		Socioeconomic Data	2013	2013			2013	2013		
		Classification	Raw Model	Raw Model			Raw Model	Raw Model		
	ID #	Source	Model	Model			Model	Model		
US 74 Segments	2	Stallings Rd / Monroe Bypass to Indian Trail Rd. North	81,600	60,700	**-20,900**	**-26%**	81,100	62,300	**-18,800**	**-23%**
	3	Indian Trail Rd. North to Unionville Indian Trail Rd. West	60,700	46,800	**-13,900**	**-23%**	59,800	46,900	**-12,900**	**-22%**
	4	Unionville Indian Trail Rd. West to Faith Church Rd.	60,100	48,700	**-11,400**	**-19%**	61,200	50,300	**-10,900**	**-18%**
	5	Faith Church Rd. to Sardis Church Rd.	54,500	46,000	**-8,500**	**-16%**	59,400	50,200	**-9,200**	**-15%**
	6	Sardis Church Rd. to Chambers Dr.	53,700	42,600	**-11,100**	**-21%**	58,700	46,000	**-12,700**	**-22%**
	7	Chambers Dr. to N. Rocky River Rd.	48,800	37,500	**-11,300**	**-23%**	53,700	40,900	**-12,800**	**-24%**
	8	N. Rocky River Rd. to Fowler Secrest Rd.	47,400	36,100	**-11,300**	**-24%**	52,100	39,400	**-12,700**	**-24%**
	9	Fowler Secrest Rd. to Rolling Hills Dr.	37,000	26,100	**-10,900**	**-29%**	40,500	28,600	**-11,900**	**-29%**
	10	Rolling Hills Dr. to Round Table Rd.	37,000	26,100	**-10,900**	**-29%**	40,500	28,600	**-11,900**	**-29%**
	11	Round Table Rd. to Williams Rd.	46,100	35,400	**-10,700**	**-23%**	50,800	39,100	**-11,700**	**-23%**
	12	Williams Rd. to Hanover Dr.	51,900	41,800	**-10,100**	**-19%**	56,800	46,200	**-10,600**	**-19%**
	13	Hanover Dr. to Dickerson Blvd.	51,900	41,800	**-10,100**	**-19%**	56,800	46,200	**-10,600**	**-19%**
	14	Dickerson Blvd. to Secrest Shortcut Rd.	56,600	42,800	**-13,800**	**-24%**	61,200	46,500	**-14,700**	**-24%**
	15	Secrest Shortcut Rd. to Secrest Shortcut Rd.	59,700	44,700	**-15,000**	**-25%**	64,700	48,000	**-16,700**	**-26%**
	16	Secrest Shortcut Rd. to Concord Ave.	59,700	44,700	**-15,000**	**-25%**	64,700	48,000	**-16,700**	**-26%**
	17	Concord Ave. to US 601	60,100	45,200	**-14,900**	**-25%**	65,200	48,500	**-16,700**	**-26%**
	18	US 601 to Stafford St.	56,900	47,800	**-9,100**	**-16%**	61,500	51,000	**-10,500**	**-17%**
	19	Stafford St. to Boyte St.	54,300	45,200	**-9,100**	**-17%**	58,600	48,100	**-10,500**	**-18%**
	20	Boyte St. to NC 200	52,500	43,300	**-9,200**	**-18%**	56,800	46,300	**-10,500**	**-18%**
	21	NC 200 to Walkup Ave.	49,900	42,300	**-7,600**	**-15%**	54,400	45,800	**-8,600**	**-16%**
	22	Walkup Ave. to S. Sutherland Ave.	49,500	42,500	**-7,000**	**-14%**	53,800	45,800	**-8,000**	**-15%**
	23	S. Sutherland Ave. to Venus St.	49,100	40,500	**-8,600**	**-18%**	53,400	43,800	**-9,600**	**-18%**
	24	Venus St. to E. Franklin St.	48,100	39,500	**-8,600**	**-18%**	52,500	42,900	**-9,600**	**-18%**
	25	E. Franklin St. to US 601 / N. Medical Center Campus	52,500	43,100	**-9,400**	**-18%**	57,500	47,200	**-10,300**	**-18%**
	26	US 601/Metro Medical Center Campus to S. Secrest Ave.	31,200	22,300	**-8,900**	**-29%**	34,000	24,400	**-9,600**	**-28%**
	27	S. Secrest Ave. to S. Bivens Rd.	32,800	23,800	**-9,000**	**-27%**	35,900	26,400	**-9,500**	**-26%**
	28	S. Bivens Rd. to Bivens St.	26,000	16,600	**-9,400**	**-36%**	28,200	18,700	**-9,500**	**-34%**
	29	Bivens St. to Austin Chaney Rd.	26,400	17,900	**-8,500**	**-32%**	29,000	20,300	**-8,700**	**-30%**
	30	Austin Chaney Rd. to Forest Hills School Rd. North	20,400	12,100	**-8,300**	**-41%**	22,300	13,700	**-8,600**	**-39%**
	31	Forest Hills School Rd. North to Monroe Connector/Bypass	14,800	6,400	**-8,400**	**-57%**	16,100	7,100	**-9,000**	**-56%**
		Corridor VMT, VMT Reduction and % Change in VMT	***842,066***	***637,290***	***-204,776***	***-24%***	***900,960***	***685,619***	***-215,341***	***-24%***

Table 11 – Effects of the Socioeconomic Data on Travel Demand Model Assignment

		Comparison Type	Travel Demand Model Raw Assignment (Sec. 5)									
		Year	2035	2035	2035	Percent Change from SE 2005 to SE 2008 Interim	Percent Change from SE 2005 to SE 2009	2035	2035	2035	Percent Change from SE 2005 to SE 2008 Interim	Percent Change from SE 2005 to SE 2009
		Scenario	No-Build	No-Build	No-Build			Build	Build	Build		
		Model Version	MRM11	MRM11	MRM11			MRM11	MRM11	MRM11		
		Socioeconomic Data	2005	2008 Interim	2009			2005	2008 Interim	2009		
		Classification	Raw Model	Raw Model	Raw Model			Raw Model	Raw Model	Raw Model		
Facility	**ID #**	Source	Model	Model	Model			Model	Model	Model		
US 74	1	I-485 to US 74 Frontage Road	n/a	n/a	n/a	n/a	n/a	124,700	131,800	134,000	**6%**	**7%**
US 74 / Monroe Bypass	2	US 74 Frontage Rd to US 74 / Monroe Bypass Split	n/a	n/a	n/a	n/a	n/a	110,500	116,000	116,500	**5%**	**5%**
Frontage Road	3	McKee Rd to Stallings Rd	n/a	n/a	n/a	n/a	n/a	8,300	8,100	8,600	**-2%**	**4%**
Monroe Bypass Segments	1	US 74 to Indian Trail-Fairview Rd	n/a	n/a	n/a	n/a	n/a	62,900	66,800	67,400	**6%**	**7%**
	2	Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	n/a	n/a	n/a	n/a	n/a	55,700	56,700	56,800	**2%**	**2%**
	3	Unionville-Indian Trail Rd to Rocky River Rd	n/a	n/a	n/a	n/a	n/a	49,800	50,800	50,800	**2%**	**2%**
	4	Rocky River Rd to US 601	n/a	n/a	n/a	n/a	n/a	47,100	47,300	47,700	**0%**	**1%**
	5	US 601 to NC 200 (Morgan Mill Rd)	n/a	n/a	n/a	n/a	n/a	41,700	42,800	43,100	**3%**	**3%**
	6	NC 200 (Morgan Mill Rd) to Austin Chaney Rd	n/a	n/a	n/a	n/a	n/a	35,100	35,900	36,000	**2%**	**3%**
	7	Austin Chaney Rd to Forest Hills School Rd	n/a	n/a	n/a	n/a	n/a	24,300	24,700	24,800	**2%**	**2%**
	8	Forest Hills School Rd to US 74	n/a	n/a	n/a	n/a	n/a	21,800	21,600	21,600	**-1%**	**-1%**
		Corridor VMT and % Change in VMT	***n/a***	***n/a***	***n/a***	***n/a***	***n/a***	***798,994***	***817,970***	***822,161***	***2%***	***3%***
US 74 Segments	1	I-485 to Stallings Rd	92,100*	98,800*	101,600*	**7%***	**10%***	n/a*	n/a*	n/a*	n/a*	n/a*
	2	Stallings Rd to Indian Trail Rd. North	82,300	88,500	90,300	**8%**	**10%**	61,000	64,600	65,200	**6%**	**7%**
	3	Indian Trail Rd. North to Unionville Indian Trail Rd. West	60,000	64,600	65,500	**8%**	**9%**	48,500	51,800	51,900	**7%**	**7%**
	4	Unionville Indian Trail Rd. West to Faith Church Rd.	60,700	66,300	66,400	**9%**	**9%**	49,600	53,600	53,700	**8%**	**8%**
	5	Faith Church Rd. to Sardis Church Rd.	53,100	57,200	56,900	**8%**	**7%**	45,400	48,300	48,200	**6%**	**6%**
	6	Sardis Church Rd. to Chambers Dr.	46,500	47,500	47,400	**2%**	**2%**	39,700	40,200	39,800	**1%**	**0%**
	7	Chambers Dr. to N. Rocky River Rd.	45,200	46,200	46,100	**2%**	**2%**	38,100	38,600	38,300	**1%**	**1%**
	8	N. Rocky River Rd. to Fowler Secrest Rd.	46,600	45,600	45,300	**-2%**	**-3%**	40,300	38,800	38,400	**-4%**	**-5%**
	9	Fowler Secrest Rd. to Rolling Hills Dr.	38,500	38,300	38,100	**-1%**	**-1%**	31,700	31,700	31,300	**0%**	**-1%**
	10	Rolling Hills Dr. to Round Table Rd.	38,500	38,300	38,100	**-1%**	**-1%**	31,700	31,700	31,300	**0%**	**-1%**
	11	Round Table Rd. to Williams Rd.	43,300	49,100	43,100	**13%**	**0%**	37,500	43,900	37,400	**17%**	**0%**
	12	Williams Rd. to Hanover Dr.	49,500	49,100	49,200	**-1%**	**-1%**	43,800	43,900	43,900	**0%**	**0%**
	13	Hanover Dr. to Dickerson Blvd.	49,500	49,100	49,200	**-1%**	**-1%**	43,800	43,900	43,900	**0%**	**0%**
	14	Dickerson Blvd. to Secrest Shortcut Rd.	66,400	66,300	66,400	**0%**	**0%**	57,000	56,900	56,700	**0%**	**-1%**
	15	Secrest Shortcut Rd. to Secrest Shortcut Rd.	71,400	71,400	71,500	**0%**	**0%**	59,600	59,400	59,200	**0%**	**-1%**
	16	Secrest Shortcut Rd. to Concord Ave.	71,400	71,400	71,500	**0%**	**0%**	59,600	59,400	59,200	**0%**	**-1%**
	17	Concord Ave. to US 601	72,900	73,100	73,200	**0%**	**0%**	61,200	61,100	60,900	**0%**	**0%**
	18	US 601 to Stafford St.	67,000	69,200	69,300	**3%**	**3%**	58,100	50,900	60,400	**-12%**	**4%**
	19	Stafford St. to Boyte St.	65,000	67,000	67,100	**3%**	**3%**	56,100	58,100	57,500	**4%**	**2%**
	20	Boyte St. to NC 200	63,800	66,300	66,400	**4%**	**4%**	55,200	57,600	57,500	**4%**	**4%**
	21	NC 200 to Walkup Ave.	66,200	67,900	68,200	**3%**	**3%**	57,000	59,500	59,300	**4%**	**4%**
	22	Walkup Ave. to S. Sutherland Ave.	64,800	66,400	66,800	**2%**	**3%**	55,700	58,000	58,000	**4%**	**4%**
	23	S. Sutherland Ave. to Venus St.	62,800	65,300	65,500	**4%**	**4%**	53,100	56,000	56,100	**5%**	**6%**
	24	Venus St. to E. Franklin St.	63,100	66,200	66,400	**5%**	**5%**	53,300	56,600	56,700	**6%**	**6%**
	25	E. Franklin St. to US 601 / N. Medical Center Campus	71,400	75,400	75,500	**6%**	**6%**	60,700	65,100	65,200	**7%**	**7%**
	26	US 601/Metro Medical Center Campus to S. Secrest Ave.	38,900	41,400	41,500	**6%**	**7%**	29,600	32,400	32,500	**9%**	**10%**
	27	S. Secrest Ave. to S. Bivens Rd.	45,000	48,300	48,300	**7%**	**7%**	36,600	40,000	40,100	**9%**	**10%**
	28	S. Bivens Rd. to Bivens St.	33,900	36,300	36,500	**7%**	**8%**	25,700	28,300	28,500	**10%**	**11%**
	29	Bivens St. to Austin Chaney Rd.	35,000	37,600	37,700	**7%**	**8%**	27,200	30,000	30,000	**10%**	**10%**
	30	Austin Chaney Rd. to Forest Hills School Rd. North	27,600	30,900	30,700	**12%**	**11%**	17,800	21,200	22,700	**19%**	**28%**
	31	Forest Hills School Rd. North to Monroe Bypass	19,900	21,200	21,200	**7%**	**7%**	10,200	11,700	11,600	**15%**	**14%**
		Corridor VMT and % Change in VMT	***921,342***	***965,324***	***965,940***	***5%***	***5%***	***743,793***	***778,388***	***782,051***	***5%***	***5%***

* US 74 Corridor Segment ID #1 not included in US 74 corridor VMT calculations to provide consistent No-Build and Build corridor comparisons.

Table 12 – Effects of Indirect and Cumulative Effects Socioeconomic Data on Travel Demand Model Assignment

		Comparison Type	Travel Demand Model Raw Assignment (Sec. 6)					
		Year	2030	2030	Percent Change from 2030 NB 2009 SE to 2030 B 2009 SE	2030	Percent Change from 2030 NB 2009 SE to 2030 B 2009 ICE	Percent Change from 2030 B 2009 SE to 2030 B 2009 ICE
		Scenario	No-Build	Build		Build		
		Model Version	MRM11	MRM11		MRM11		
		Socioeconomic Data	2009	2009		2009 ICE		
		Classification	Raw Model	Raw Model		Raw Model		
Facility	**ID #**	Source	Model	Model		Model		
US 74	1	I-485 to US 74 Frontage Road	n/a	125,400	n/a	125,600	n/a	0%
US 74 / Monroe Bypass	2	US 74 Frontage Rd to US 74 / Monroe Bypass Split	n/a	109,500	n/a	109,700	n/a	0%
Frontage Road	3	McKee Rd to Stallings Rd	n/a	7,700	n/a	8,100	n/a	5%
Monroe Bypass Segments	1	US 74 to Indian Trail-Fairview Rd	n/a	62,500	n/a	63,100	n/a	1%
	2	Indian Trail-Fairview Rd to Unionville-Indian Trail Rd	n/a	52,900	n/a	54,400	n/a	3%
	3	Unionville-Indian Trail Rd to Rocky River Rd	n/a	47,200	n/a	48,600	n/a	3%
	4	Rocky River Rd to US 601	n/a	44,100	n/a	46,300	n/a	5%
	5	US 601 to NC 200 (Morgan Mill Rd)	n/a	39,500	n/a	42,400	n/a	7%
	6	NC 200 (Morgan Mill Rd) to Austin Chaney Rd	n/a	32,500	n/a	35,800	n/a	10%
	7	Austin Chaney Rd to Forest Hills School Rd	n/a	22,600	n/a	23,800	n/a	5%
	8	Forest Hills School Rd to US 74	n/a	20,000	n/a	20,400	n/a	2%
		Corridor VMT and % Change in VMT	***n/a***	***757,407***	***n/a***	***793,567***	***n/a***	***5%***
US 74 Corridor Segments	1	I-485 to Stallings Rd	83,500*	n/a*	n/a*	n/a*	n/a*	n/a*
	2	Stallings Rd to Indian Trail Rd. North	83,500	61,400	-26%	61,400	-26%	0%
	3	Indian Trail Rd. North to Unionville Indian Trail Rd. West	60,300	48,200	-20%	48,400	-20%	0%
	4	Unionville Indian Trail Rd. West to Faith Church Rd.	61,700	50,100	-19%	50,200	-19%	0%
	5	Faith Church Rd. to Sardis Church Rd.	54,000	45,800	-15%	46,100	-15%	1%
	6	Sardis Church Rd. to Chambers Dr.	44,500	37,300	-16%	38,100	-14%	2%
	7	Chambers Dr. to N. Rocky River Rd.	42,200	35,800	-15%	35,500	-16%	-1%
	8	N. Rocky River Rd. to Fowler Secrest Rd.	42,900	36,200	-16%	37,300	-13%	3%
	9	Fowler Secrest Rd. to Rolling Hills Dr.	42,900	29,400	-31%	30,300	-29%	3%
	10	Rolling Hills Dr. to Round Table Rd.	40,900	29,400	-28%	30,300	-26%	3%
	11	Round Table Rd. to Williams Rd.	46,700	35,200	-25%	35,900	-23%	2%
	12	Williams Rd. to Hanover Dr.	62,600	41,600	-34%	42,000	-33%	1%
	13	Hanover Dr. to Dickerson Blvd.	62,600	41,600	-34%	42,000	-33%	1%
	14	Dickerson Blvd. to Secrest Shortcut Rd.	62,600	53,300	-15%	54,700	-13%	3%
	15	Secrest Shortcut Rd. to Secrest Shortcut Rd.	68,000	56,200	-17%	56,900	-16%	1%
	16	Secrest Shortcut Rd. to Concord Ave.	68,000	56,200	-17%	56,900	-16%	1%
	17	Concord Ave. to US 601	69,500	57,800	-17%	58,600	-16%	1%
	18	US 601 to Stafford St.	65,800	57,100	-13%	57,900	-12%	1%
	19	Stafford St. to Boyte St.	63,700	55,000	-14%	55,800	-12%	1%
	20	Boyte St. to NC 200	62,900	54,300	-14%	55,100	-12%	1%
	21	NC 200 to Walkup Ave.	63,300	55,200	-13%	56,300	-11%	2%
	22	Walkup Ave. to S. Sutherland Ave.	62,200	54,600	-12%	55,600	-11%	2%
	23	S. Sutherland Ave. to Venus St.	61,600	52,700	-14%	54,200	-12%	3%
	24	Venus St. to E. Franklin St.	62,000	53,100	-14%	55,200	-11%	4%
	25	E. Franklin St. to US 601 / N. Medical Center Campus	70,200	60,600	-14%	63,400	-10%	5%
	26	US 601/Metro Medical Center Campus to S. Secrest Ave.	38,800	30,400	-22%	33,400	-14%	10%
	27	S. Secrest Ave. to S. Bivens Rd.	44,900	37,000	-18%	41,400	-8%	12%
	28	S. Bivens Rd. to Bivens St.	33,800	26,000	-23%	29,300	-13%	13%
	29	Bivens St. to Austin Chaney Rd.	34,700	27,300	-21%	31,900	-8%	17%
	30	Austin Chaney Rd. to Forest Hills School Rd. North	27,800	19,800	-29%	24,500	-12%	24%
	31	Forest Hills School Rd. North to Monroe Bypass	19,400	10,600	-45%	12,400	-36%	17%
		Corridor VMT and % Change in VMT	***918,517***	***729,912***	***-21%***	***760,974***	***-17%***	***4%***

* US 74 Corridor Segment ID #1 not included in US 74 corridor VMT calculations to provide consistent No-Build and Build corridor comparisons.

Table 13 – 2030 Build VMT and VHT Comparison

	2030 Build (with Monroe Connector/Bypass)				2009 SE Data vs. 2009 ICE Data	
	with 2009 SE Data		with 2009 ICE Data			
COUNTY	**TOTAL VMT**	**TOTAL VHT**	**TOTAL VMT**	**TOTAL VHT**	**% CHANGE in VMT**	**% CHANGE in VHT**
Mecklenburg County	44,747,461	1,664,994	44,745,210	1,665,283	**0%**	**0%**
Union County	9,612,887	302,260	9,948,279	315,582	**3%**	**4%**
MRM Network	105,856,112	3,494,897	106,207,332	3,508,645	**0%**	**0%**

VMT – Vehicle Miles Traveled
VHT – Vehicle Hours Traveled

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APPENDIX E-3

Review of New CRTPO Socioeconomic Projections (May 2014)

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Memorandum

To:	Jennifer Harris, PE NCDOT	Date:	May 1, 2014
From:	Scudder Wagg and Ken Gilland Michael Baker Engineering, Inc.	Subject:	Review of New CRTPO Socioeconomic Projections

Introduction

This memorandum discusses the newly adopted Charlotte Regional Transportation Planning Organization (CRTPO) socioeconomic projections developed for the 2040 Metropolitan Transportation Plan (MTP) and how these new projections compare to the projections used in the Indirect and Cumulative Effects (ICE) Quantitative Analysis Update (Quantitative Analysis Update) for the Monroe Connector/Bypass (R-3329/R-2559) completed by Baker in November of 2013. The CRTPO is the metropolitan planning organization (MPO), formerly Mecklenburg-Union MPO (MUMPO), for the Charlotte region. The MPO changed its name after 2010 Census results required the addition of portions of Iredell County to the MPO area. The Quantitative Analysis Update was completed using the projections developed by MUMPO for its 2035 Long-Range Transportation Plan (LRTP)[1] as these were the most recent, fully adopted and completed projections available at the traffic analysis zone (TAZ) level at the time that report was completed. These forecasts were completed in 2009 and are therefore called the 2009 Projections here and in the Quantitative Analysis Update. The methodology and assumptions used in the 2009 Projections are discussed in detail in Section 3 of the Quantitative Analysis Update. The newly adopted CRPTO projections were completed in January 2014.

These newly adopted projections serve as a critical input to the new Metrolina Regional Travel Demand Model version 2014 (MRM14v1.0), which CRPTO uses to test the new 2040 Metropolitan Transportation Plan (MTP) for air quality conformity. CRPTO adopted the 2040 MTP on April 16, 2014 and is working with the Federal Highway Administration (FHWA) and the Environmental Protection Agency (EPA) to test the 2040 MTP for air quality conformity. CRPTO expects to receive its air quality conformity certification on May 2, 2014. CRTPO staff provided the newly adopted projections in January 2014, while the MTP was still draft and under review. No changes were made to the projections between January 2014 and the date the MTP was adopted. To maintain consistency with the naming of projection versions from the Quantitative Analysis Update, these newly adopted projections will be called the 2014 Projections. This memorandum compares and contrasts the 2009 and 2014 Projections and estimates what the differences between the projections might have on the conclusions of the Quantitative Analysis Update.

[1] MPOs now use the terminology "Metropolitan Transportation Plan" (MTP) instead of "Long-Range Transportation Plan" (LRTP) but both documents serve the same purposes as described in Section 3 of the Quantitative Analysis Update.

Development of the 2014 Projections

Baker staff received the files that contained the TAZ level projections of the 2014 Projections on February 3, 2014. The 2014 Projections forecast population, household and employment to the TAZ level for the entire MRM region with a base year of 2010 and forecast years of 2015, 2025, 2030 and 2040. The 2014 Projections were developed using a two part process:

1. A top-down economic and demographic analysis driven forecast of employment and household growth at the county and district level completed by Dr. Steven Appold of the University of North Carolina.
2. A bottom-up disaggregation of those county and district level totals to the travel analysis zone (TAZ) level using the Land Use Allocation Model (LUSAM) spreadsheet workbook process by county planners and CRTPO staff.

The 2009 Projections forecast population, household and employment to the TAZ level for the entire MRM region with a base year of 2005 and forecast years of 2010, 2015, 2025, and 2035. The 2009 Projections used in the Quantitative Analysis Update are updated projections based on a similar two part process as described in detail in Section 3.2 of the Quantitative Analysis Update. The top-down forecasting for the 2009 Projections was completed by Dr. Thomas Hammer of UNC-Charlotte in 2003.

The bottom-up disaggregation process for the 2014 Projections used the LUSAM process, similar to the same process used to update the 2009 Projections as described in Section 3.2 of the Quantitative Analysis Update. The LUSAM spreadsheet workbook uses a number of inputs to generate the future projections of households and employment for each TAZ and uses a district level approach to determining the factors considered in the distribution of the households and employment to each TAZ. For the 2014 Projections, the LUSAM model overall design and setup was the same as was used in the 2009 Projections; however the specific weights for different inputs was different. The Travel Time to Core Employment factor that is available as an optional factor was not used in the allocation process in the LUSAM model for either the 2009 or 2014 Projections. For the 2009 Projections, the Base Year Households and the Predicted Growth from the 2005 Projections were the only two factors used in disaggregating the district level household projections. For the 2014 Projections, four factors were used with Planners Judgment weighted most heavily at 40 percent, while Vacant Residential Land, Base Year Household and the Prior Decade Household Growth were each weighted at 20 percent. Table 1 shows the factors and weights used for household projections for the 2009 and 2014 Projections.

Table 1: LUSAM Variable Weights for Households from 2009 and 2014 Projections for Union County

LUSAM Input	2009 Projections Weight	2014 Projections Weight
Prior Decade Household Growth	-	20%
Base Year Households	60%	20%
Vacant Residential Land	-	20%
Planners Judgment	-	40%
Prior Projection (2005 Projections) Predicted Growth in Households	40%	-

County Level Review of 2014 Projections

In his calculations, Dr. Hammer calculated growth trends and allocating growth at four (4) different levels of geography. These different levels of geography are the national, regional, county, and district levels. Hammer based the regional levels of growth off the regional share of national growth and projected into the future. On the other hand, the dispersion of future growth to the regional, county and district levels are based on allocation. The growth is allocated from the regional level to the counties, and then to the districts within each county. This included 42 districts and four (4) counties that were not subdivided into districts.

Dr. Hammer allocated growth based on demand and supply side factors based on the allocation of regional growth to the counties and the allocation of county growth to the districts. Demand side factors include past and existing economic trends, past and existing demographic trends, economic-demographic linkages, influence of income on growth patterns, and location. The supply side factors consist of land area and past land use and infrastructure policies. These demand and supply side factors dictate the placement of growth from the regional level to the counties and from the counties to the district level.

Dr. Stephen Appold completed the top-down portion of the 2014 Projections using a similar economic and demographic focused methodology and allocated growth from the regional level to the county and district levels. Two major differences result in different forecasts for the regional, county and district levels. First, with the recent economic disruptions, Dr. Appold has forecasted lower levels of employment and household growth across the region. The second major difference is in the allocation methods as Dr. Appold has assumed that the density to distance gradient will flatten out more slowly than Dr. Hammer assumed. In the Dr. Hammer's projections, the historical trends of population and employment density showed a trend of more dispersion throughout the region. In Dr. Appold's analysis of recent trends, between 1990 and 2010, the density to distance gradient steepened over time. This would suggest greater growth occurring in the core of the region (Mecklenburg County) versus periphery counties. Dr. Appold, therefore, presumed that the density to distance gradient would flatten more slowly than Dr. Hammer assumed, and his forecasts allocate more growth closer to the existing urban core and less to the peripheral communities.[2] Table 2 outlines the difference between the projected number of households from the forecasts by Dr. Appold and Dr. Hammer. For Mecklenburg County, Dr. Appold's projections show about 10 percent higher households and about 1 percent higher employment in 2030 than Dr. Hammer. For Union County, Dr. Appold's projections show about 9 percent fewer households and about 23 percent fewer jobs in 2030 than Dr. Hammer. The district breakdown for Union County shows how the change in the density to distance gradient assumption substantially shifted the expected growth toward the northwest district of Union County relative to the east and central districts.

[2] Appold, Stephen, PhD. Presentation of Partial Results to Charlotte Regional Alliance tor Transportation (Craft). October 16, 2012.

Table 2: Employment and Household Projections for 2030 for Union County

		Mecklenburg	Union				
		All Districts	Central	Northwest	South	East	Total
Appold: 2013	Household	505,264	29,009	54,521	11,691	5,112	100,333
	Employment	951,622	47,308	47,340	3,799	4,955	103,402
Hammer: 2003	Household	457,674	40,343	48,561	13,988	7,881	110,773
	Employment	945,591	62,531	51,613	5,752	8,598	128,494
Difference	Household	47,590	-11,334	5,960	-2,297	-2,769	-10,440
	Employment	6,031	-15,223	-4,273	-1,953	-3,643	-25,092
% Difference	Household	10%	-28%	12%	-16%	-35%	-9%
	Employment	1%	-38%	-9%	-14%	-46%	-23%

Subsequent to the completion of Dr. Hammer's top-down forecasting, Paul Smith completed a bottom-up disaggregation process to create the 2005 Projections (as described in Section 3.2 of the Quantitative Analysis Update). These 2005 Projections were then updated through various iterations by CRTPO (then known as MUMPO) to eventually develop the 2009 Projections (as described in more detail in Section 3.2 of the Quantitative Analysis Update), which were used in the Quantitative Analysis Update.

The 2009 Projections were developed using updated household, population and employment targets at the district level based on the following inputs:

- Interpolation and extrapolation of the previous projections (2005 Projections),
- NC State Data Center Demographic Projections (Summer 2007) and
- Hammer Report Five Year Forecasts.

These district level totals were then disaggregated to the TAZ level using the LUSAM workbook process.

Table 3 summarizes the 2014 and 2009 Projections for Mecklenburg and Union Counties and compares the total households and total employment in each county in 2030 from each set of projections. The table shows that for Mecklenburg County, the 2014 Projections of future households and employment in 2030 are similar to the 2009 Projections, differing by only 1% and -4 percent respectively. For Union County, the 2014 Projections for 2030 households and employment differ from the 2009 Projections by -16 percent and -21 percent respectively.

Table 3: Household and Employment Projections for 2030 for Mecklenburg and Union Counties

		Mecklenburg	Union
CRTPO (then known as MUMPO) 2009 Projections	Households	512,041	118,886
	Employment	988,580	130,193
CRTPO 2014 Projections	Households	517,196	100,335
	Employment	951,356	103,282
Difference	Households	5,155	(18,551)
	Employment	(37,224)	(26,911)
% Difference	Households	1%	-16%
	Employment	-4%	-21%

Of note, however, is that while the forecasts of household and employment are substantially lower in Year 2030 in the 2014 Projections, substantial growth is still expected to occur between 2010 and 2030.

Table 4: Household Growth in Union County 2010-2030 from 2014 Projections

	2010	2030	Raw Change	% Growth	Compounded Annual % Growth
Households	67,862	100,335	32,473	48%	1.97%

Furthermore, a look at the Year 2040 forecasts from the 2014 Projections shows that the forecasts of growth continue to occur in Union County and that the household growth is expected to nearly reach the Year 2030 forecasted value from the 2009 Projections.

Table 5: Comparison of 2009 Projections Year 2030 and 2014 Projections Year 2040 for Union County

	2009 Projections of Year 2030	2014 Projections of Year 2040	Difference	% Difference
Households	118,886	115,220	(3,666)	-3%
Employment	130,193	116,645	(13,548)	-10%

Thus, at a county level, the new projections show similar levels of growth in households and employment by 2030 for Mecklenburg County, but lower levels of growth in households and employment by 2030 in Union County. Nevertheless, the new projections still show steady growth in Union County that continues to 2040 and households in Year 2040 are expected to nearly reach the levels previously forecasted for Year 2030 in the 2009 Projections.

Watershed Level Review of 2014 Projections

The 2013 Indirect and Cumulative (ICE) Quantitative Analysis Update for the Monroe Connector/Bypass (Baker 2013) looked at impacts at a watershed level. In order to understand if the new 2014 Projections might substantially alter the ICE conclusions, it is necessary to compare the 2009 and 2014 Projections at the watershed level. To make this comparison some data processing was needed to assure accurate

comparisons between the different projection versions. As documented in Section 3 of the ICE Quantitative Analysis Update, the 2009 Projections were most representative of a No-Build Scenario since the various methods used to develop the forecasts were not influenced by the proposed Monroe Connector/Bypass. The 2014 Projections, however, were developed with the explicit expectation that the Monroe Connector/Bypass would be constructed and open by 2020.[3] Therefore, a direct comparison between the two projection sets would be somewhat misleading. To make direct comparisons clearer, the Baker team used the Adjusted 2009 Projections that were developed as described in Section 5.8 of the ICE Quantitative Analysis Update as a basis for comparison. These projections were adjusted to specifically incorporate the additional households and employment expected as a result of the project as documented in Section 4.2 of the ICE Quantitative Analysis Update. By using the Adjusted 2009 Projections, a reasonable comparison between the 2009 and 2014 projections can be made.

To compare the two sets of projections at the watershed level, the TAZ level data was aggregated to the watershed level for each set of TAZ forecasts. Baker staff completed the aggregation in ArcGIS using an Intersect function to overlay the TAZs with the watersheds. Where a TAZ crossed a watershed boundary, households were portioned to each watershed based on the percent of the area of the TAZ that fell in any given watershed. For example, for the 2014 Projection TAZ analysis, only 70.9 percent of TAZ 10629 is within the Fourmile Creek watershed boundary for the Future Land Use Study Area (FLUSA). Therefore, when aggregating the totals for all TAZs within the Fourmile Creek watershed, only 70.9 percent of the households, population and employment were used for that TAZ.

Since the projections show similar results for Mecklenburg County as a whole and since residential development is the main driver of land use change in the study area, the comparison of these projections will focus on the differences in the household growth trends by watershed. The results of the aggregation for each watershed and for the FLUSA overall for the Adjusted 2009 Projections is shown in Table 4.

[3] Union County 2040 Population and Employment Projection Methodology, CRTPO, p 1

Table 6: Household Forecasts from Adjusted 2009 Projections by Watershed

Watershed	Household Forecasts from Adjusted 2009 Projections			
	2010	2030	Change	% Change
Bakers Branch	79	117	38	48%
Bearskin Creek	4,779	5,879	1,100	23%
Beaverdam Creek	551	1,072	521	94%
Crooked Creek	10,471	14,110	3,639	35%
Fourmile Creek	8,186	9,955	1,769	22%
Goose Creek	6,694	16,057	9,363	140%
Gourdvine Creek	32	55	23	73%
Ivins Creek	9,391	9,761	369	4%
McAlpine Creek	27,487	29,064	1,577	6%
Rays Fork	1,617	4,258	2,641	163%
Richardson Creek (Lower)	2,289	6,958	4,670	204%
Richardson Creek (Middle)	2,020	3,602	1,582	78%
Richardson Creek (Upper)	2,881	5,833	2,952	102%
Salem Creek	1,230	4,377	3,147	256%
Sixmile Creek	1,474	1,211	(263)	-18%
Stewarts Creek	5,948	14,745	8,797	148%
Twelvemile Creek	8,773	7,646	(1,127)	-13%
Wide Mouth Branch	744	1,192	448	60%
Totals for FLUSA	94,647	135,891	41,244	44%

The 2009 Projections used a base year of 2005 and included forecasts for 2010, 2015, 2025 and 2035. 2030 Projections were interpolated between 2025 and 2035. The 2010 values shown here are forecasted values and therefore differ from the 2014 Projections for 2010.

The results show overall household growth in the FLUSA would be about 44 percent, with the greatest percentage growth coming in watersheds in the central and eastern portions of the study area, and the greatest raw increase in households coming in Goose Creek and Stewarts Creek watersheds. In total, the Adjusted 2009 Projections would add about 41,000 households to the FLUSA from 2010 to 2030. Notably, two watersheds, Sixmile Creek and Twelvemile Creek would see decreases in total households with the Adjusted 2009 Projections. The percentage change in households varies greatly across watersheds with two watersheds showing changes around -15 percent, while six watersheds show change of over 100 percent.

The results of the aggregation for each watershed for the 2014 Projections is shown in Table 5.

Table 7: Household Forecasts from 2014 Projections by Watershed

Watershed	Household Forecasts from 2014 Projections			
	2010	2030	Change	% Change
Bakers Branch	70	101	31	45%
Bearskin Creek	4,713	6,017	1,303	28%
Beaverdam Creek	455	728	274	60%
Crooked Creek	10,789	16,040	5,251	49%
Fourmile Creek	8,680	11,281	2,602	30%
Goose Creek	6,236	8,490	2,253	36%
Gourdvine Creek	28	42	14	52%
Ivins Creek	9,143	11,843	2,700	30%
McAlpine Creek	26,862	31,785	4,923	18%
Rays Fork	1,147	1,625	479	42%
Richardson Creek (Lower)	1,888	2,538	650	34%
Richardson Creek (Middle)	1,603	1,912	310	19%
Richardson Creek (Upper)	2,151	2,888	736	34%
Salem Creek	1,014	1,502	488	48%
Sixmile Creek	1,482	2,079	597	40%
Stewarts Creek	5,129	7,102	1,974	38%
Twelvemile Creek	10,004	13,767	3,763	38%
Wide Mouth Branch	604	921	317	52%
Totals for FLUSA	91,996	120,661	28,666	31%

The 2014 Projections show less growth in households across the FLUSA with a 31 percent expected increase in households for the entire study area and a raw increase of about 28,500. In the 2014 Projections, all watersheds see increases in households but the distribution of that growth is different than in the Adjusted 2009 Projections. The greatest raw increases in households are in Crooked Creek, McAlpine Creek and Twelvemile Creek watersheds. The percentage increases in households do not vary nearly as much across watersheds in the 2014 Projections as they do in the Adjusted 2009 Projections. Similar to the Adjusted 2009 Projections which had 16 of the 18 watersheds showing positive change in households, all 18 watersheds in the 2014 Projections show positive change in households.

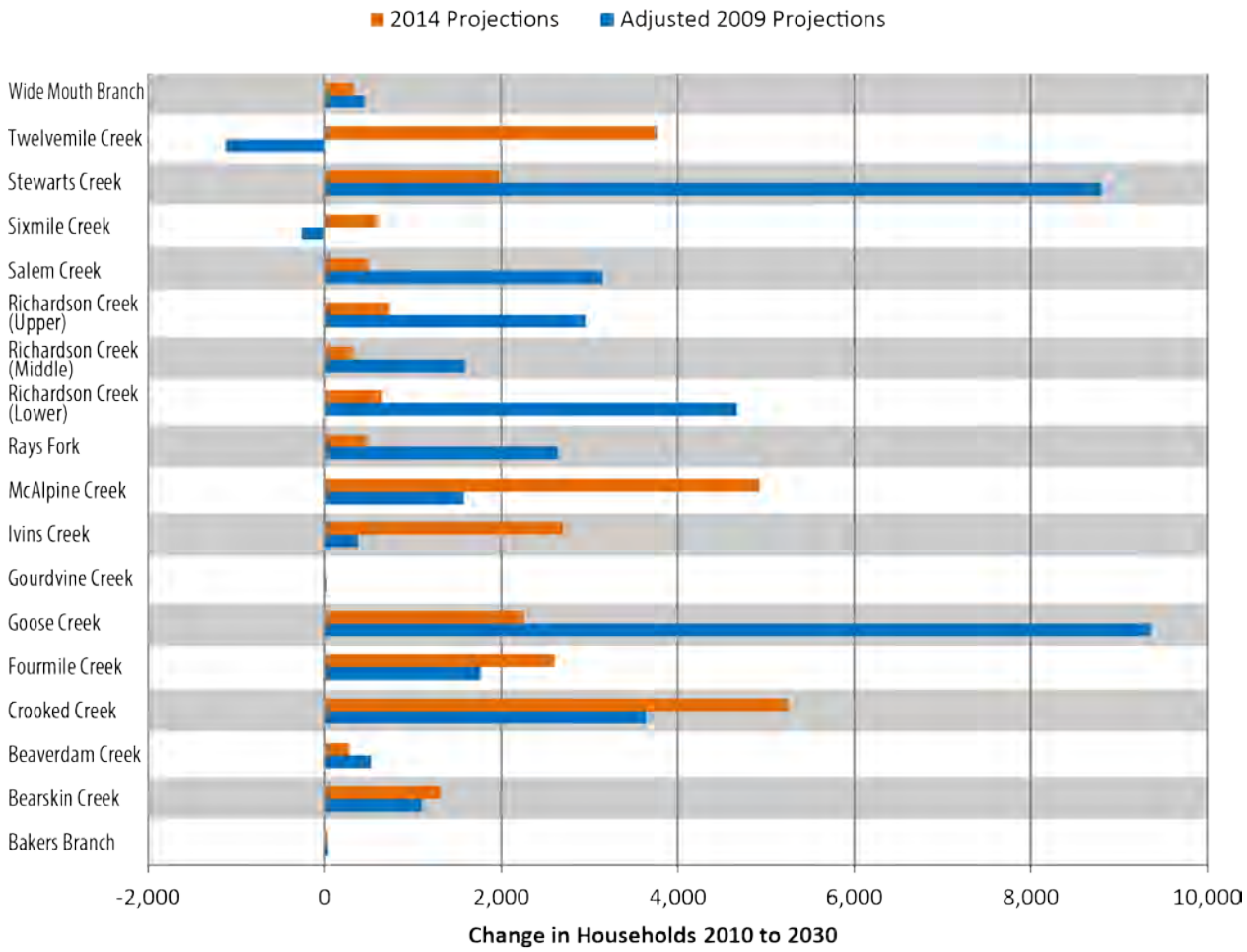
Table 6 provides a comparison of the total households in 2030 by watershed across both projections. The raw differences are illustrated in the chart in Figure 1. The percentage differences are also shown in the map in Figure 2, which is attached at the end of this memo.

Table 8: Comparison of 2030 Households for Adjusted 2009 and 2014 Projection Versions

	Households in 2030			
Watershed	Adjusted 2009 Projections	2014 Projections	Difference	% Difference
Bakers Branch	117	101	(16)	-14%
Bearskin Creek	5,879	6,017	138	2%
Beaverdam Creek	1,072	728	(344)	-32%
Crooked Creek	14,110	16,040	1,930	14%
Fourmile Creek	9,955	11,281	1,327	13%
Goose Creek	16,057	8,490	(7,567)	-47%
Gourdvine Creek	55	42	(13)	-23%
Ivins Creek	9,761	11,843	2,082	21%
McAlpine Creek	29,064	31,785	2,721	9%
Rays Fork	4,258	1,625	(2,632)	-62%
Richardson Creek (Lower)	6,958	2,538	(4,421)	-64%
Richardson Creek (Middle)	3,602	1,912	(1,690)	-47%
Richardson Creek (Upper)	5,833	2,888	(2,945)	-50%
Salem Creek	4,377	1,502	(2,875)	-66%
Sixmile Creek	1,211	2,079	868	72%
Stewarts Creek	14,745	7,102	(7,643)	-52%
Twelvemile Creek	7,646	13,767	6,121	80%
Wide Mouth Branch	1,192	921	(270)	-23%
Total for FLUSA	135,891	120,661	(15,230)	-11%

The household totals by watershed in 2030 are different in the 2014 Projections than in the Adjusted 2009 Projections. Seven of the 18 watersheds show more household growth in the 2014 Projections than in the Adjusted 2009 Projections. These watersheds are generally in the central to western parts of the FLUSA. The remaining eleven watersheds generally see lower household growth in the new 2014 Projections. In raw numbers, the largest decreases in expected households in 2030 are in Goose Creek and Stewarts Creek watersheds. Both watersheds now expect to see about 7,500 fewer households in the 2014 Projections of 2030 conditions compared to the Adjusted 2009 Projections of 2030 conditions. Overall, the impression is that the Adjusted 2009 Projections expected low to modest growth in the western to central portions of the FLUSA and higher growth rates in central and eastern portions of the FLUSA, particularly, Stewarts Creek, Richardson Creek Lower, Salem Creek and Rays Fork Creek. Conversely, the new 2014 Projections expect much more modest growth in the central and eastern portions of the FLUSA and moderate to higher growth in the western portions.

Figure 1: Household Change 2010 to 2030 by Watershed
Adjusted 2009 and 2014 Projections



As noted in Section 3.5 of the Quantitative Analysis Update, the range of error for any future projection of households is typically quite high. "For county level projections of 25 years, the typical mean algebraic percentage errors are about 30 percent while for census tracts (which are typically larger than TAZs) errors are typically 45 percent for the same period.[4] Thus, despite the best efforts of researchers and forecasters, the error rates for long-range projections are still quite high and thus any projection or estimate of induced and cumulative effects must be considered the best estimate within a wide range of error." As noted in Table 6, for the entire FLUSA, the 2014 Projections of 2030 households are only eleven percent lower than the Adjusted 2009 Projections. Thus, while these projections are different in their totals and their geographic distribution, the overall difference is not unexpected given the range of error likely in any forecasting process. It is also notable that the 2014 Projections show growth continuing in the FLUSA at a consistent pace beyond 2030. The 2014 Projections final forecast year is

[4] Smith, Stanely K., Tayman, Jeff, Swanson, David A. *State and Local Population Projections: Methodology and Analysis.* Kluwere Academic/Plenum Publishers, New York, 2001. p 340

2040, and the total households forecasted within the FLUSA in 2040 is 134,854, a growth of 42,858 households. This total is less than one percent less than the 2030 forecast of households from the Adjusted 2009 Projections. Thus, on an overall study area level, the 2014 Projections show that the growth forecasted in the 2009 Projections will still occur, it will just occur later in time.

In a new Build Scenario based on the 2014 Projections, these differences would likely result in lower levels of developed land in the eleven watersheds with lower household totals and higher levels of developed land in the seven watersheds with higher household totals. The percentage differences in development for an updated Build Scenario would not be as large as the percentages noted in Table 6. For example, in Bearskin Creek the 2014 Projections show about 2 percent more households than the 2009 Projections, but that would not lead to 2 percent more developed land compared to the estimate in the Quantitative Analysis Update. The increase in developed land would be less than 2 percent once density, infill and other factors are considered. Similarly, since the 2014 Projections indicate that the total households in 2030 would 66 percent less in Salem Creek that the 2009 Projection, the total developed land would be less in a new Build Scenario using the 2014 Projections. The adjustments for density, potential infill development and other factors used in the conversion of household growth to land development (see Section 4.1 of the Quantitative Analysis Update) would mean that the reduction in developed land would be about 15 to 25 percent when compared to the results in the Quantitative Analysis Update. Other watersheds would see similar shifts in the acres of developed land with the magnitude of adjustment being about one-quarter to one-third of the household change noted in Table 6.

The 2014 Projections and Induced Growth Estimation

The 2014 Projections support an estimate of induced growth similar to that reported in the ICE analysis. As documented in Section 4.1 of the Quantitative Analysis Update, the original 2009 Projections were used as a baseline of growth in developing the No-Build Scenario, and induced growth was estimated and added to develop a Build Scenario. The Adjusted 2009 Projections were then developed to create a socioeconomic dataset that could be used in travel demand modeling to assess the indirect and cumulative traffic impacts. Since the 2014 Projections explicitly include the growth and development distribution associated with the Monroe Connector/Bypass, then a reverse method would likely be used if the Quantitative ICE Analysis were to be redone.[5] In that situation, the 2014 Projections would serve as a basis for developing Build Scenario of land use in 2030, and estimates of the induced growth attributable to the road would be developed and then subtracted from the Build Scenario to create a No-Build Scenario in 2030.

The next methodological question would be how to assess the level of induced growth. The original ICE Quantitative Analysis (Baker 2009) and the Updated Analysis (Baker 2013) both used the same combination of four methods that were based on assessments of changes in accessibility, a build-out analysis, scenario writing approach and the Hartgen Method (as documented in Section 4.2 of the Quantitative Analysis Update). The build-out analysis and scenario writing approaches both relied heavily on the recent land use plans from the jurisdictions in the study area and information gathered

[5] Union County 2040 Population and Employment Projection Methodology, CRTPO, p 1

during interviews with local planners. Since the bottom-up LUSAM process used in the development of the 2014 Projections relied heavily on planner judgment, then similar methodologies would likely be useful in any updated ICE analysis. Section 4.2 of the Quantitative Analysis Update documents clearly state the estimate of induced growth that was added to create a Build Scenario. Thus, to evaluate how induced growth estimates might change if the 2014 Projections were used, it is instructive to assess how the change in projections might affect any of the four methods used.

First, the results of the accessibility analysis would not be affected by the changes in the projections, and would therefore not change the conclusions regarding the likely location of most of the induced growth.

Second, the changes in the projections would affect how the build-out and scenario writing analyses were conducted. In both of those analyses, the methodology was to estimate how much additional growth might occur over and above what was occurring in the background (the No-Build Scenario). The new methodology would estimate how much less growth might occur compared to what is expected to occur in the background (Build Scenario). Since the overall level of development in 2030 is expected to be lower based on the 2014 Projections, then the estimates of how much less growth might occur without the road (i.e., the induced growth) would likely be reduced. As documented in Section 4.2 of the Quantitative Analysis Update the state of the regional economy and the overall desirability of an area for development are major factors that affect the potential for induced growth. The 2014 Projections (which presumably represent a Build Scenario) shift much of the expected growth in Union County toward the western part of the County. CRTPO worked with local Union County and town planners to develop the distribution of growth within the county using its Land Use Allocation Model spreadsheet workbook system (LUSAM). The CRTPO documentation of the LUSAM process indicates that in practice, the LUSAM model weighs planner judgment at 40 percent.[6] Thus, the shift in growth toward the western portions of the study area suggests that central and eastern parts of the county are less desirable for development than was previously thought. This would suggest that induced growth might be lower than previously estimated. The one exception to this conclusion is in the Crooked Creek Watershed. In the Quantitative ICE Update, that watershed was expected to see induced growth and the 2014 Projections suggest it will see more growth than previously projected; therefore, it is possible that induced growth in that watershed might be higher than previously estimated. Nevertheless, since the accessibility analysis suggests that travel time improvements in that watershed would be minimal, it is unlikely that the estimate of induced growth would increase dramatically. Other assumptions from these methodologies, such as the expected availability of sewer and water, and the inclination of different jurisdictions toward different kinds of development, would not change.

Lastly, the results of the Hartgen Analysis of interchange areas would potentially change with the new 2014 Projections. Since these new projections suggest the total number of households in Union County and the FLUSA in 2030 would be lower than previously estimated, it is possible that traffic levels might be lower at most of the interchange areas. In particular, in the areas where induced growth is most likely (the eastern and central portions of the FLUSA) the new 2014 Projections show much lower household

[6] Documentation LUSAM: Land Use Allocation Model, Union County, Metrolina Model Team, January 29,2014, CRTPO, p 38

totals than the 2009 Projections. As a result, traffic levels would likely be lower at these interchange areas in 2030 than the prior forecasts indicated. This would possibly reduce the development potential of interchange areas in the eastern and central portions of the FLUSA and therefore reduce the potential induced growth at those interchange areas.

In summary, analysis of the 2014 Projections suggests that these new projections would result in estimates of induced growth that would likely be similar or slightly lower with the exception of a possible small increase in induced growth estimated for the Crooked Creek watershed.

The 2014 Projections and Indirect and Cumulative Effects Conclusions

Since the induced growth level would likely be similar in absolute level and geographic extent even with the new 2014 Projections, the indirect land use effects of the project would still be limited to the following watersheds:

- Crooked Creek
- Stewarts Creek
- Richardson Creek (Middle)
- Richardson Creek (Lower)
- Salem Creek
- Rays Fork.

Therefore, using the 2014 Projections would not change the conclusions regarding indirect impacts to other watersheds. As noted above, the induced growth impacts on an absolute level might increase in the Crooked Creek watershed, but that increase is likely to be small and would therefore still remain relatively small. In the other watersheds, the induced growth on an absolute level is likely to be similar or a little lower. Since these watersheds are all seeing less development overall in 2030, the relative indirect impacts (i.e. the indirect increase in development relative to the overall level of development) would be somewhat higher. In looking at these watersheds, there are no sensitive resources (such as endangered species) in these watersheds and therefore the indirect effects are less critical. Four of the watersheds are 303(d) listed streams:

- Crooked Creek
- Stewarts Creek
- Richardson Creek (Middle)
- Richardson Creek (Lower).

For these watersheds, the cumulative effects are a greater concern because the overall increases in impervious surface are the main driver of possible declines in water quality. For Stewarts Creek, Richardson Creek (Middle) and Richardson Creek (Lower), the new 2014 Projections indicate less development in 2030 than previously predicted, which means cumulative impacts would likely be lower.

For Crooked Creek watershed, the new 2014 Projections indicate more development in 2030 than previously predicted which means cumulative impacts would likely be higher. Since there are no known populations of federally protected species in streams within the Crooked Creek watershed, water quality changes would not affect any federally protected species in aquatic habitats. However, Crooked Creek is

home to known populations of Schweinitz's sunflower. These populations have been identified and are already being protected by NCDOT. As noted in Section 5.4 of the Quantitative Analysis Update: "Crooked Creek watershed is identified in the 2008 Yadkin-Pee Dee River Basinwide Water Quality Plan as a watershed with habitat degradation, turbidity, fecal coliform and nutrient issues due to stormwater runoff and construction. The analysis of benthic communities, however, showed good to good-fair conditions for Crooked Creek in 2006, which was an improvement from previous studies." Thus despite recent development, conditions in Crooked Creek appear to be improving.

As to other watersheds, the following watersheds are expected to see more development in 2030 than previously predicted solely because of changes in expectations associated with the 2014 Projections:

- McAlpine Creek
- Ivins Creek
- Fourmile Creek
- Sixmile Creek
- Twelvemile Creek
- Beaverdam Creek.

Since these differences are solely attributable to the changes in the underlying projections and because no induced growth is expected in these watersheds, there are no indirect or cumulative effects expected in these watersheds. It is notable that Sixmile Creek watershed would see higher development levels, given that it is upstream of a critical habitat for the Carolina heelsplitter. However, as described above, the changes in growth assumed in these watersheds is a result of changes in the assumptions regarding how growth will spread across the region in general based largely on the density to distance gradient assumptions used by Dr. Appold. Therefore, these changes are attributable to factors unrelated to the Monroe Connector/Bypass.

The following watersheds are expected to see less development in 2030 than previously predicted solely because of changes associated with the 2014 Projections which includes changes overall growth expectations for the region, changes in assumptions regarding the density to distance gradient and changes in planner expectations regarding growth distribution in the area in general:

- Goose Creek
- Bearskin Creek
- Richardson Creek (Upper)
- Wide Mouth Branch
- Bakers Branch.

Since these differences are solely attributable to the changes in the underlying projections and because no induced growth is expected in these watersheds, there are no indirect or cumulative effects expected in these watersheds. Furthermore, given that it is home to a critical habitat for the Carolina heelsplitter, it is notable that Goose Creek watershed would see lower development levels.

Thus, despite the lower growth forecasted in the 2014 Projections and the difference in the distribution of that growth, a reanalysis of the indirect and cumulative effects using the new 2014 Projections would

likely lead to similar conclusions regarding the indirect and cumulative effects of the Monroe Connector/Bypass. The one exception to this conclusion is for Crooked Creek watershed, where slightly higher indirect effects and cumulative effects are likely due to the increase in expected development in the watershed relative to the 2009 Projections. Finally, for five of the six watersheds where induced growth is expected to occur, the 2014 Projections show lower household growth than the Adjusted 2009 Projections. Therefore, the Quantitative Analysis Update, which used the 2009 Projections, would reflect a higher estimate of cumulative effects than would likely occur if it had used the 2014 Projections. Thus, the Quantitative Analysis Update (Baker 2013) would reflect generally conservative (i.e. overestimated) potential impacts from indirect and cumulative effects than the results of an analysis using the 2014 Projections might reveal. Since the conclusions regarding impacts to sensitive resources would be highly unlikely to change and the overall assessment of impacts would likely show lower impacts, then using the 2014 Projections to develop a wholly new indirect and cumulative effects analysis would likely waste time and resources.

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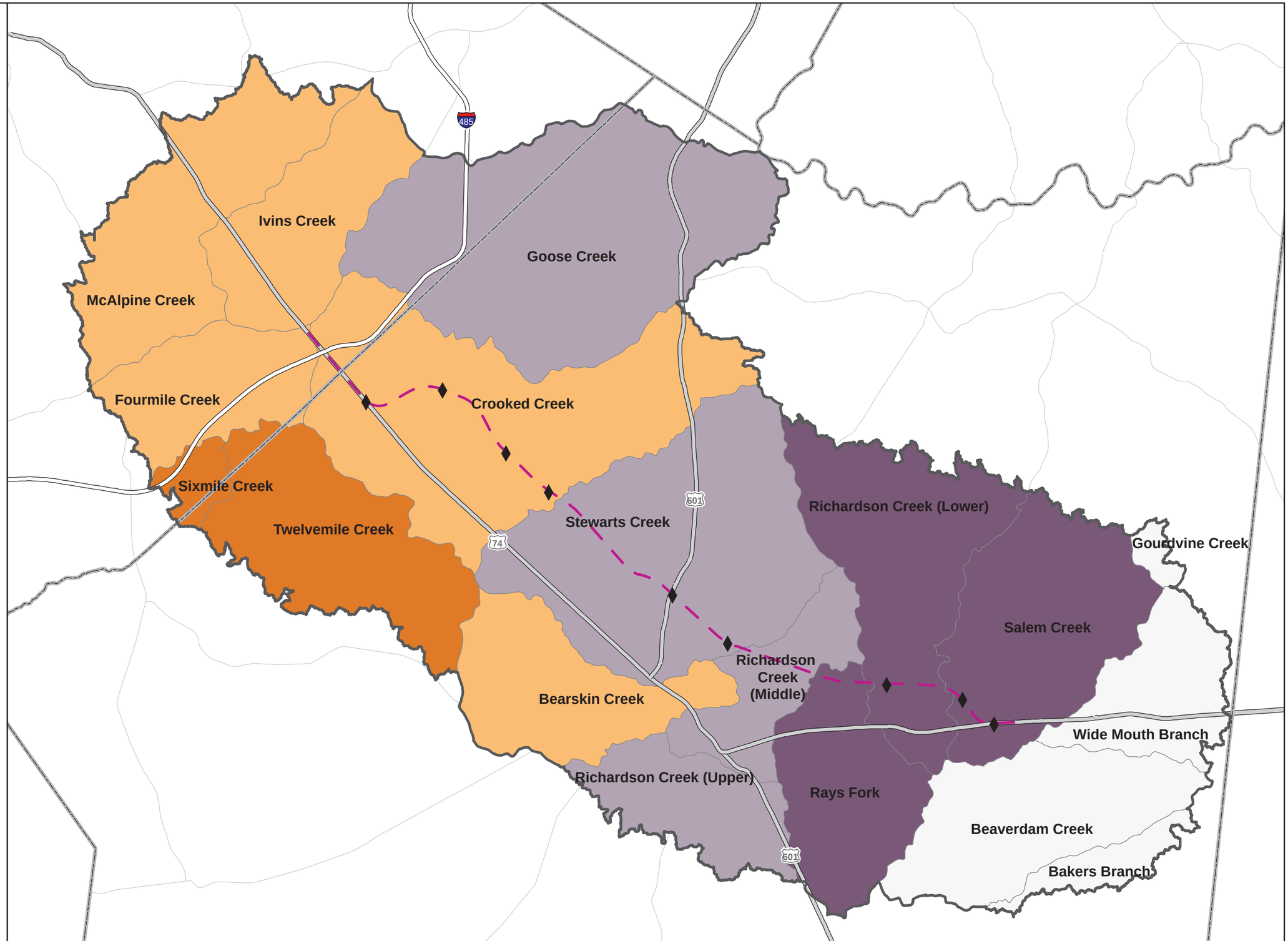
Figure 2: Difference Between 2030 Household Projections

2009 and 2014 Projections



Legend

- Study Area
- RPA Centerline
- Proposed Interchange

2030 Household Difference (%)

2009 vs 2014 Projections

- 72% - 80%
- 2% - 21%
- -32% - -14%
- -52% - -47%
- -66% - -62%

NORTH CAROLINA Turnpike Authority

N W E S

0 1 2 4 Miles

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APPENDIX E-4

Review of the report titled, *Review of Traffic Forecasting: Monroe Connector/Bypass Draft Supplemental Final EIS, November 2013,* prepared by The Hartgen Group for the Southern Environmental Law Center

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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: Spencer Franklin, PE, PTOE

Subject: Review of the report titled, *Review of Traffic Forecasting: Monroe Connector/Bypass Draft Supplemental Final EIS*, November 2013,prepared by The Hartgen Group for the Southern Environmental Law Center

Date: May 1, 2014

Project #: R-3329, R-2559

NORTH CAROLINA PROFESSIONAL SEAL 028657 ENGINEER SPENCER T. FRANKLIN

Spencer Franklin
5-1-14

Purpose of this Memorandum

The purpose of the memorandum is to document how NCDOT assessed and considered comments and recommendations included in the *Review of Traffic Forecasting: Monroe Connector/Bypass Draft Supplemental Final EIS* (Hartgen Report) and to explain how the appropriate response was determined as described in 40 CFR § 1503.4 (Response to Comments).

The Hartgen Report was prepared by David T. Hartgen, Ph.D., PE. of The Hartgen Group (Hartgen) at the request of the Southern Environmental Law Center (SELC). The primary focus of the report is described on page three of the Report:

> *The Southern Environmental Law Center has asked [Hartgen] to review the Draft Supplemental Final Environmental Impact Statement ("DSFEIS") for the Monroe Connector/Bypass, dated November 2013, with particular focus on the traffic forecasts for the proposed Connector and US 74. (Hartgen Report, page 3).*

Discussion

The NCDOT and its project consultants considered comments provided in the Hartgen Report and have determined that conclusions from *Monroe Connector/Bypass Traffic Forecast Summary Memorandum* (HNTB, May 2014) are still valid. That document analyzed the history of the traffic forecasts prepared for the project to this point, the methodologies used for each, and compared results for each to determine the validity of the information in relation to its usefulness in supporting the Purpose and Need for the project.

Appendices

The Hartgen Report features a substantial discussion covering a wide range of topics related not only to the traffic forecasting process and results for the Monroe Bypass, but to the NEPA process for the project, as well. Because of the many detailed points it raises and questions it asks, the NCDOT and its project consultants have structured this response document into individual Appendix sections, briefly described below, which fully cover the responses to the Hartgen Report.

Appendix A includes the meeting summary and PowerPoint slides used for discussion purposes from a meeting held on January 31, 2014, with FHWA, NCDOT, and their consultants, as part of this review process to consider the Hartgen Report.

Appendix B includes responses to each specific comment and topic raised in the Hartgen Report.

Appendix C is the *2012 NCDOT Superstreet Analysis Results* (Reese, November 5, 2012) memo. This memo is referenced in both ***Appendix A*** and ***Appendix B***.

Appendix D includes the Hartgen report in its entirety with brackets denoting the numbered response for each specific comment included in ***Appendix B***.

Recommendation

As demonstrated in this memo and fully elaborated upon in its appendices, the NCDOT and its project consultants carefully assessed and considered comments provided on the DSFEIS from Dr. Hartgen and have determined that the traffic forecasts prepared for the project are relevant and are to be used as part of the NEPA decision-making process. Therefore, we find that no further action is required to respond to the Hartgen Report.

It should also be noted that many of the topics and arguments contained within the Hartgen Report do not refute the applicability or validity of the project's traffic forecasts, but are much broader criticisms of the NEPA project process in general as it relates to travel demand modeling, traffic forecasting, and traffic capacity analysis. Dr. Hartgen concludes his report in Item 10 by highlighting his opinion that there should be "less reliance on traffic forecasts for transportation decision-making." Dr. Hartgen's point that the forecasts are uncertain is well taken but tends to undermine his own criticisms.

Appendix A – Meeting Minutes and Discussion Slides

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Monroe Connector/Bypass Meeting

MEETING SUMMARY
(Final)

Date: January 31, 2014
9:00 AM to 12:00 PM

Project: STIP R-3329/R-2559 Monroe Connector/Bypass

Attendees:

John Sullivan, FHWA
Brian Gardner, FHWA*
Scott Jones, FHWA*
George Hoops, FHWA
Scott Slusser, NCDOJ
Jennifer Harris, NCDOT - PDEA
Jamal Alavi, NCDOT – TPB*
Rick Baucom, NCDOT – Div 10*
Spencer Franklin, HNTB
Bradley Reynolds, HNTB
Jill Gurak, Atkins
Jenny Noonkester, Atkins*
Carl Gibilaro, Atkins
Ken Gilland, Michael Baker Eng.
Lorna Parkins, Michael Baker Eng.*
Scudder Wagg, Michael Baker Eng.*
Nancy Scott, The Catena Group*
Michael Wood, The Catena Group*

*Participated via telephone

Purpose

The primary purpose of this meeting was to discuss how to respond to the main points presented in the *Review of Traffic Forecasting: Monroe Connector/Bypass Draft Supplemental Final EIS* (The Hartgen Group, December 26, 2013) (Hartgen Report) which was attached to SELC's comment letter on the *Draft Supplemental Final EIS* dated January 6, 2014.

The meeting discussion specifically focused on items 3, 4, 5, 6, 7, and 9 of the ten primary points presented on page 3 of the Hartgen Report.

Discussion

The following summary is presented by item number as listed in the Hartgen Report, followed by a summary of the general discussion at the end of the meeting.

Hartgen Report Item #3 – "Traffic forecasts were not re-computed for some alternatives, thus possibly over-stating future Bypass traffic and under-stating traffic improvements for some alternatives. Some of the recently completed and planned future improvements to US 74 and their effect on traffic forecasts have not been included in the traffic forecasts, their effect on Bypass traffic therefore appears to be under-stated."

- Dr. Hartgen states that "the standard for a speed study is the 85th percentile, not the average speed." He then incorrectly applies speed study standards, saying that the INRIX data reported average (close to 50th percentile) operating speed on US 74 is 44 miles per hour (mph), and that using the 85th percentile would raise the current operating speeds on US 74 even further, probably to the 48-50 mph range. HNTB clarified that the 85th percentile is used to set speed limits and is defined as the speed at or below which 85 percent of the observed free-flowing vehicles are traveling. The value is based on observations of individual vehicles. Dr. Hartgen misuses the term by applying it to the INRIX data average values across many hours of the day,

including times when conditions are not free-flowing, to estimate average travel times on US 74. INRIX data is provided in averages, not by individual vehicle speeds, so it is inappropriate to attempt to calculate an 85th percentile (as used in speeds studies) using this data.

- HNTB noted that INRIX data and data from travel time runs (floating car studies) were directly compared using data from the exact same days and times. Some differences are expected in the travel speeds from the travel time runs compared to speeds from the INRIX data since vehicles traveling only a portion of the corridor would be included in the INRIX data. The travel time runs are for individual vehicles traveling the entire corridor. In the US 74 case, the INRIX average speeds were slightly higher than the travel time runs for the same day and time.
- FHWA would like HNTB to provide the responses to the Hartgen Report to Kevin Lacy (NCDOT State Traffic Engineer) for him to confirm our response that the methodology proposed by Dr. Hartgen is not appropriate. It was also suggested that citations from the ITE handbook be included.
- NCDOT did a study comparing operations of traditional intersections along US 74 to Superstreet intersections. The study showed some improvement with the Superstreets, but not significant improvement. FHWA asked for a table comparing the operational diagrams from the study, and giving a context for the level of service (LOS). FHWA asked how LOS factors into the purpose and need for the project. HNTB replied that LOS did not factor into the purpose and need, nor was it a measurement used in the analysis of alternatives. The purpose and need calls for a high-speed corridor (50 mph or higher). It was also pointed out that the currently proposed Superstreet improvements only affect a small percentage of the total project corridor (2 miles out of 20). NCDOT Division 10 has confirmed which intersections are included in the safety project. FHWA noted that to meet the purpose and need of a high-speed corridor, US 74 would have to have higher posted speed limits, but there are geometric constraints that would preclude this.

Hartgen Report Item #5 – "The regional travel demand model (used to forecast Bypass traffic) and the traffic operations simulation model (used to study traffic flow on US 74) both appear to have been insufficiently calibrated."

- The model is just one input into forecast development. The model is a regional tool while the traffic forecasts consider many other data sources, such as traffic counts, historic trends, etc. to develop a project-specific forecast.
- FHWA asked if the Charlotte Department of Transportation (CDOT) has a report documenting how the Metrolina Regional Model (MRM) was calibrated. NCDOT-Transportation Planning Branch (TPB) stated that the MRM model is well calibrated for planning and conformity purposes and the base model was appropriately calibrated in accordance with accepted practice. The calibration report will be obtained and referenced.
- FHWA asked if there is anything to show how the MRM was used to develop the modeling specific to this project. FHWA recommended explaining what we did in developing the forecast – show what was done to calibrate the model and how we got to a project specific forecast. Verify what was done was valid. HNTB noted that the MRM model was used to determine growth rates and diversions, but raw data directly from the model is not the sole source of data for the forecasts. NCDOT-TPB will get the calibration report from CDOT. FHWA said we should focus on the fact that the model was approved for use by the MPO.

Hartgen Report Item #6 – "The DSFEIS attempts to address the directive of the 4th Circuit Court, but leaves key questions regarding induced traffic unanswered."

- HNTB stated that the issue of induced traffic is fully discussed in the traffic forecast memo (HNTB, November 2013). The project team did take a hard look – the new socio-economic (SE) data from the build condition in the quantitative indirect and cumulative effects (ICE) analysis was used to re-run the MRM model (going through the full 4-step process). NCDOT-Project Development and Environmental Analysis (PDEA) noted that Dr. Hartgen asked for a clear explanation of the process used in the Draft Supplemental Final EIS. HNTB said they could include additional information in the traffic forecast memo, or address this in the comment responses in the Final Supplemental Final EIS. It was decided to add it to the traffic forecast memo.

- FHWA stated that the ICE maps in the Draft Supplemental Final EIS (Figures 4-7, 4-8 and 4-9) showing the differences between the no-build and build conditions were helpful. For traffic we need to say that there were changes in land use, but go on to explain that, based on our analysis, these changes would not lead to substantial changes in traffic forecasts (due to the location of growth, etc.). Highlight Section 5.8 of the ICE report and Figures 16 and 17. Make it clear in the response what was done and why.

Hartgen Report Item #4 – "Traffic growth on US 74 has been flat from 2000 to 2012 and is inconsistent with population growth trends. The DSFEIS simply ignores these inconsistencies. Moreover, the forecast of population, which drive the traffic forecast, is based on a pre-Recession projection; recent population growth has slowed markedly. Essentially the entire justification for the project rests on traffic forecasts that ignore 12 years of recent history, recent economic upheaval, and slower population growth."

- Baker pointed out that Dr. Hartgen has errors in his numbers for population growth. He also fails to consider the size differences in the areas he's comparing. Almost half of the growth isn't in the southwest quadrant as he contends; the entire western portion of Union County has seen growth. He also noted that short-term trends at the end of a major recession may not be completely indicative of future conditions is the project area. Based on data from the North Carolina State Demographics Unit, Mecklenburg and Union Counties are projected to grow more quickly than the vast majority of counties in North Carolina through the design year of the project.
- Dr. Hartgen focuses on growth only along the US 74 corridor, but he should consider surrounding corridors to get the full picture – people are using alternative corridors, possibly to avoid congestion on US 74. Baker presented a table showing increasing Annual Average Daily Traffic (ADT) for connecting routes between Union and Mecklenburg Counties. FHWA asked that we include the raw numbers and absolute change, along with a map of count locations. NCDOT Division 10 confirmed that there have not been any work zones on US 74 recently that would have diverted major amounts of traffic to these alternate routes.

Hartgen Report Item #7 – "Questions remain concerning details of the traffic forecasts. The three key assumptions of the traffic forecasts (growth of the area population, percentage diversion, and magnitude of long-distance travel) all appear to be overly optimistic."

- NCDOT-TPB pointed out that a traffic forecast prepared as part of the National Environmental Policy Act (NEPA) process and a traffic and revenue study are different studies done for different purposes and are expected to have different outputs. Also, the capacities for roadways in a regional model are derived differently than capacities used in traffic operations analyses.
- FHWA commented that the timeline developed by HNTB to show the progression of the traffic forecasts is helpful.

Hartgen Report Item #9 – "External traffic forecasts are undocumented."

- An external traffic survey is part of the MRM development. HNTB pointed out that through trips are inherently included in the traffic counts. One of the external count locations is within the project study area.
- FHWA stated that we need to know how we are going to address macroeconomic data and how the recession is being addressed. Baker responded that new SE data will be evaluated qualitatively to see where there are changes and the magnitude of those changes. Growth has not stopped forever, but it may take a few additional years to reach previously projected levels.

General Discussion

- It was agreed that Dr. Hartgen is generally respected as a land use and transportation expert despite the errors in this report. His report references the project documents he reviewed and it is important to note that based on the list provided in the report, it appears he may not have reviewed the full body of documents prepared throughout the history of this project. The entire project document library continues to be available at: www.ncdot.gov/projects/monroeconnector/.
- While his report critiqued the traffic forecast prepared for the project, he did not raise any issues with the land use analysis in the ICE document. Dr. Hartgen did not challenge the Monroe Connector/Bypass Study's use of his analyses from *Beltways, Traffic and Sprawl: The Empirical*

Evidence, 1990- 1997 which stated that building of new roads does not necessarily create new growth.

- In his last observation, Dr. Hartgen notes that the traffic modeling and forecasting process is "fraught with uncertainty." This confirms that there is a lot of variability in traffic forecasting, and deference should be given to the experts. This observation actually provides support for the analyses completed for the project.

Action Items:

- Responses to the Hartgen Report will be provided in a memo. The response memo will be included as an appendix to the *Final Supplemental Final EIS*.
- For response to #3, HNTB will add a table comparing the traditional intersections vs. superstreets to give context for LOS.
- HNTB will share the memo with responses to the Hartgen Report (specifically #3) with Kevin Lacy for review.
- For response to #3, HNTB will add a map showing the portion of the project area planned for superstreet improvements.
- For response to #5, NCDOT-TPB will get the model calibration report from CDOT. (Note: the model calibration report has been provided.)
- For response to #5, HNTB will detail and verify the methodology for using the MRM model as an input to the forecasts.
- For response to #6, HNTB will create "heat maps" from the forecast to show comparison between the build and no-build. Mr. Hoops will verify what Mr. Gardner and Mr. Jones want to see in these graphics.
- For response to #4, Baker will add a map of traffic count stations and include raw numbers and absolute change in the table they created.
- For response to #7, HNTB will add a reference to the Appold letter.
- For response to #9, HNTB will supplement with data from additional years. Baker will look at qualitative data from Appold and trends related to recession.

3. Travel time improvements on U.S. 74 and their effect on traffic forecasts for the Monroe Connector/Bypass appear to be under-estimated. (Hargen)

Table 1 – US 74 Corridor Travel Time and INRIX Data Summary

		Field Runs		INRIX Data	
		Travel Time (minutes)	Average Speed (mph)	Travel Time (minutes)	Average Speed (mph)
AM	Eastbound	32.0	41.7	30.2	44.9
	Westbound	33.1	40.5	31.2	43.6
	Cumulative	32.5	41.1	30.7	44.2
Noon	Eastbound	30.4	43.9	30.7	44.2
	Westbound	34.9	39.1	31.0	43.7
	Cumulative	32.9	41.3	30.8	43.9
PM	Eastbound	34.0	39.3	30.2	44.9
	Westbound	33.7	39.7	30.7	44.2
	Cumulative	33.8	39.5	30.4	44.5

* US 74 corridor approximately 22.5 miles from I-485 (west of Stallings) to Elm Street (in Marshville)
* Travel time runs and INRIX data were collected and compared between 3/19/2013 to 3/21/2013 (Tuesday thru Thursday) for the AM (6:30-9:00 AM), noon (11:30-1:30 PM) and PM (4:00-6:00 PM).

US 74 Corridor Travel Time Memo Speed Tables

Table 2 - US 74 Corridor INRIX Average Speed Data
January 2013 - Februay 2013, Tuesday - Thursday

Average Speed for US 74 from I-485 to NC 205 (Elm St.)
Eastbound US 74 Corridor Average Speed

TMC CODE	SEGMENT NAME	LENGTH (MILES)	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
125P05817	I-485	0.76	56	56	56	56	57	56	56	56	57	57	57	57	57	57	57	57	55	52	53	54	55	56	56	56
125+05818	Stallings Rd	0.75	52	52	51	53	52	52	47	45	45	40	37	38	36	35	33	33	26	20	26	34	45	47	50	51
125+05819	Indian Trail Fairview Rd	1.27	52	52	52	53	53	52	48	48	48	48	48	47	46	46	45	41	37	36	37	42	47	47	50	51
125+05820	Roland Dr	6.86	49	50	50	50	50	50	48	46	46	48	50	48	48	48	47	48	48	47	47	45	47	46	48	49
125+05821	US-601/NC-200/Concord Hwy/Skyway Dr	1.58	43	44	44	44	44	43	42	41	38	36	36	34	33	32	34	34	35	33	34	37	39	37	41	42
125P05821	US-601/NC-200/Concord Hwy/Skyway Dr	0.35	51	50	51	50	51	52	51	51	51	51	51	51	50	50	51	50	50	50	50	49	50	50	50	50
125+07486	NC-200/Morgan Mill Rd	1.11	44	44	44	45	45	46	44	41	40	43	43	42	41	41	41	37	35	35	37	37	40	40	43	43
125+07487	E Franklin St	1.21	43	44	43	44	44	44	42	39	38	41	41	41	40	39	39	39	40	39	40	42	42	39	42	41
125+05822	US-601/Pageland Hwy	0.12	39	40	39	39	39	38	37	35	34	32	32	32	31	30	29	34	36	35	35	35	35	34	37	38
125P05822	US-601/Pageland Hwy	0.02	41	41	40	40	41	40	38	35	35	34	35	34	34	33	33	35	37	36	37	36	37	37	39	39
125+07488	NC-205/Elm St	8.54	49	49	49	49	49	49	49	48	48	49	49	49	49	48	48	47	48	47	48	48	48	48	49	49
	Average US 74 EB Corridor Speed (mph)		48	49	49	49	49	49	48	46	46	47	47	47	46	46	45	45	45	44	45	45	46	46	48	48

Average Speed for US 74 from NC 205 (Elm St.) to I-485
Westbound US 74 Corridor Average Speed

TMC CODE	SEGMENT NAME	LENGTH (MILES)	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
125-05822	US-601/Pageland Hwy	8.55	48	48	48	48	49	48	47	46	46	47	47	47	47	47	47	46	47	46	46	47	47	47	47	48
125N05822	US-601/Pageland Hwy	0.01	35	36	36	35	35	36	32	29	29	31	31	30	29	30	28	30	30	31	30	32	33	32	34	35
125-07487	E Franklin St	0.11	36	35	36	35	36	36	34	29	28	29	28	27	26	26	25	25	25	26	27	30	31	31	34	35
125-07486	NC-200/Morgan Mill Rd	1.22	41	41	41	41	42	42	41	36	36	34	33	34	33	33	32	34	33	33	36	38	39	37	39	41
125-05821	US-601/NC-200/Concord Hwy/Skyway Dr	1.07	44	44	44	44	45	46	46	43	42	40	39	38	38	38	38	41	42	42	41	42	42	41	43	44
125N05821	US-601/NC-200/Concord Hwy/Skyway Dr	0.30	49	49	49	49	50	50	50	50	49	49	49	49	49	48	49	50	50	49	49	48	48	48	49	49
125-05820	Roland Dr	1.66	44	45	45	45	45	45	44	36	34	39	40	38	36	36	37	39	42	39	36	37	38	39	42	44
125-05819	Indian Trail Fairview Rd	6.86	48	49	49	49	49	49	47	45	46	47	47	46	43	44	43	42	42	39	41	44	45	44	47	48
125-05818	Stallings Rd	1.26	51	50	51	51	52	51	44	36	41	48	50	48	48	48	48	45	45	39	40	43	46	46	49	50
125-05817	I-485	0.61	52	51	52	52	53	53	50	47	49	51	52	51	51	51	51	50	50	48	47	47	49	48	50	52
125N05817	I-485	0.91	56	55	55	56	56	55	55	44	47	56	57	56	55	56	56	56	55	54	54	54	54	54	55	56
	Average US 74 WB Corridor Speed (mph)		48	48	48	48	49	48	47	44	44	46	46	45	44	45	44	44	44	42	43	45	45	45	46	48

3. Travel time improvements on U.S. 74 and their effect on traffic forecasts for the Monroe Connector/Bypass appear to be under-estimated. (Hartgen)

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

BEVERLY EAVES PERDUE
GOVERNOR

November 5, 2012

EUGENE A. CONTI, JR.
SECRETARY

Project: SP-2012-35
Division: 10
County: Union
Description: Indian Trail – US 74 Corridor from E of I-485 to SR 1515 (Sardis Church Road)

NORTH CAROLINA PROFESSIONAL SEAL 027401 ENGINEER MICHAEL REESE

Michael Reese
5 NOV 2012

MEMORANDUM

To: Sean M. Epperson, Deputy Division Traffic Engineer
Division 10

From: Michael P. Reese, P.E., Western Region Project Engineer
Congestion Management Section

Subject: US 74 Corridor Superstreet and Traditional Intersection Capacity Analysis

As requested, the Congestion Management Section has completed a review of the subject vicinity to compare the existing traditional intersections to if a superstreet (paired directional crossovers with median U-turns) were installed along the corridor. We performed capacity analysis for the following intersections based on base year AM/PM peak hours using Synchro/SimTraffic, version 7.

1. US 74 and SR 1365 (Stallings Road) (4-leg signal)
2. US 74 and SR 1520/1008 (Indian Trail-Fairview Road) (4-leg signal)
3. US 74 and SR 1367 (Unionville-Indian Trail Road) (4-leg signal)
4. US 74 and SR 3014 (Faith Church Road)/Harris Teeter Distribution Center (4-leg signal)
5. US 74 and SR 1515 (Sardis Church Road)/SR 1377 (Wesley Chapel-Stouts Road) (4-leg signal)

Recent NCDOT Average Annual Daily Traffic Maps indicate that traffic volumes have been steady along US 74 in the last ten years, therefore no traffic volume growth was used. This analysis is based on year 2007 traffic volumes from the March 2008 Draft Traffic Tech Memo for the Monroe Connector/Bypass (TIP Projects R-3329 and R-2559) by PBS&J. Traffic counts have been conducted at these intersections in 2010, 2011, and 2012, but the 2007 volumes were primarily used since they are balanced along the corridor and generally higher than the counts. Six percent trucks were used along the entire corridor, except 50% trucks were used for all movements to and from the Harris Teeter Distribution Center. The following comments and recommendations are based on our analysis.

This analysis compares two scenarios: 1) Existing all-movement signalized intersections including some new or extended turn lanes as needed (shown in attached Figure 2); and 2) Conversion of the corridor to a superstreet with all intersections and U-turn points signalized (shown in attached Figure

E4-10

Sean M. Epperson
November 5, 2012
Page 2 of 2

1). Base year analysis results and general recommendations comparing the two scenarios are shown in the following attachments:

1. Geometric recommendations
2. Arterial, intersection, and intersection approach levels of service (LOS) and volume-to-capacity (v/c) ratios
3. Maximum queuing along the corridor
4. Table comparing network operations

The superstreet analysis indicates some approaches would continue to operate at LOS F with some intersections operating over capacity (v/c > 1) and some significant queuing, but improved corridor operations can be attained with implementation of a superstreet without significant geometric improvements. Regardless of whether a superstreet is installed, widening of US 74 will be needed in the near future as traffic volumes grow along this corridor, but a superstreet can be installed in the existing median now with any future US 74 widening to the outside. In addition, superstreets separate and reduce conflict points providing improved safety compared to traditional all-movement intersections.

Therefore compared to the existing all-movement intersections, **we recommend implementation of a superstreet along this corridor**. Compared to traditional intersections, a superstreet can improve both current conditions and future traffic operations when US 74 is widened to a six-lane section.

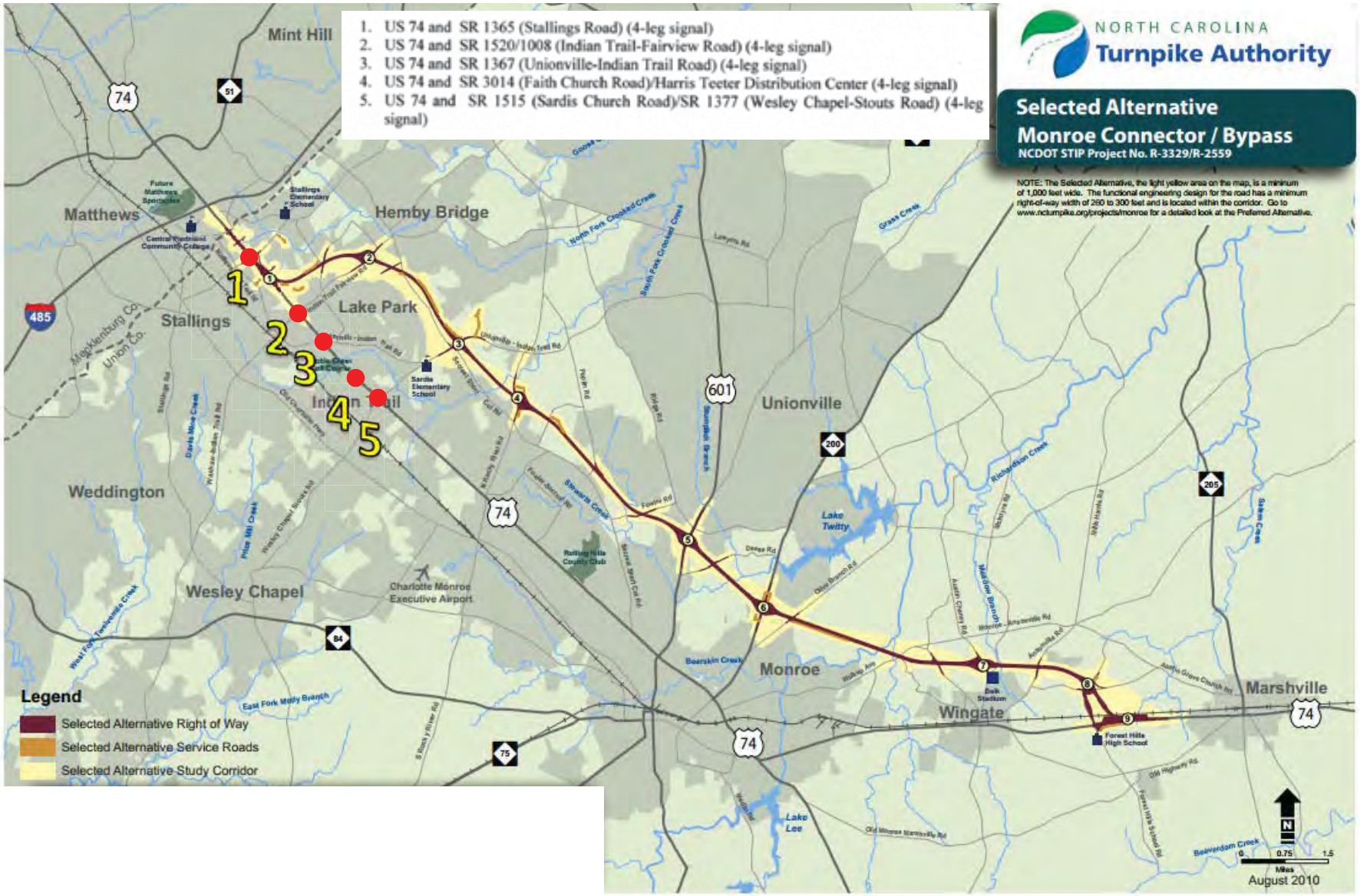
If you have questions regarding this analysis, or if additional analysis or information is needed, please contact me or Congestion Management Project Design Engineer Mohammad S. Islam, P.E., at (919) 773-2800.

MPR/msi

Attachments

cc: J. S. Cole, P.E.,
J. K. Lacy, P.E., C.P.M.
D. D. Galloway, P.E.
M. P. Butler, P.E.
J. H. Dunlop, P.E.
M. S. Islam, P.E.

3. Travel time improvements on U.S. 74 and their effect on traffic forecasts for the Monroe Connector/Bypass appear to be under-estimated. (Hartgen)



E4-11

Level of Service Description

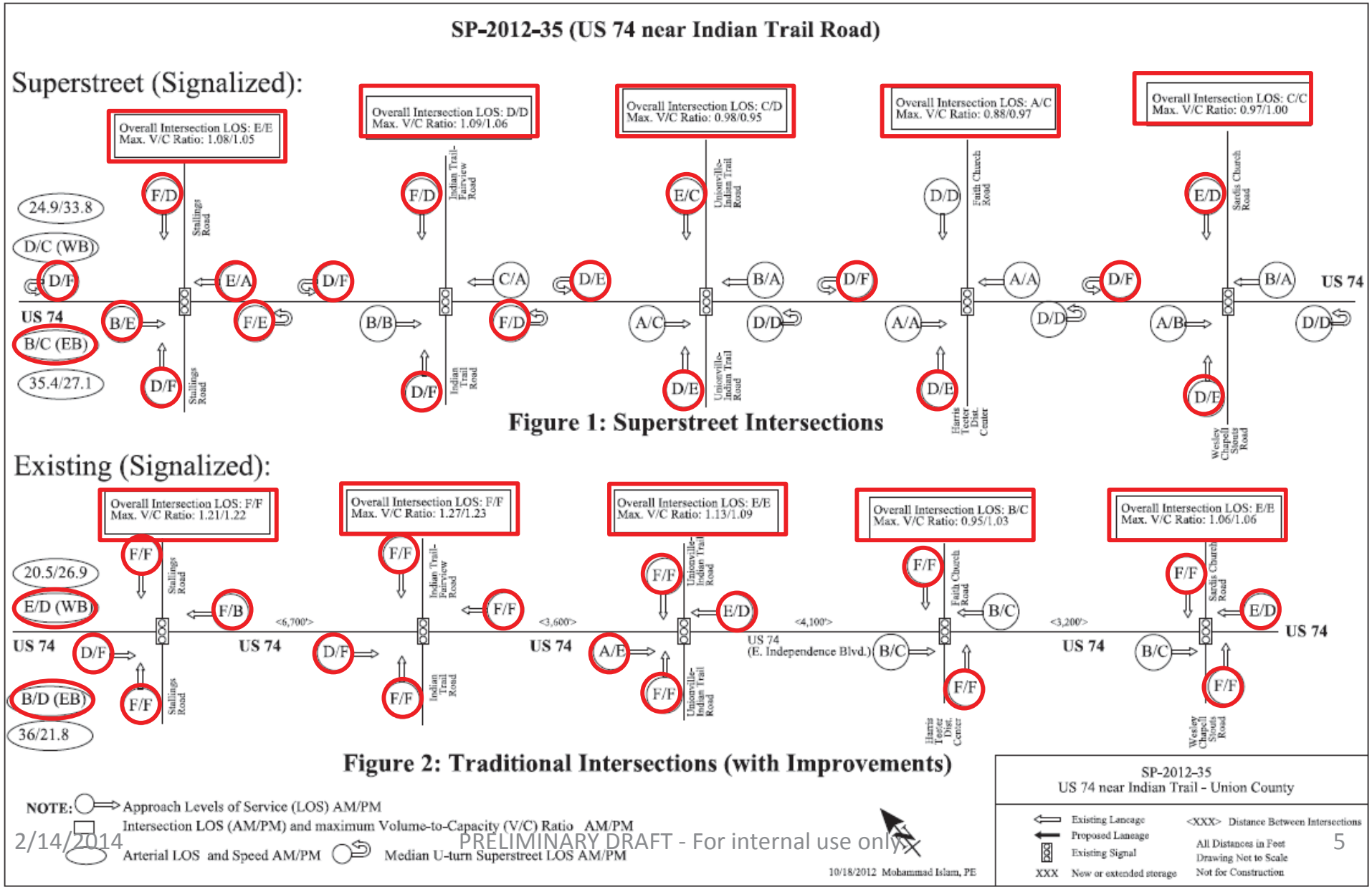
Level of Service Description	Intersection	
	Per Vehicle Delay Signal Control	Per Vehicle Delay Stop Control
LOS A ➢ Free flow ➢ Freedom to select desired speed / maneuver is extremely high ➢ General comfort level & convenience for motorists is excellent	**< 10.0 seconds**	**< 10.0 seconds**
LOS B ➢ Stable flow ➢ Other vehicles in the traffic stream become noticeable ➢ Reduction in freedom to maneuver from LOS A	**10.0 – 20.0 seconds**	**10.0 – 15.0 seconds**
LOS C ➢ Stable flow ➢ Maneuverability/operating speed are significantly affected by other vehicles ➢ General level of comfort and convenience declines noticeably	**20.0 – 35.0 seconds**	**15.0 – 25.0 seconds**
LOS D ➢ High density but stable flow ➢ Speed and freedom to maneuver are severely restricted ➢ General level of comfort / convenience is poor ➢ Small traffic increases will generally cause operational problems	**35.0 – 55.0 seconds**	**25.0 – 35.0 seconds**
LOS E ➢ Unstable flow ➢ Speed reduced to lower but relatively uniform value ➢ Volumes at or near capacity level ➢ Comfort and convenience are extremely poor ➢ Small flow increases/minor traffic disturbances will cause breakdowns	**55.0 – 80.0 seconds**	**35.0 – 50.0 seconds**
LOS F ➢ Forced or breakdown flow ➢ Volumes exceed roadway capacity ➢ Formation of unstable queues ➢ Stoppages for long periods of time because of traffic congestion	**> 80.0 seconds**	**> 50.0 seconds**

*** Per Highway Capacity Manual 2010, Volume 3, Exhibits 18-4 & 19-1.**

E4-12

3. Travel time improvements on U.S. 74 and their effect on traffic forecasts for the Monroe Connector/Bypass appear to be under-estimated. (Hartgen)

□ ○ - Denotes LOS E/F for overall intersection & movements or V/C ratio > 0.85



E4-13

4. Traffic growth on US 74 has been flat from 2000 to 2012, and is inconsistent with population growth. (Hartgen)

- Dr. Hartgen growth comparisons are erroneous.

Population Growth, 2000-2010, Union County and Study Area[49]

E4-14

Geographic area	2000 Population	2010 Population	Difference	Percent Change from 2000-10
Union County	123,677	201,292	77,615	62.8
DSA-Union Co. part	66,603	102,357	35,745	53.7
DSA-Mecklenburg Co. part	13,867	17,746	3,879	28.0
Total DSA	80,470	120,103	39,633	**49.3**
Union NON-DSA part	43,207	81,189	37,982	**87.9**

Geographic area	2000 Population	2010 Population	Difference	Percent Change from 2000-10
Union County	123,677	201,292	77,615	62.8%
DSA-Union Co. part	66,576	102,357	35,781	53.7%
DSA-Mecklenburg Co. part	13,867	17,746	3,879	28.0%
Total DSA	80,470	120,103	39,633	49.3%
Union NON-DSA part	57,101	98,935	41,834	73.3%

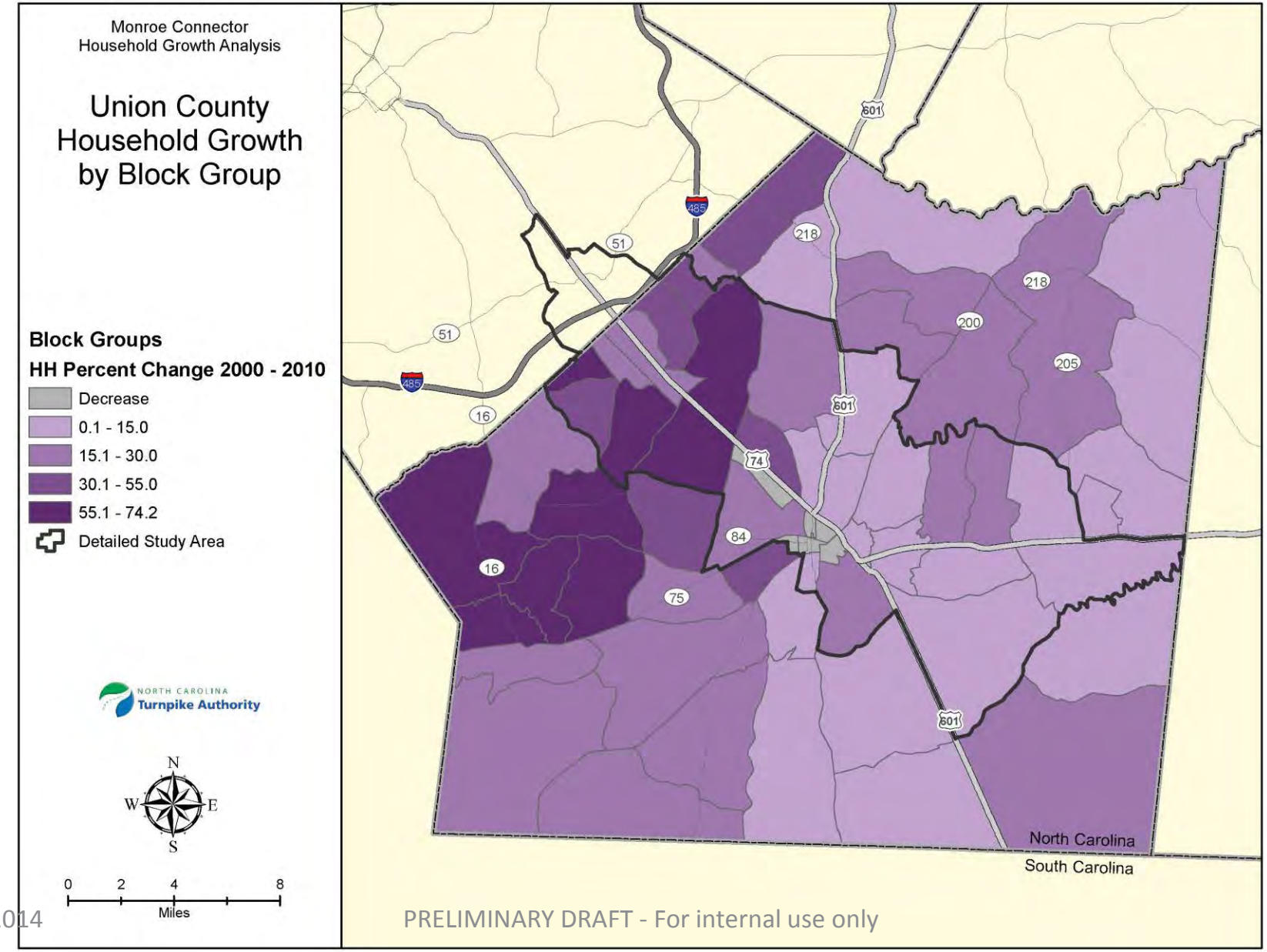
4. Traffic growth on US 74 has been flat from 2000 to 2012, and is inconsistent with population growth. (Hartgen)

- Dr. Hartgen fails to consider size differences between areas he compares.

E4-15

Geographic area	Area in Sq Miles	% of Total Area	% of Population Growth Captured 2000 to 2010
Union County	639.3	100%	-
DSA-Union Co. part	176.6	28%	46%
Union NON-DSA part	462.7	72%	54%
Ratio of NON-DSA to DSA part	2.62	2.62	1.17

4. Traffic growth on US 74 has been flat from 2000 to 2012, and is inconsistent with population growth. (Hartgen)



E4-16

4. Traffic growth on US 74 has been flat from 2000 to 2012, and is inconsistent with population growth. (Hartgen)

			2004 to 2012 Change		AADT			
AADT Station	ROUTE	LOCATION	AADT	% Change	2012	2010	2006	2004
119	US 74	W OF SR 1365	3,000	5.6%	57,000	54,000	58,000	54,000
27	NC 16	N OF SR 1346	5,000	21.7%	28,000		25,000	23,000
3	NC 218	W OF SR 1539	1,700	26.2%	8,200	8,200	8,700	6,500
1783	SR 1365	N OF SR 1524	700	33.3%	2,800	3,600	2,900	2,100
1824	SR 1460	N OF SR 1009	550	64.7%	1,400	1,100	820	850
1794	SR 1501	W OF SR 1524	3,000	20.0%	18,000	20,000	18,000	15,000
1294	SR 3468	S OF SR 3440	1,000	9.1%	12,000	12,000	12,000	11,000
3518	SR 1004	W OF SR 1524	2,000	14.3%	16,000	15,000	15,000	14,000
3481	SR 3445	E OF SR 3440	2,100	27.3%	9,800	11,000	11,000	7,700
Total			19,050	14.2%	153,200		151,420	134,150
Total w/o NC 16			14,050	12.6%	125,200	124,900	126,420	111,150

E4-17

5. The Regional Travel Model and the traffic operations model appear to have been insufficiently calibrated. (Hartgen)

- Per the Metrolina Model User's Guide (July 11th, 2008), Documentation Revision 2.0, page 3-11, extensive surveys and studies were performed to "serve as a basis for model equations, settings, and calibration targets."
- Additional supporting information requested from CDOT (Anna Gallup)

3.4 Surveys and Studies

As part of the model update process, the model team undertook significant efforts to collect new travel behavior throughout the region. Nearly $2.5 million was invested in these studies and surveys, which serve as a basis for model equations, settings, and calibration targets. **Table 3.1** shows the major sources for data in the metrolina modal, along with the years collected and developed. In addition to these sources, a number of smaller scale special and on-going data efforts have been a resource for model development and maintenance.

Table 3.1. Data Sources

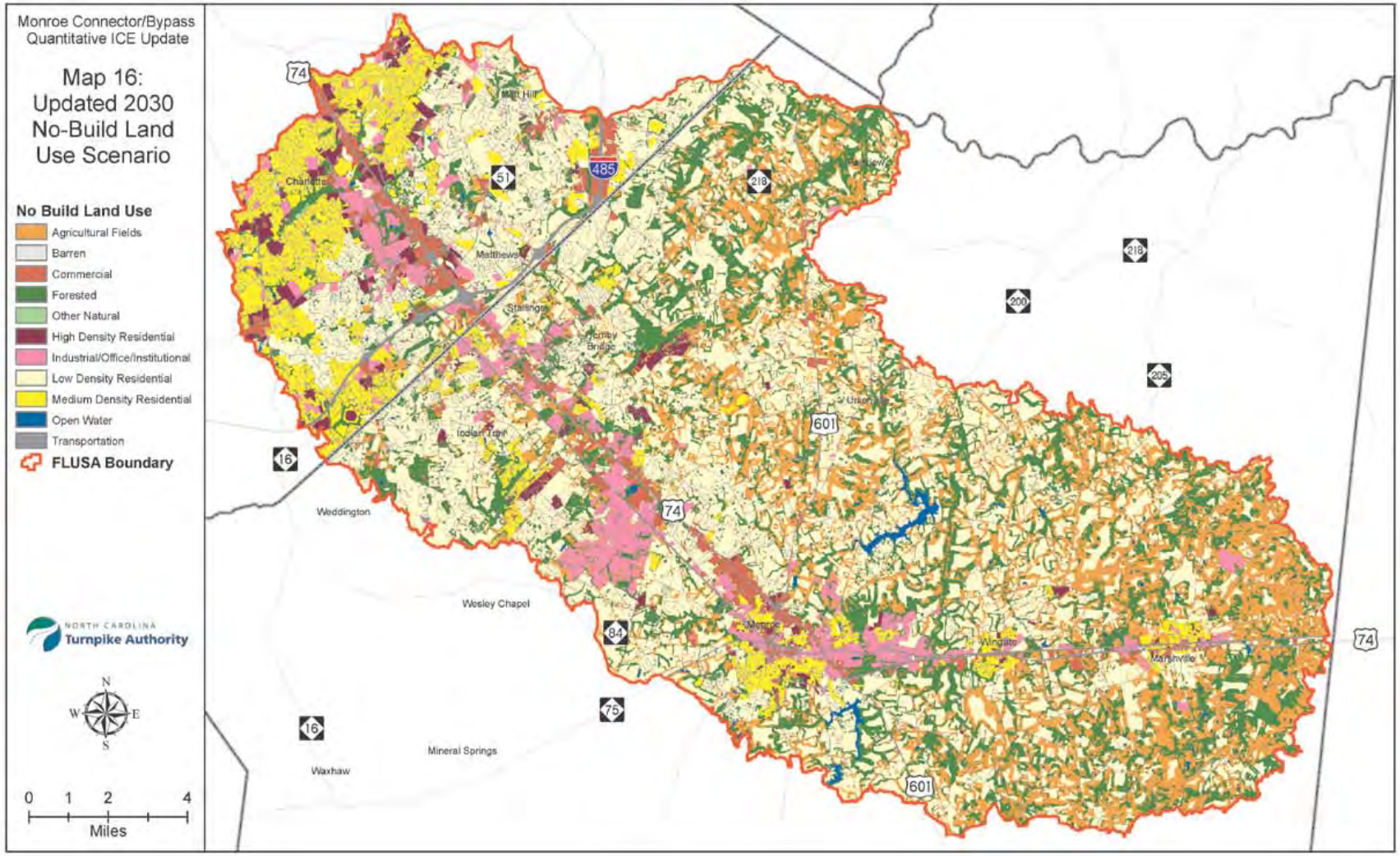
Data Source	Year(s)
U.S. Decennial Census	2000
Greater Charlotte Regional Household Travel Survey	2002
Workplace Survey	2003
External Station Survey	2001
Transit On-board survey	2003/2004
Traffic Counts	2000/2003
Demographic and Economic Forecasts	2003
Dun and Bradstreet Employment Data	2003
InfoUSA Employment Data	2002
UNC-Charlotte Employment Survey	2003

3.5 Highway Network

The model network has been developed to represent all regionally and locally significant roads in the study area. Significance is measured in terms of functional classification, average daily traffic and connection with transportation system. The highway network also incorporates planned projects that are expected to be opened by each of the forecast years. As discussed in **Section 3.5.1**, a single "master" network stores all years and alternatives in its database, and builds the appropriate network for use in a model run based on the year and project database selected. As discussed in **Sections 3.5.2 and 3.5.3**, the network also stores all of the attributes necessary to develop the capacities and speeds used in the travel demand model.

In the model CD version **MRM06v1.1, dated 9-6-2007**, there is one "official" master network (master_070131.dbd) and project list (PROJECT LIST_070131.DBF), which are financially-constrained and were used for air quality conformity. NCDOT and CDOT recommend that any long range project analysis uses this network as a starting point, with variations to the network only made specific to that project.

6. The DSFEIS leaves unanswered key questions regarding induced travel. (Hartgen)



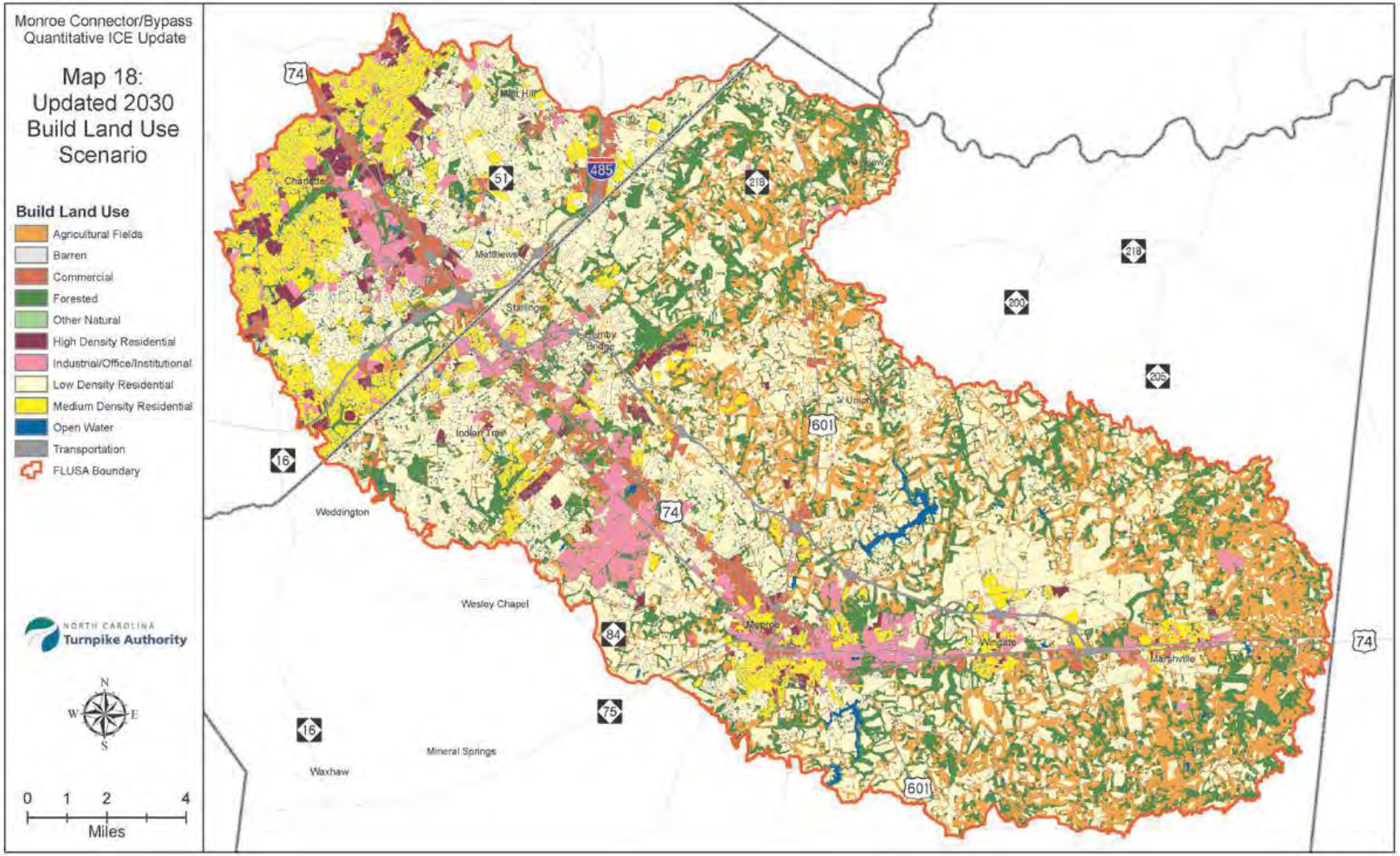
E4-19

6. The DSFEIS leaves unanswered key questions regarding induced travel. (Hartgen)

Interchange	Route #/Road
1	US 74/Andrew Jackson Hwy
2	Indian Trail-Fairview Rd
3	Unionville-Indian Trail Rd
4	Rocky River Rd
5	US 601/Concord Hwy
6	Morgan Mill Rd
7	Austin Chaney Rd
8	Forest Hills School Rd
9	US 74/Andrew Jackson Hwy

E4-20

6. The DSFEIS leaves unanswered key questions regarding induced travel. (Hartgen)



E4-21

6. The DSFEIS leaves unanswered key questions regarding induced travel. (Hartgen)

E4-22

7. Questions remain concerning details of traffic forecasts. (Hartgen)

- Section 3-5-3 (pages 3-23 – 3-32) of the Metrolina Model User's Guide (July 11th, 2008), Documentation Revision 2.0, details the approach for determining highway capacities and speeds in the approved MRM.

3.5.3. Highway Capacities and Speeds

E4-23

The Metrolina model uses comprehensive capacity settings that estimate the link capacity throughout the model based on the link attributes. Issues such as functional classification, speed, intersection controls, parking, pedestrian activity, and driveway density are accounted for in the process to provide realistic link capacities in a regional modeling environment. Capacities are calculated for Level of Service (LOS) E, and are calculated for each of the four time periods in the model (see **Section 3.9** for more information on time-of-day modeling). These capacities are used in conjunction with estimated free-flow and loaded speeds in the model to reflect the impacts of congestion on travel times and route choices in the model.

Following network selection and creation, model speeds and capacities (by link direction) are estimated using these network characteristics:

- Number of lanes
- Speed Limit
- Functional Classification (Freeway, major thoroughfare, local, etc.)
- Intersection Control (Signal, Stop Sign, Yield, etc.)
- Median Type (Divided, Turn Lanes, etc.)
- Area Type (CBD, CBD Fringe, Urban, Suburban, Rural)
- Functional Classification of Crossing Streets

Sections 3.5.3.1 and 3.5.3.2 discuss the capacities and speed details further.

One of 17 capacity / speed tables in Section 3.5.3

Table 3.3. Lane Capacity Lookup Table

Functional Class	Area Type 1 CBD	2 Fringe	3 Urban	4 Suburban	5 Rural
1- Freeway	1,900	2,000	2,000	2,100	2,200
2- Expressway	1,500	1,550	1,550	1,550	1,600
3- Class II	1,300	1,300	1,300	1,350	1,400
4- Major	1,250	1,250	1,250	1,300	1,350
5- Minor	1,200	1,200	1,200	1,250	1,300
6- Collector	1,500	1,500	1,500	1,550	1,650
7- Local	1,500	1,500	1,500	1,550	1,600
8- Ramp	700	800	800	800	8000
9- Freeway Ramp	1,200	1,200	1,200	1,000	1,000
20- HOV	1,600	1,700	1,700	1,800	1,800
22- HOV Bus	1,600	1,700	1,700	1,800	1,800

7. Questions remain concerning details of traffic forecasts. (Hartgen)

- Table from Monroe Traffic Forecast Summary Memo and Draft Quantitative ICE Analysis Update.

Table 4: MRM Socioeconomic Projection Versions

Projection Name	TAZ File Name	Projections Completed	Use for LRTP Conformity Determination	Associated Model Version	Base and Horizon Years
2009 Projections	SE_*Year*_091028	October 2009	MUMPO 2035 LRTP	MRM 09 v1.0 MRM 11 v1.0 MRM 11 v1.1	Base: 2005 Horizon: 2015, 2025, 2035
2008 Interim Projections	SE_*Year*_081119_MUMPO_interim	November 2008	None	None	Base: 2005 Horizon: 2015, 2025, 2035
2008 Projections	SE_*Year*_081024	October 2008	RFATS 2035 LRTP	MRM 08 v1.0	Base: 2005 Horizon: 2015, 2025, 2035
2005 Projections	SE_*Year*_taz2934	April 2005	MUMPO 2030 LRTP	MRM 05 v1.0 MRM 06 v1.0 MRM 06 v1.1	Base: 2000 Horizon:2010, 2020, 2030

Figure 6: Timeline of MRM Projection Development

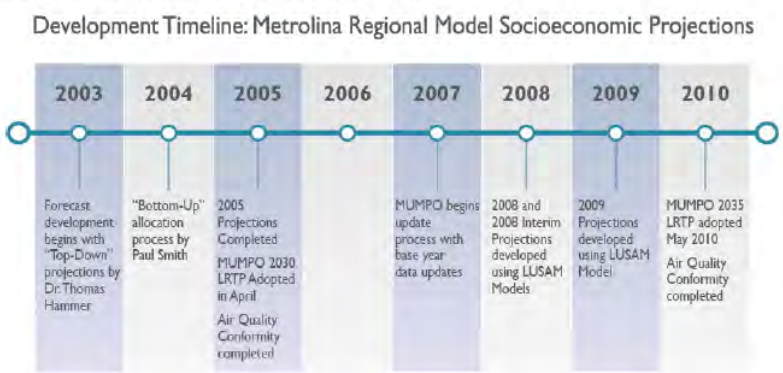


Table 1 – Summary of Monroe Connector/Bypass Project Traffic Forecasts

	Document Name	Prepared By, Date	Forecast Years	Forecast Scenarios	Model Version and SE Data	Used in NEPA Documents
	Traffic Forecasts					
A	*Traffic Forecast for the No-Build Alternatives for NCDOT State TIP Project No. R-3329 and NCDOT State TIP Project No. R-2559, Monroe Connector/Bypass Study*	Martin/Alexiou/Bryson (MAB), June 2008	2007, 2030	2007 & 2030 No-Build	MRM05 and 2005 SE data (SE_*Year*_taz2934)	Yes
B	*Technical Memorandum for TIP Projects R-2559 & R-3329 US74 Upgrade Scenario*	Wilbur Smith Associates (WSA), June 2008	2035	2035 Upgrade Existing Build Non-Toll & Toll	MRM06 and 2005 SE data (SE_*Year*_taz2934)	Yes
C	*Traffic Forecast for TIP Projects R-3329 & R-2559 Monroe Connector/Bypass*	WSA, September 2008	2008, 2035	2008 & 2035 No-Build, Build Non-Toll & Build Toll	MRM06 and 2005 SE data (SE_*Year*_taz2934)	Yes
	Traffic Forecast Interpolations, Extrapolations and Redistributions					
D	*Monroe Connector/Bypass Alternative 3A 2013 AADT Build Toll Scenario*	HNTB, January 2009	2013	2013 Build Toll	MRM06 and 2005 SE data (SE_*Year*_taz2934).	No
E	*2035 Build Toll Forecast, Segment 2 (Alternative 3A)*	HNTB, July 2009	2035	2035 Build Toll	MRM06 and 2005 SE data (SE_*Year*_taz2934).	Yes
F	*NCDOT STIP Project R-3329 & R-2559 Revised Monroe Connector Bypass No-Build Traffic Forecast Memorandum*	HNTB, March 2010	2008, 2035	2008 & 2035 No-Build	MRM06 and 2005 SE data (SE_*Year*_taz2934).	Yes
G	*Monroe Connector / Bypass Year 2025 Build Toll Alternative 3A Traffic Volume Projections*	HNTB, August 2010	2025	2025 Build Toll	MRM06 and 2005 SE data (SE_*Year*_taz2934).	No
	Traffic & Revenue Studies					
H	*Monroe Connector/Bypass 2009 Update to Preliminary Study*	WSA, April 2009	2014 thru 2054	2014 thru 2054 Build Toll	Modified MRM06 and modified 2008 Interim SE data (SE_*Year*_081119_MUMPO_interim)	No
I	*Proposed Monroe Connector/Bypass Comprehensive Traffic and Revenue Study, Final Report*	WSA, October 2010	2015 thru 2055	2015 thru 2055 Build Toll	Modified MRM06 and modified 2008 Interim SE data (SE_*Year*_081119_MUMPO_interim)	No

E-4-2

Traffic Forecast & SE Projections Timeline

Year	MRM SE Projections	MRM SE Projections (cont.)	Traffic Forecasts	Traffic Forecast Interpolations, Extrapolations & Redistributions	Traffic & Revenue Studies
2003	"Top Down" Dr. Hammer				
2004	"Bottom Up" P. Smith				
2005	2005 Projection; MUMPO 2030 LRTP Adopted April 2005; AQ Conformity	2005 Projections, Completed April 2005, Conformity MUMPO 2030 LRTP, MRM 05 & 06 Version			
2006					
2007	MUMPO update process				
2008	2008 & 2008 Interim Projections LUSAM Models	2008 Projections, Completed October 2008, Conformity RFATS 2035 LRTP, MRM 08 Version; 2008 Interim Projections, Completed October 2009, Conformity None, Model Version None	2007/2030 No-Build (MAB, June 2008); 2035 Upgrade Existing Non-Toll & Toll (WSA, June 2008); 2008 & 2035 No-Build, Build Non-Toll & Build Toll (WSA Sept. 2008)		
2009	2009 Projections LUSAM Models	2009 Projections, Completed October 2009, Conformity MUMPO 2035 LRTP, MRM 09 & 11 Version		2013 Alt 3A Build Toll (HNTB, Jan. 2009); 2035 Alt 3 A Segment 2 Build Toll (HNTB, July 2009)	T&R 2009 Update to Preliminary Study (WSA, April 2009)
2010	MUMPO 2035 LRTP Adopted May 2010; AQ Conformity			2008/2035 No-Build Update (HNTB, March 2010); 2025 Build Toll (HNTB, Aug. 2010)	Final Comprehensive T&R Study (WSA, Oct. 2010)

9. External traffic forecasts for U.S. 74 and other roads is not discussed. (Hartgen)

- MUMPO (CRTPO) prepared a *Draft Final External Travel Survey Report (May, 2003)* that was used to assist with the current MRM11 and previous MRM05, 06, 09 model development.
- CRTPO is currently conducting a new external travel survey, which is expected to be complete in mid-2014.

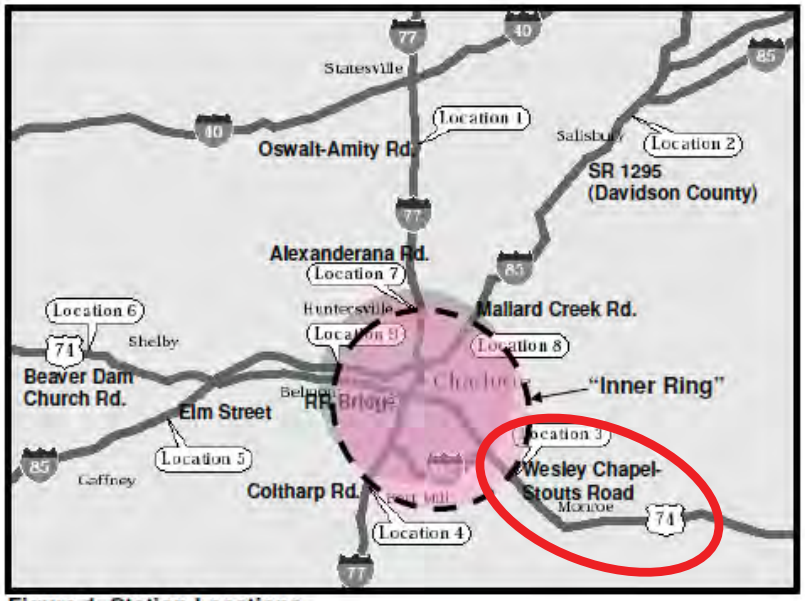
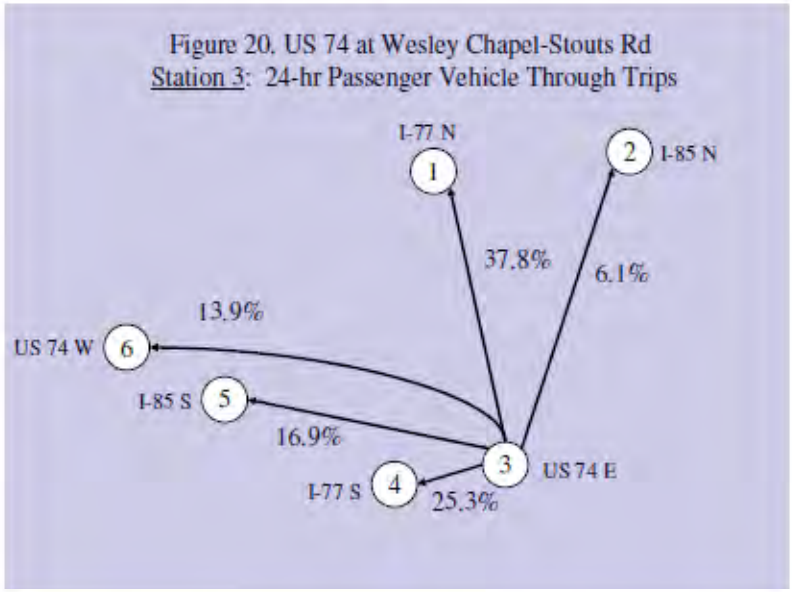


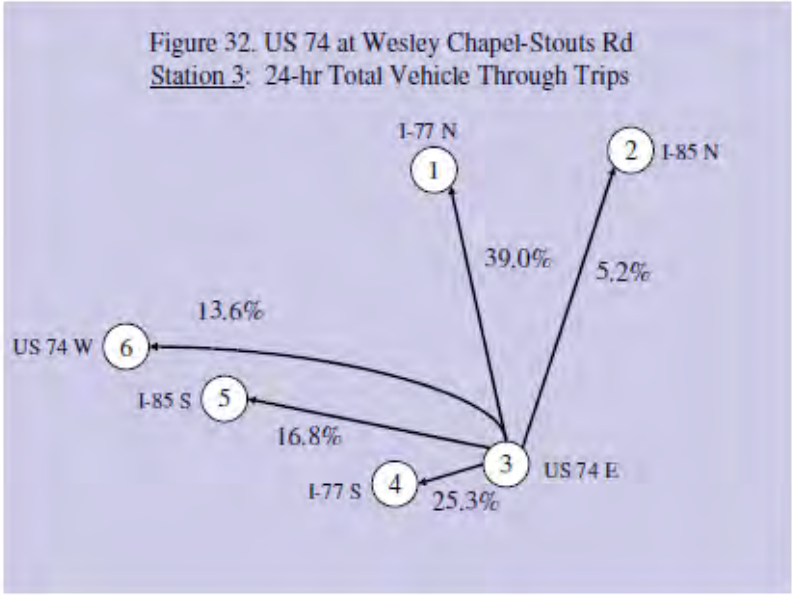
Figure 1. Station Locations.

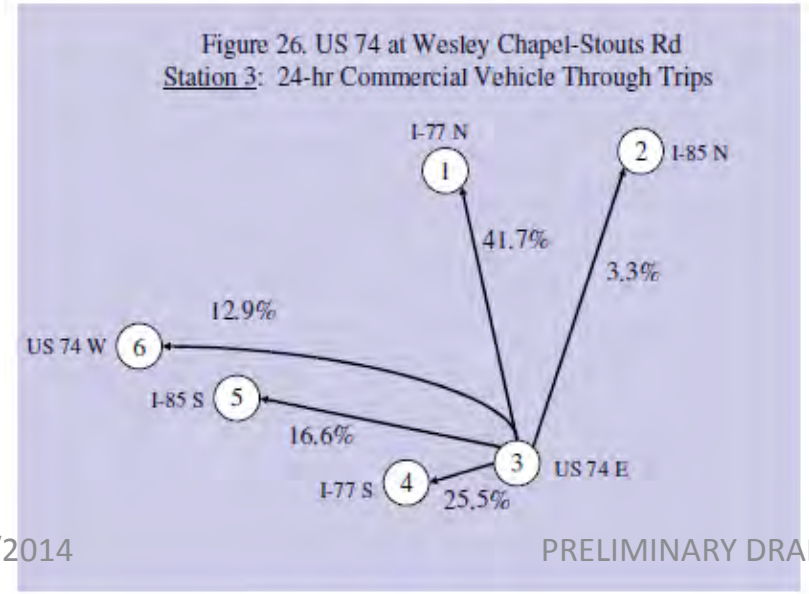
Total Vehicle Trips	From Station	Total Vehicle Trip Type				Total Vehicles of Trip Type				
		Through	Through w/Stop	Turn-Around	Ext-Int	Total Through	Through w/Stop	Turn-Around	Ext-Int	Total
23,729	1	6,540	1605	3833	11,751	28%	7%	16%	50%	100%
27,618	2	6,682	2,460	4188	14,288	24%	9%	15%	52%	100%
21,574	3	2286	1549	6,139	11,600	11%	7%	28%	54%	100%
38,623	4	6,394	1880	12,525	17,824	17%	5%	32%	46%	100%
19,396	5	6,231	1784	2563	8,818	32%	9%	13%	45%	100%
10,571	6	932	887	2640	6,112	9%	8%	25%	58%	100%
141,511	All Stations	29,065	10,165	31,888	70,393	21%	7%	23%	50%	100%

Table 12. Adjusted 24-Hour Number of Total Vehicle Plates by Trip Type.

9. External traffic forecasts for U.S. 74 and other roads is not discussed. (Hartgen)







- Figures from *Draft Final External Travel Survey Report (May, 2003)*

E4-27

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Appendix B – Responses to Hartgen Report

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Table 1. Hartgen Report – Detailed Comment/Response Summary

Hartgen Report Page	General Topic	Comment #	Comment	Response
3	P&N	1	The stated Purpose and Need for the Bypass appear to have been written narrowly so that only alternatives on new alignment satisfy the stated Purpose and Need.	See response to **Comment #s 12 through 20.**
3	Alternatives	2	The alternatives considered appear to be inappropriately biased against upgrades to U.S. 74.	See response to **Comment #s 21 through 29.**
3	Traffic forecasts	3	Traffic forecasts for 2035 were not re-computed for some alternatives, thus possibly over-stating future Bypass traffic and under-stating traffic improvements for some alternatives. Some of the recently completed and planned future improvements to U.S. 74 and their effect on traffic forecasts have not been included in the traffic forecasts, and their effect on Bypass traffic therefore appears to be under-stated.	See response to **Comment #s 30 through 36.**
3	Traffic forecasts	4	Traffic growth on U.S. 74 has been flat from 2000 to 2012 and is inconsistent with population growth trends. The DSFEIS simply ignores these inconsistencies. Moreover, the forecast of population, which drives the traffic forecast, is based on a pre-Recession projection; recent population growth has slowed markedly. Essentially the entire justification for the project rests on traffic forecasts that ignore 12 years of recent history, recent economic upheaval, and slower population growth.	See response to **Comment #s 37 through 48.**
3	Travel demand modeling	5	The regional travel demand model (used to forecast Bypass traffic) and the traffic operations simulation model (used to study traffic flow on U.S. 74) both appear to have been insufficiently calibrated.	See response to **Comment #s 49 through 54.**
3	Induced traffic	6	The DSFEIS attempts to addresses the directive of the 4th Circuit Court, but leaves key questions regarding induced traffic unanswered.	See response to **Comment #s 55 through 59.**
3	Traffic forecasts	7	Questions remain concerning details of the traffic forecasts. The three key assumptions of the traffic forecasts (growth of the area population, percentage diversion, and magnitude of long-distance travel) all appear to be overly optimistic.	See response to **Comment #s 60 through 68.**
3	Project costs	8	Project costs and cost-effectiveness are not sufficiently detailed.	See response to **Comment # 69**.
3	Traffic forecasts	9	External traffic forecasts are undocumented.	See response to **Comment # 70.**
3	Traffic forecasts	10	Inherent uncertainty in traffic forecasts has not been sufficiently considered.	See response to **Comment #s 71 and 72**.
4	Traffic forecasts	11	In summary, based on these and other issues described below, my review finds that the traffic forecasts presented in the DSFEIS are too uncertain and insufficiently supported to be the basis for decision-making regarding the Monroe Connector/Bypass.	This comment/response table provides a thorough response to all individual comments and arguments raised in the Hartgen Report. The traffic forecast results and conclusions made for this project are the product of a detailed, approved methodology and standard process used for project-level traffic forecasting and analysis in North Carolina, and meet the requirements under 40 CFR 1502.24. Because the traffic forecasts attempt to predict the future, they are subject to uncertainty. The results and conclusions have gone through a detailed review and update process to ensure that uncertainty was considered and accounted for, as deemed reasonable and necessary, using the latest available data. Also, see responses to **Comment #s 12 through 72.**

Hartgen Report Page	General Topic	Comment #	Comment (Observation #1)	Response
4	P&N	12	**The stated Purpose and Need for the Bypass appear to have been written narrowly.** According to the DSFEIS, the purpose of the project is to: "*improve mobility and capacity within the project study area by providing a facility for the U.S. 74 corridor from near I-485 in Mecklenburg County to between the towns of Wingate and Marshville in Union County that allows for high-speed regional travel consistent with the designations of the North Carolina SHC program and the North Carolina Intrastate System, while maintaining access to properties along existing U.S. 74*." This statement implies that congestion within the study area is long-distance in character, that a high-speed long-distance facility will increase study-area mobility, and that the system designations of the Legislature are inviolate. None of these assumptions are the case. Indeed, the North Carolina General Assembly has recently (2013) repealed the Intrastate System legislation.	We disagree with the commenter's suggested interpretation that the project's purpose and need statement is too narrow. We also disagree with the commenter's interpretation that the purpose and need suggests that congestion within the study area is long distance in character. We have responded previously to comments suggesting that the purpose and need is too narrow in the Final EIS Section 3.3.1 (Responses to Generalized Comments on Purpose and Need) and responses to comments 1 and 2 from the SELC letter dated June 15, 2009 in Final EIS Appendix B (pages B3-25 through B3-26), particularly in regards to providing for high-speed regional travel. In summary, the term "high speed" as used in the EIS does not unduly narrow alternatives nor preordains any one particular alternative. The term "high speed" is defined as 50 miles per hour, and this travel speed might be achieved by several different types of facilities on any number of new location alignments or along existing roadways, for example: controlled-access freeways, superstreets, or even public transportation on dedicated right of way. Section 2.2.1 of the *Draft EIS* explains the criteria used to determine the ability of alternative concepts to meet purpose and need. These included the ability to enhance mobility and increase capacity, serve high-speed regional travel, and ability to maintain access to properties along US 74. All three criteria were considered in the evaluation of alternatives. Table 2-1 of the *Draft EIS* shows that three alternative concepts met qualitative first screening criteria: 1) Improve Existing US 74 Controlled Access Highway, 2) New Location Highway, and 3) New Location/Improve Existing Roadways Hybrid. The project's purpose and need has remained consistent throughout the EIS process and has been clearly stated in the NEPA documents and public meeting materials. As stated in the introduction to the *Draft Supplemental Final EIS* Section 1, "based upon a review of new information and public and agency comments received to date, the purpose and need for the project remain unchanged." As stated in Section 1.1.2 of the *Draft Supplemental Final EIS*, the purpose of the project is "to improve mobility and capacity within the project study area by providing a facility for the US 74 corridor from near I-485 in Mecklenburg County to between the towns of Wingate and Marshville in Union County that allows for high-speed regional travel consistent with the designations of the North Carolina SHC program and the North Carolina Intrastate System, while maintaining access to properties along existing US 74." (SEE NOTE BELOW) The use of regional travel clearly delineates that the project purpose and need is not specifically long-distance travel. NOTE: The State legislation regarding the Intrastate System was recently repealed by the State Legislature in Session Law 2013-183, signed by the Governor on June 26, 2013. The *Final Supplemental Final EIS* includes an errata section (Appendix D) updating the project purpose to remove reference to the NC Intrastate System. High speed travel is still designated for the corridor in the NC Strategic Highway Corridor (SHC) program, so the substantive statements of the project purpose remain unchanged.
4	P&N	13	**The DSFEIS focuses on the second and third stated purposes, not the first.** Focusing on the second and third purposes, and not the first, leads to the consideration of alternatives that are largely on new alignment, that is, off existing U.S. 74's current location. This is inconsistent with the requirements of the National Environmental Policy Act ("NEPA") and virtually all of transportation economics, in which the objective is to evaluate proposed projects by their benefits versus their costs.	Consistent with 23 CFR 771.111 – Environmental Impact and Related Procedures, the purpose and need for the project was developed with input from local officials, agencies and the public as described throughout the EIS. The project's purpose and need is consistent with 40 CFR 1502.23, which states that "The statement shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action." The purpose and need statement also is consistent with the FHWA guidelines *NEPA and Transportation Decision making* (FHWA, Sept 1990), which lists three key points relative to a purpose and need section of an EIS, which are: 1) justification of why the improvement must be implemented, 2) as comprehensive and specific as possible, and 3) reexamined and updated as appropriate throughout the project development process. Neither NEPA nor the transportation planning requirements under title 23, U.S.C. requires proposed projects to be evaluated by their benefits versus cost.

Hartgen Report Page	General Topic	Comment #	Comment (Observation #1)	Response
				The commenter's assertion that the stated purpose element, "improve mobility and capacity within the project study area", was not adequately considered in the evaluation of alternatives is not correct. A multi-step, objective screening process was used to evaluate alternatives to identify those to move forward for detailed study. Section 2 of the *Draft Supplemental Final EIS* summarizes the extensive multi-step alternatives development process carried out during the preparation of the *Draft EIS*, additional analyses conducted and documented in the *Final EIS* as a result of public and agency comments, and updates and analyses conducted after the *Final EIS*. The alternatives screening process is described in Section 2 of the *Draft EIS* and Section 2 of the *Draft Supplemental Final EIS*. As discussed in Section 2.2.1 of the *Draft EIS*, for the first qualitative screening of alternatives: "Each Alternative Concept was considered for its potential to meet the purpose and need for this project. The screening criteria listed below were applied. • Does the alternative address the need to improve mobility and capacity in the US 74 corridor? • Is the alternative consistent with the NC Strategic Highway Corridor (SHC) program and NC Intrastate System (i.e., does it allow for high-speed regional travel)? • Does the alternative maintain access to properties along existing US 74?" The conclusion of the first qualitative screening of alternatives, which considered <u>all three</u> screening criteria, is summarized in Section 2.2.3 and Table 2-1 of the *Draft EIS*. The second and third screenings, summarized in Section2 of the *Draft EIS*, qualitatively and quantitatively compared the benefits and impacts (including costs) of preliminary alternatives to identify the Detailed Study Alternatives. The use of all three screening criteria does not result in an undue narrowing of alternatives. This is explained in detail in *Final EIS* Section 3.3.1 (Responses to Generalized Comments on Purpose and Need) and responses to comments 1 and 2 from the SELC letter dated June 15, 2009 in *Final EIS* Appendix B (pages B3-25 through B3-26), particularly relating to the inclusion of providing high-speed regional travel in the project purpose. Support for the high-speed component of the screening criteria is provided in Section II.8 of 23 CFR 450 Appendix A (Linking the Transportation Planning and NEPA Processes) which states, "The statement of purpose and need shall include a clear statement of the objectives that the proposed action is intended to achieved, which may include: (a) Achieving a transportation objective identified in an applicable statewide or metropolitan transportation plan; (b) supporting land use, economic development, or growth objectives established in applicable Federal, State, local, or Tribal plans; and (c) serving national defense, national security, or other national objectives, as established in Federal laws, plans, or policies." On page 3-10 of the *Final EIS*, it is explained that, "Maintaining access to properties along existing US 74 was included because numerous industries, office, retail businesses, and institutions are located along the corridor, many of which have US 74 as their only access. US 74 is a critical commercial corridor for the economic vitality of Union County."
4-5	Congestion	14	**Congestion on US 74 is largely locally-based, not long-distance.** The DSFEIS says that congestion on U.S. 74 is uniform throughout the day and by direction: "*Based on these field travel time runs, corridor average travel speeds are approximately 40 mph eastbound and westbound during all three peak periods.*" The NCDOT travel time runs and recent INRIX data show that travel speeds are essentially uniform by direction and AM peak-lunch-PM peak (DOT 40 mph, INRIX 43-44 mph). This suggests that most of the traffic on U.S. 74 is	We disagree with the commenter's interpretation that the DSFEIS says that congestion on U.S. 74 is uniform throughout the day and by direction. The DSFEIS Table 1-2 (page1-7) summarized congestion for the morning peak hour, the lunch peak hour and the afternoon peak hour. An evaluation of INRIX average travel speeds by hour shows that congestion varies throughout the day and is not uniform. Congestion on US 74 during the morning and afternoon peaks is largely affected by commuter traffic. Congestion throughout the day is a result of the combination of long-distance regional trips, local commuter trips, and local access trips – including

Hartgen Report Page	General Topic	Comment #	Comment (Observation #1)	Response
			locally-based traffic (otherwise the congestion would be more severe in peaks and nearer to Charlotte, where traffic volumes are higher). A further observation is that there is a *reduction* in traffic volume on U.S. 74 between Monroe and the Mecklenburg County line, also suggesting that the traffic congestion around Monroe is locally-based, and is not headed to Charlotte. A third point is that the location of the facility, about 2 miles north of U.S. 74, means that local traffic on U.S. 74 would be unlikely to use the proposed Bypass as such use would require driving farther and out of the way for many local short trips, *and* paying a toll, to save (or perhaps even lose) travel time by using the Connector.	trips utilizing numerous crossing facilities. Regardless of trip type being local or regional, existing traffic congestion along the corridor currently impairs the US 74 corridor from operating at 50 mph or its posted speed limits for much of the day. Continued growth, both locally and regionally will further exacerbate existing congestion along the corridor for all types of trips. Travel time information presented in Section 1.2.4 of the *Draft Supplemental Final EIS* was updated for the *Final Supplemental Final EIS* in Section 1.1.1 to include a review of INRIX data for all of 2013, as well as 2011 and 2012 (see Tables 1-2 and 1-3 in the *Final Supplemental Final EIS*). The updated data resulted in the same conclusions as presented in the *Draft Supplemental Final EIS*. Table 1-2 and Table 1-3 show that the US 74 corridor from I-485 to US 601 (Pageland Highway), which makes up 60 percent of the studied corridor, operates substantially below 50 mph and posted speed limits, both eastbound and westbound, during all peak periods. For the portion of the corridor east of US 601 (Pageland Highway), average peak hour speeds are at or slightly above the weighted average posted speed limit, both eastbound and westbound. All speeds are still below the desired 50 mph for a high-speed corridor. Also as presented in the tables, contrary to the statement in this comment, congestion is more pronounced nearer to Charlotte, where differences between posted speed limits and INRIX average speeds are greater for the segment from I-485 to Fowler Secrest Road, indicating more congestion. The commenter states that there is a reduction in traffic volume on US 74 between Monroe and the Mecklenburg County line. A review of NCDOT 2012 traffic count maps show that existing volumes along US 74 from Monroe to I-485 show higher volumes near Monroe and similar or higher volumes near I-485, compared with lower volumes in areas in between. However, average speeds throughout the corridor from I-485 to US 601 just east of Monroe show average speeds 4-14 mph below the speed limits in the eastbound direction and 6-16 mph below the speed limits in the westbound direction. All projections of land use, employment, and population growth incorporated into the MRM models utilized in developing project-level traffic forecasts indicate that growth will continue to occur in Union County and throughout the project study area in the future. Thus, the MRM models predict increased traffic growth along the US 74 corridor and facilities accessing it with the result being increased traffic congestion in the future. The fact that MRM model results show that future traffic assignments utilize both the existing corridor and the proposed Bypass indicates that local trips would still utilize the existing US 74 corridor, depending on specific trip origin and destination, as well as use the Bypass for trips where the value of time would indicate a trip made using the Bypass is more desirable than using the existing corridor.
5	Traffic Volumes	15	**Long-distance traffic is low in volume.** Traffic volumes on U.S. 74 fall off sharply at the eastern edge of Monroe, from about 38,000 ADT in the vicinity of the Medical Center, to just 24,000 ADT at eastern edge of the study area, and about 19,000 ADT at Forest Hill Road, where the proposed Connector would rejoin U.S. 74. Although no data on external traffic (leaving the study area) is provided, probably only 1/3 of the 19,000 ADT at the study area's eastern edge is long-distance traffic (the ADT at the Anson County line, further east, is just 13,000 and some of that is local). Even if 1/2 of the 19000 ADT were to divert to the Bypass (an optimistic assumption), the resulting drop in traffic on U.S. 74 (about 8500) would be about 6-7%, less than the typical daily variation in traffic volume. Therefore the primary justification for the Bypass, long-distance traffic, is also relatively low in volume.	A project purpose is to improve mobility and capacity within the project study by providing a facility for the US 74 corridor from near I-485 in Mecklenburg County to between the towns of Wingate and Marshville in Union County that allows for high-speed regional travel. Facilitating long-distance travel is not a primary purpose of the project nor a criterion used to screen alternatives. Nowhere in the project documentation is the primary justification for the Bypass noted as being "for long distance traffic." The Bypass is expected to provide a high speed option for all trip types – local, regional, and long-distance. Traffic forecasts for the Bypass show variation between proposed interchanges, owing to the fact that varying levels of all three trip types described are expected to occur depending on relative location between project termini. Speculation on anticipated trip diversion to the Bypass using existing daily traffic data neglects any effects of increased future growth in the area and increased congestion along the existing US 74 facility.

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5	Congestion	16	**The proposed Bypass is unlikely to reduce congestion on US 74.** The above two factors — most traffic on U.S. 74 is local, and long-distance traffic is quite low and might not divert — suggest that it is almost entirely local traffic, not long distance traffic or the lack of a high-speed bypass, that causes the present congestion on U.S. 74. If most congestion is locally-based, then provision of a bypass will not alleviate it. It is therefore not likely that the proposed Connector would significantly reduce congestion on U.S. 74 or improve mobility in the study area.	We do not agree with the bulleted comment that the proposed bypass is unlikely to reduce congestion on U.S. 74. We also don't agree that it is unlikely that the proposed connector would improve mobility in the study area. These qualitative comments offer little data or analysis in support of its conclusion. However, as described in Section 2.5.2 of *the Draft Supplemental EIS* (under the heading Question 6 – How would the Monroe Connector/Bypass affect traffic volumes on the US 74 Corridor?), the project's traffic forecasts estimate that traffic volumes would be less along the existing US 74 corridor with the Monroe Connector/Bypass in place, thereby improving traffic flow conditions along existing US 74 compared to the No-Build scenario.
5	Funding	17	**The DSFEIS misrepresents the availability of "sufficient' funds."** The DSFEIS states that "*Similar to previous state and local TIPs and the conclusion in the Final EIS, current fiscally constrained planning documents do not have sufficient funds available from traditional sources in the foreseeable future to construct all priority projects in the state.*"[6] This statement ignores the Governor's new Strategic T r a n sportation Investment ("STI") Plan (2013), an effort to prioritize and fund highway projects by worthiness. The statement therefore pre-judges that the Monroe Bypass would not "pass muster" under the new statewide transportation prioritization formula, and therefore needs more funds in the form of tolls. But elementary transportation economics teaches that a project's worthiness should be determined WITHOUT regard to its funding sources. The Monroe Bypass should be subjected to the same worthiness criteria as virtually all other projects in the state, and if found sufficiently worthy it could then be funded without tolls. But no data on the project's cost-effectiveness is provided. The Monroe Connector/Bypass is the only yet-to-be-built road project presently authorized to be directly funded by the NC General Assembly through the NC Turnpike Authority; other projects previously permitted (the Garden Parkway, the Cape Fear Skyway, and the Mid-Currituck Bridge) have been removed from toll-authorized funding.	This comment consists of the author's opinion that the Monroe Connector/Bypass would not be a "worthy" project under the new Strategic Transportation Investments (STI) Law (House Bill 817). However, the STI law clearly excludes the Project and therefore it is not subject to STI scoring. Specifically, the STI law is scheduled to be fully implemented after July 1, 2015. Projects funded for construction before then will proceed as scheduled and are excluded from the STI law. The Monroe Connector/Bypass project was funded for construction in 2011, therefore it is not subject to STI scoring. Additionally, the STI Law expressly excludes the twenty-four million dollars ($24,000,000) that has been allocated to the Monroe Connector/Bypass to be used to pay debt service or related financing expenses on revenue bonds or notes issued for construction. The *Final Supplemental Final EIS* **Section 2.4** includes current cost estimates for the Project.
6	Project termini	18	**The DSFEIS misstates the end point of the project.** The DSFEIS states that "*On the western end, the project would begin at I-485, another controlled-access facility.*" This is factually not the case (it ends on U.S. 74, about 1 mile from the present I-485). Though the Draft recognizes the facility's true end point elsewhere, this inaccurate statement at the beginning of the document, in the summary of its purpose and need, wrongly implies that the project extends the Interstate system by providing for long- distance travel, whereas the project's asserted justification is the reduction of congestion.	The western project terminus is I-485. As noted in Section 3.1.1 of the *Draft Supplemental Final EIS*, the Preferred Alternative (DSA D) follows existing US 74 for approximately one mile from just east of I-485 to east of Stallings Road (SR 1365). As shown in Figures 3-4a and 3-4b in the *Draft Supplemental Final EIS*, the Preferred Alternative upgrades this approximately one-mile segment of existing US 74 to a controlled-access highway facility with frontage roads to access adjacent properties.
6	Miscellaneous	19	**The DSFEIS inappropriately introduces the issue of fairness.** The DSFEIS states: "*Although Union County is the fastest growing county in the State, it is the only county adjacent to Mecklenburg County that does not have a high-speed interstate-type facility connecting it to Mecklenburg County.*" This statement is factually incorrect. Union County is no longer the fastest growing county in North Carolina. At least 10 counties, led by Onslow, reported faster growth rates between 2010 and 2012 than Union County's 3.3%, or 1.7/%/year. Also, Lancaster County, SC, adjacent to Mecklenburg County, has no high-speed connection to Mecklenburg County. The statement further implies wrongly that all "adjacent" counties to metropolitan areas	According to the North Carolina State Demographic Unit and ACS estimates, Union County is still among the fastest growing counties in the region and is growing at a faster rate than the majority of counties in North Carolina. The quote in this comment has been clarified with minor corrections included in the Errata section of the *Final Supplemental Final EIS* (Appendix D). The quoted text, which comes from Section 1.1.1 of the *Draft Supplemental Final EIS*, should read: "Although Union County is one of the fastest growing counties in the State, it is the only county having a major border with Mecklenburg County that does not have a high-speed interstate-type facility connecting it to Mecklenburg County." We do not agree with the commenter's interpretation. This statement was not intended to imply anything other than a statement of existing conditions regarding the region's transportation network. This statement was not used as a criterion to evaluate the Monroe Connector/Bypass alternatives. The criteria used to evaluate the ability of alternatives to meet the

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			somehow deserve a high-speed "interstate-type" connection to the metropolitan county. This criterion is not one used by the STI program to evaluate projects. The STI criteria require that all highway projects be evaluated by cost-effectiveness and congestion reduction, among other factors, but not by geographic proximity or design level. Further, NCDOT is already upgrading existing U.S. 74 in Mecklenburg County to high-speed design standards, and this upgrade could be continued into Union County. If this criterion were added to the STI, then counties adjacent to Wake, Guilford, Forsythe, Cumberland, Buncombe, New Hanover, and Durham should also have their connections upgraded and raised to "interstate- type."	project's purpose and need are stated in Section 2.2.1 of the *Draft Supplemental Final EIS*.
7	Weekend Travel	20	**Neither beach access nor weekend traffic is mentioned in the document.** It is commonly thought that travel times from Charlotte to the North Carolina beaches are hampered by congestion on U.S. 74, and that as a result, beach- going weekend traffic is often stuck in congestion between Charlotte and Monroe. Yet the DSFEIS does not study, review or even mention local or long-distance *weekend* traffic. The proposed Monroe Bypass might serve an additional *unmentioned* purpose of providing faster access across Union County for Charlotte-area beach-goers — in other words, a major unmentioned beneficiary of the Bypass would be the occasional (largely weekend) users from an adjacent county! If these factors are part of the project's justification, they must be spelled out and evaluated on their merits using appropriate traffic analysis methods. This oversight demonstrates either unfamiliarity with an unstated key "purpose and need" of the project, or (worse) implies that stating this additional purpose would reduce the project's political support.	Alternatives studied in the NEPA process were analyzed for their ability to meet purpose and need, as explained in Section 2.2.1 of the *Draft Supplemental Final EIS*. Long-distance travel associated with beach and weekend travel was not part of the project purpose and need. Therefore, this information was not needed to evaluate proposed alternatives for the project. Although improving weekend travel to the beach is not a purpose of the project, some of these trips likely would benefit from the construction of the proposed Monroe Connector/Bypass.

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7	Alternatives	21	**The alternatives considered appear to be inappropriately biased against US 74 upgrades.** NEPA requires that the alternatives considered for road projects include the "no- build" alternative, a TSM/TDM alternative, and a variety of "build" alternatives. While the ranges of alternatives to be considered vary widely from project to project, the intent of NEPA is to ensure that a wide range is considered. Alternatives found to be viable must then be evaluated to equivalent levels of detail in terms of benefits, impacts and costs. This does not appear to be the case for the Monroe Connector/Bypass.	We disagree with the commenter's suggestion that we did not appropriately evaluate alternatives as required under NEPA. Section 2 of the *Draft Supplemental Final EIS* summarizes the extensive multi-step alternatives development process for a wide range of alternatives carried out during the preparation of the *Draft EIS*, additional analyses conducted and documented in the *Final EIS* as a result of public and agency comment, and updates and analyses conducted after the *Final EIS*. Figure 2-1a-b in the *Draft Supplemental Final EIS* is a graphic summary of the alternatives evaluations conducted. Alternatives evaluated included transportation demand management (includes measures such as flex-time, staggered work hours, and ridesharing), mass transit/multi-modal, improve existing US 74, new location, and combinations of improve existing roadways and new location.
7	Alternatives & Purpose and Need	22	**The DSFEIS limits the alternatives to those that were judged to fit a biased Purpose and Need.** The DSFEIS describes the three-stage winnowing process used to identify feasible alternatives. In the first step, a wide range of alternatives were considered, including: • *No-Build or No-Action Alternative* • *Transportation Demand Management Alternative* • *Transportation System Management Alternative* • *Mass Transit and Multi-Modal Alternatives* • *"Build" Alternatives, including Upgrading Existing Roadways and New Location Alternatives* The DSFEIS then states that three criteria, based on the purpose and need, were applied to each alternative: • *Does the alternative address the need to enhance mobility and increase capacity in the U.S. 74 corridor?* • *Is the alternative consistent with the NC Strategic Highway Corridor program and the NC Intrastate System (i.e. does it allow for high- speed regional travel)?* • *Does the alternative maintain access to properties along existing U.S 74* But as detailed above, because the stated "Purpose and Need" is biased toward inappropriate criteria, the alternatives developed to meet those criteria are not judged on the right set of criteria.	*See responses to* ***Comment #s 12, 13, and 21****.*
8	Alternatives & Purpose and Need	23	**Elimination of "frontage road" and "not maintaining property access" alternatives arbitrarily restricts the options.** The DSFEIS eliminates several alternatives based on their asserted failure to provide access to existing U.S. 74 properties. It notes that "*However, as part of the purpose and need criteria for the project, there is a need to maintain access to existing properties along existing U.S. 74, so frontage roads would be needed for the Upgrade Existing U.S. 74 Alternatives under either a toll or non-toll scenario to provide property access.*" But the alternatives apparently do not include various "frontage road" options, either separately or in combination with other features such as Superstreets, reversible lanes, or signal optimization. Essentially, by restricting the review to those alternatives that are asserted to *strictly* meet the biased Purpose and Need, the DSFEIS arbitrarily eliminates a wide range of other feasible options. Partial frontage roads for some sections and not others are also not explored fully. Partial freeway upgrades along with partial upgraded arterial treatment is another option that is clearly possible but is not explored. Neither do the alternatives apparently consider options that take a minimal, or minor, number of existing properties along existing U.S. 74, while the proposed Bypass would take 95 households, 47 businesses and 499 acres of active agricultural land. Failure to adequately consider "on-current-alignment" options is also surprising as upgrades to U.S. 74 in Mecklenburg County include on-current-alignment upgrades. If NCDOT could pursue this alternative to improve U.S. 74 in one county, then why not in the adjacent county?	As discussed in Section 2 of the *Draft Supplemental Final EIS*, and shown in Figure 2-1b of the *Draft Supplemental Final EIS*, NCDOT thoroughly studied many improve existing US 74 alternatives, including Transportation System Management (TSM), Superstreets, Standard Arterial Widening, Controlled Access Highway, and New Location/Improve Existing Hybrid. Figure 2-1b of the *Draft Supplemental Final EIS* summarizes the alternative concepts and decision points for improve existing US 74 alternatives. Figure 2-1b also lists other types of improve existing US 74 alternatives considered, including TSM Alternative, superstreets, standard arterial widening, and new location hybrids. As listed in Figure 2-1b, Preliminary Study Alternative G (PSA G) would improve existing US 74 to a 6-lane freeway with one-way frontage roads on either side to maintain access to adjacent properties. PSA G was determined in the *Draft EIS* to have significant human environment impacts (including relocations of businesses), substantial disruption during construction, and more impacts to streams compared to new location PSAs. In response to agency comments requesting further study of PSA G, NCDOT developed Revised PSA G to reduce impact and costs and improve operations. Additional evaluation of PSA G and Revised PSA G in the *Draft EIS* determined neither would be reasonable or practicable and were eliminated from further consideration.

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8-9	Tolling	24	**Tolling availability further restricts the options to those off U.S. 74.** Tolling options are not permitted in North Carolina without the express approval of the Legislature. As of this writing, only one un-built road, the Monroe Connector/Bypass, is presently approved for tolling. The presence of the tolling option for the Monroe Connector/Bypass, not permitted for other projects in the state, biases the review of alternatives towards those that rely on additional traffic-generated revenue, rather than on the usual funding options. Although the DSFEIS states that "*the tolling aspect of the project had no influence on the concepts identified for detailed study and little influence on the roadway preliminary design*," the screening process nevertheless eliminated all options except tolling options: "*All [25] PSAs [preliminary screening alternatives] assumed that toll collection would be made using an open road tolling technology, which allows for tolls to be collected at highway speeds and eliminates the need for conventional toll plazas.*" This is either a remarkable coincidence, or a result of a process that pre-judges the range of feasible options.	The purpose of the two statements noted by the commenter is to underscore the fact that conventional toll plazas and their associated impacts were not considered because the NCDOT will operate the facility in an open road tolling configuration utilizing electronic collecting not cash collection in the lane. As documented in Section 2 of the Draft Supplemental Final EIS, a range of alternatives were rigorously considered for the project, including mass transit, upgrading existing roadways and combinations of upgrading existing roads with new location segments, and multi-modal alternatives. Existing corridors considered for upgrading were US 74 (in its entirety or in part), Old Monroe Road/Old Charlotte Highway, and Secrest Shortcut Road. These alternatives were found to not to meet the project purpose and need, regardless of their ability or inability to be toll facilities, as reaffirmed in the *Draft Supplemental Final EIS*.
9	Legislation	25	**The DSFEIS ignores MAP-21's focus on projects "within operational right-of-way."** The new federal highway act, MAP-21, passed in August 2012, specifically streamlines the environmental review process for projects "within the operational right-of-way." This new law, not mentioned in the DSFEIS, is intended to rapidly progress projects that have minimal or little environment impact, speeding their construction. By ignoring this opportunity, the DSFEIS eliminates a wide variety of options that could be progressed faster, and possibly cheaper, than the proposed Monroe Connector/Bypass.	The project development process considered improvements within the operational right-of-way throughout the alternatives development and screening projects, as shown in Table 2-1 of the *Draft EIS* and Section 2 of the *Draft Supplemental Final EIS* (as referenced above in **Comment #s 21 to 23**).
9-10	Alternatives	26	**Other alternatives, particularly upgrading US 74 using "Superstreets," providing frontage roads while upgrading US 74 to freeway status, and/or consolidating intersections should have been evaluated.** The DSFEIS discusses the effectiveness of one lately-added alternative, "TSM Alternative Concept 2" that would improve traffic flow on U.S. 74 over the short term (to 2015). The DSFEIS concludes that "*by implementing the improvements listed in Table 3-5 of the Final EIS, an overall Level-of- Service D in 2015 could be attained at the intersections along the U.S. 74 study corridor, except for the intersection of U.S. 74 at Rocky River Road (SR1514).*" The DSFEIS relies on 2007 estimates projecting that implementing these improvements would result in an average 2015 peak travel speed of between 29-30 mph. However, after implementing just some of these solutions, NCDOT has observed average peak travel speeds well above these projections, as high as 45 mph. This finding is then dismissed because the alternative does not meet the need for "high speed travel" through the corridor, even though it is estimated to result in improved operation (LOS D) on U.S. 74. The DSFEIS also states that assuming the 2035 traffic volumes, the option is not feasible: "*A comparison of the year 2015 traffic volumes used in the U.S. 74 Corridor Study to the year 2035 No-Build volumes developed in Revised Monroe Connector/Bypass No-Build Traffic Forecast Memo (HNTB, March 2010), shows that the volumes in 2035 along U.S. 74 would generally be significantly higher. Therefore, the levels of service at the intersections in 2035 would be expected to degrade to below LOS D and travel speeds based on the computer model also would decrease.*" However, given the admitted success of the recent improvements in improving LOS, the highly uncertain traffic forecasts (see below) and the flat recent traffic counts (discussed below), this is clearly a premature conclusion."	See responses to **Comment #s 21, 23, and 40** in this table**.** The DSFEIS summarized the US 74 Corridor Study's Appendix IV estimated travel speed and time results for the 12.5-mile segment of US 74 from its intersection with US 601 South to Stallings Road. It appears that the commenter is comparing those estimated speeds to INRIX average travel speeds collected in 2011, 2012 and August 2013, shown for an 8.2-mile segment of the corridor from I-485 to Fowler Secrest Road shown in DSFEIS Tables 1-2 and 1-3. We don't believe that comparing predicted speeds to real-time travel speeds for segments of roads with differing lengths and termini is appropriate. A superstreet concept was considered at various stages of the EIS process. NCDOT's analysis showed that the concept would not meet the purpose and need of the project. No further analysis is needed to determine how much the improvements might reduce the need. The NCDOT has implemented and plans to implement the superstreet concept throughout the US 74 corridor in an effort to provide short-term improvements to mobility that, based on analyses conducted for this project, will not provide long-term solutions to meet the Monroe Connector/Bypass's stated purpose and need due to future forecasted traffic growth along US 74. As discussed in Section 2.4 of the *Draft Supplemental Final EIS* , numerous TSM measures have been implemented along existing US 74 by NCDOT as funds have become available and by developers of adjacent properties as they improve their properties. Overall, improvements have been implemented at all 23 intersections along existing US 74 that were mentioned for improvement in the *US 74 Corridor Study*. As presented *in* Section1.2.4 of the *Draft Supplemental Final EIS* and updated in **Section 1.1.1** of the *Final Supplemental Final EIS*, existing average travel speeds along US 74 within the project corridor are less than 50 mph during peak travel periods, even with implementation of the TSM measures described in Section 2.4. TSM improvements, while providing some short term benefits, would be overwhelmed by projected 2035 traffic in the corridor, and would not provide long-term benefit nor meet the purpose and need for the Monroe Connector/Bypass project.

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10-11	Alternatives	27	**An additional option, widening U.S. 74 without tolls, was also eliminated prematurely.** The DSFEIS also notes that based on questions raised by the Corps of Engineers, the option of an "on-current location" was revisited. The review concluded that "*[I]n the design year 2035, U.S. 74 under all four scenarios is expected to exceed LOS D in the majority of the corridor…. The Superstreet 6-Lane scenario option provided the highest corridor capacity compared to the other three scenarios.*" This statement finds that U.S. 74's level of service will be unsatisfactory (LOS D is the NCDOT standard for operation) with any of these options, but (in apparent conflict with its own recommendation for a Bypass) NCDOT has moved to implement a "Superstreet" improvement along a 2.7 mile section of the existing U.S. 74 through Indian Trail. Therefore it is unclear, to say the least, why a "Superstreet" option was eliminated from the feasible alternatives. This appears to be a violation of NEPA which requires comparable evaluation of viable options. At the least, prudence would dictate that the "Superstreet" option now being implemented on a portion of U.S. 74 should be reviewed for effectiveness, and additional Superstreet improvements be considered in combination with other improvements in the corridor, BEFORE a decision to build the Bypass is made.	See response to **Comment 26** in this table.
11	Alternatives	28	**No discussion of "flexible work schedules" or "work-at-home" as an alternative.** Even though NCDOT's own data show no large variations in travel time by time of day or direction, and that most of the traffic using the facility is local, there is no discussion of other alternatives such as staggered work schedules, increased work-at-home, or other similar options for reducing traffic loads at specific intersections. The percentage of Union County residents working at home *doubled* from 3.4% in 2000, to 6.9% in 2012. The TDM alternatives considered did not significantly explore this issue.	See response to **Comment 14**. Figure 2-1a-b in the *Draft Supplemental Final EIS* is a graphic summary of the alternatives evaluations conducted throughout the NEPA process. Alternatives evaluated included Transportation Demand Management, which (includes measures such as flex-time, staggered work hours, and ridesharing. TDM Alternatives were evaluated in the *Draft EIS* and determined to not meet the project's purpose and need. Additional discussion of the Qualitative First Screening for the TDM Alternative is provided in *Final EIS* Section 3.3.2 under Comment 3.
11	Alternatives	29	**The DSFEIS does not contain key comparative data for all alternatives.** Most EISs contain detailed comparative data, by impact, for all viable alternatives, INCLUDING the no-build and other "improve existing road" alternatives. This information is missing from the DSFEIS, raising the question of whether it violates NEPA requirements that all alternatives be investigated and described to an equivalent level of detail.	See response to **Comment #21** in this table. The *Draft Supplemental Final EIS* follows FHWA guidance for content of supplemental EISs. As explained in Section P.3 of the *Draft Supplemental Final EIS*, the FHWA Technical Advisory T6640.8A (*Guidance for Preparing and Processing Environmental and Section 4(f) Documents*) states: *"There is no required format for a supplemental EIS. The supplemental EIS should provide sufficient information to briefly describe the proposed action, the reason(s) why a supplement is being prepared, and the status of the previous draft or final EIS. The supplemental EIS needs to address only those changes or new information that are the basis for preparing the supplement and were not addressed in the previous EIS (23 CFR 771.130(a))."* As explained in the Preface, the *Draft Supplemental Final EIS* addresses current environmental conditions and focuses on any changes that have occurred with regards to the project the alternatives analysis, the affected environment and impacts, and any new issues or information identifies since the *Final EIS* was published. The results of this analysis did not necessitate any changes to the proposed action.

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11	Travel time and traffic forecasts	30	**Travel time improvements on US 74 and their effect on traffic forecasts for the Monroe Connector/Bypass appear to be under-estimated.** For a variety of reasons detailed below, the impacts of improvements to U.S. 74 on traffic flow appear to have been under-estimated. This likely over-states the expected diversion to a future Bypass.	We disagree with the commenter's suggestion that the impacts of recent improvements along existing US 74 have been underestimated and that this likely overstates the expected diversion of traffic to a future Monroe Connector/Bypass. The commenter does not support his statements with any data for consideration. The DSFEIS listed all the operational improvements that have been on U.S. 74 within the project study area. We collected real-time traffic information from INRIX. We have also collected information now for the entire 2013. We conducted speed studies to verify the appropriate use of the INRIX data. The speed studies showed that INRIX reported speeds slightly higher than our speed studies. However, we used the INRIX data and its higher reported speeds to show the effect of the operational improvements on U.S. 74, so that we would not under-estimate the impact of those improvements.
11	Travel speeds	31	**The DSFEIS uses the wrong speed criterion for setting road performance.** There is no *requirement* that Interstate, NCSTI or STRAHNET routes have operational travel speeds that are equal to the posted speeds. If that were the case then virtually all of state-owned urban arterials in North Carolina would need upgrades, widenings or bypasses. NCDOT standards for LOS D (moderate congestion) typically have traffic operating speeds 5-15 miles below the posted speed. Even if speeds are accepted for a criterion, the standard for speed study is the 85th percentile, not the average speed. As, according to the INRIX data, the reported average (close to 50th percentile) operating speed on U.S. 74 is 44 mph, using the 85th percentile would raise the current operating speeds on U.S. 74 even further, probably to the 48-50 mph range. This reduces the need for the project and the potential time savings.	We disagree with this comment. The alternatives screening and development process does not use speed limits or level of service as criteria. Rather, a screening criterion of 50 mph was used to define a high-speed facility. As summarized in Section 1.2.4 of the *Draft Supplemental Final EIS* and updated in Section 1.1.1 of the *Final Supplemental Final EIS*, the INRIX data was compared to posted speed limits on existing US 74 to provide the public an indication of the degree of congestion on existing US 74. The travel time comparison document shows field-collected data and INRIX data produce similar results over the length of the corridor, with field-collected average travel speeds ranging between 39 and 44 mph, approximately 6 to 10 percent lower than INRIX data for the exact time period that the field data was collected. The commenter's analysis incorrectly uses an 85th percentile speed calculation of INRIX data and, as a result, incorrectly inflates INRIX travel speeds and concludes/implies that current operating speeds are "probably to the 48-50 mph range. This reduces the need for the project…." The commenter's incorrect analysis fails to account for the fact that field-collected travel speeds were collected and are available for comparison. The 85th percentile speed is primarily used for establishing regulatory speed zones when adequate speed samples are available for free-flowing traffic. The commenter's analysis incorrectly estimates a US 74 corridor 85th percentile speed based the SDFEIS summary of average travel speeds for only three peak hours during the day instead of using field-collected speed data for all periods throughout the day to develop a speed distribution curve along US 74. In reality, the US 74 corridor is an interrupted flow, arterial facility consisting of 30 signalized intersections over 22.5 miles with stop-and-go conditions that generally "progresses" traffic in platoons from signal to signal. The INRIX data clearly show multiple segments currently operating at speeds far below the commenter's estimates of "48-50 mph". Also, see **Comment #32** in this table.
12	Travel speeds	32	**Possible misuse of speed measurement data.** The 2013 INRIX data show an average travel speed through the corridor of 44 mph, 10% (4 mph) higher than the NCDOT's travel time runs. In other words, drivers now are averaging faster speeds than the DOT speed-run tests. This 10% difference is so large that it calls into question the accuracy of the travel time savings from the model. Later it is noted that the speed runs appear to be based on just three runs in each direction/time period which is a very small sample. The INRIX data, on the other hand, are based on observed speeds of hundreds (perhaps thousands) of actual drivers over a *2-month period, 24 hours a day, Tues-Thurs*. This is a huge amount of data that is a much more realistic description of actual corridor operation than just a few speed runs. Therefore, the INRIX actual operating speeds, not the travel time runs or posted speeds, should be used as the basis for the traffic forecasts on U.S. 74. Without this correction, estimates of future traffic speeds on U.S. 74 (build and no-build) will continue to be too low, and diversion to the proposed	See **Comment #31** in this table. The 2013 speed study was not conducted to calibrate the traffic simulation computer models (SimTraffic) used to predict travel speeds in 2007 for the draft EIS. Instead, the 2013 travel speed study was used to determine if it was appropriate to use INRIX data to represent average week day travel speeds on U.S.74 in 2011, 2012 and 2013. Since there was only 10% (4 mph) difference between the speed study and the INRIX data; and the INRIX data reported higher speeds, we used INRIX data to represent average travel speeds on U.S. 74 during peak hours after implementation of operational improvements on the road. Regarding how speed data may affect the traffic forecasting process, link speed data used in the Metrolina Regional Model (MRM) includes posted and estimated free flow speeds and produces estimated peak period travel speeds as an output. While recent spot intersection and signal timing improvements on US 74 may have improved local operations and increased travel speeds in the local vicinity of these improvements and these localized intersection improvements would not change the traffic assignments in the model. No data is provided by the commenter that directly shows the need to update travel time inputs in the MRM used for traffic forecasting or what effect that might have in the form of changes to traffic assignments from the model. Ultimately, a project-level traffic forecast is forecasting the demand on a given facility, not the operations of that facility. AM and PM peak hour operating speeds are not used as direct inputs into the MRM. The MRM uses comprehensive capacity settings that estimate the link capacity through the model based on the link attributes" as part of the standard, approved modeling procedures (MRM User's Guide, July 11, 2008). These link attributes include: number of lanes, speed limit, functional classification, intersection control, median type, area type and functional classification of crossing streets. Travel speeds are inherently calculated in this process to compute model demand and vehicle paths within the network.

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			Bypass will continue to be over-stated.	
12-13	Value Of Time	33	**The suggested diversion to the Bypass (40-50%) would require a very high value of time.** Traffic diversion (assignment) models operate by assigning traffic to the path with the shortest "generalized cost," considering travel time, reliability, congestion, and tolls. The fundamental principle underlying most modeling systems is that users choose that path which has the lowest generalized cost, spreading out by route (and time-of-day in advanced models) such that no traveler can improve his generalized cost by changing paths. To estimate total generalized cost, tolls must be converted into time units using a traveler value of time, which is generally assumed to vary by location, trip purpose and vehicle class. Values of time vary by region, but most *value-of-time studies put it at about ½ the average wage rate, or about $9/hr.* That is about ½ the prevailing median wage rate for Union County, $18.48/hr. Using the reported INRIX actual speeds for U.S. 74, the average 44-mph travel time through the 19.7-mile U.S. 74 section (between the approximate end points of the proposed Bypass) is now about 26.9 minutes, and at 65 mph the average travel time between the same points using the Bypass, would be 18.2 minutes. To be worth paying the proposed $2.58 average toll, the average savings in time (8.7 minutes) would have to be worth about $17.80/hour. This is a high value of time for traffic modeling, almost twice the commonly used rate, and about twice the value of time that the NCDOT found in its own stated preference survey. This means that, if local residents value their travel time at less than $17.80/hour, the traffic estimate for the Bypass is likely to be significantly overstated. Another implication is that Bypass use might be *infrequent* rather than regular, for trips when time is valued highly, but not for most trips.	The commenter suggests that the estimated diversion of traffic to the Monroe Connector/Bypass is 40-50 percent, but does not provide a reference for these values. The traffic forecasts used in the *Draft Supplemental Final EIS* predict a lower rate of traffic diversion. Table 2-8 in the *Draft Supplemental EIS* shows that diversion from existing US 74 is estimated to be approximately 30 percent based on the 2035 traffic forecasts, and 19-30 percent based on raw output from various MRM model versions. All information and comparisons made by the commenter regarding trip diversion and value of time are simplified calculations for existing year conditions and assumptions about current travel speeds. No information is provided by the commenter that addresses travel time savings in future scenarios, where congestion is expected to increase on US 74, increasing the likelihood of diversion onto the Monroe Connector/Bypass. The *Final Report Proposed Monroe Connector/Bypass Comprehensive Traffic and Revenue Study* (Wilbur Smith Associates, October 2010) was conducted at a level of detail sufficient for use in support of project financing and incorporated a comprehensive methodology, as described in the report. As discussed in the *Final Report Proposed Monroe Connector/Bypass Comprehensive Traffic and Revenue Study*, surveys were conducted to provide value-of-time data for use in the toll diversion modeling. Three methods of obtaining information were used. Interactive, notepad-based interviews were held at various employment centers, shopping areas, and government offices. Interactive, internet-based surveys were also conducted along with an OD (origin-destination) study. Finally, individuals were contacted to participate in a detailed stated preference survey.
13	Forecast	34	**The DSFEIS downplays the effectiveness of prior and planned actions on US 74.** The DSFEIS notes that some improvements to U.S. 74 have been implemented. But these improvements have not been incorporated into the 2035 traffic forecasts, which were created in 2007 and have not been updated in the DSFEIS. In fact these improvements post-date the 2035 forecasts — occurring mostly between 2010 and the present — and so have of course not been included. Additionally, the 2035 forecasts do not factor in additional improvements such as	See response to **Comment #32** in this table. While superstreet (or similar) type improvements may improve travel speed on US 74 in the short-term, the 2012 NCDOT Superstreet Analysis Results (Reese, November 5, 2012) demonstrates that the planned superstreet improvements for a five intersection segment of US 74 near Indian Trail (which represents two miles of the 20-mile corridor) may only provide travel speeds in this vicinity in the range of 25-35 mph, using 2007 traffic volume data, far below 45 mph posted speeds. The NCDOT analysis also states the need for additional corridor improvements (six-lane widening) to preserve mobility in this area – with no assumption that the Bypass will be built. This memo is included in Appendix C and referenced in Appendix A on Slides 2 thru 5 with an intersection study area map and level of service reference table.

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			the four Superstreets that are now planned in the next couple of years. It is likely that the improvements made so far helped to improve the current operating speeds in the 44-mph range, given that traffic volumes have not increased and INRIX speeds show an increase over time. Additional future improvements (e.g. partial Superstreet treatment, shutting off some access, better signal timing, or even upgrading more of U.S. 74 to freeway status) might also be equally effective. But at the very least, the planned improvements should be coded into the regional network and used as the basis for all forecasts.	
13	Operations	35	**An inappropriate traffic forecast was used for the operations simulation model.** Instead of using just one traffic forecast predicted to use U.S. 74 in the local simulation model (SIMTraffic, which estimates future driving speeds based on a forecast of traffic), the consultant should have also tested the operation of U.S. 74 with lower more-realistic future traffic volumes, as discussed below.	As discussed in Section 1.8.2 of the *Draft EIS*, travel times along the existing US 74 corridor were estimated using a computer model (SimTraffic). INRIX data was not available at the time of the *Draft EIS*, nor is data for 2007 currently available from INRIX. However, the EIS analysis is no longer relying on a traffic simulation computer model to predict speeds on existing US 74, as INRIX data is available to provide an estimate of real-time speeds. As described in Section 1.2.4 of the *Draft Supplemental Final EIS*, NCDOT collected travel time information to update travel performance along the existing corridor. Based on this data, which is from actual travel speeds as reported by INRIX, average travel speeds along the US 74 corridor are still below 50 mph, Updated travel speed information for all of 2013 is included in Section 1.1.1 and Appendix E of the *Final Supplemental Final EIS* and continues to show that current average travel speeds along the US 74 corridor are below 50 mph, even with the improvements made to the existing US 74 corridor. See also response to **Comment #30** in this table.
13-14	Forecast	36	**Inconsistent traffic forecasts for U.S. 74 WEST of the project.** The DSFEIS asserts that "*Year 2035 traffic volumes on U.S. 74 west of I-485 are projected to be lower with the proposed project than under the No-Build alternative.*" The difference is about 7% lower, quite a large amount. This finding is inconsistent with traffic modeling theory which predicts that improvements in travel time caused by new roads will also result in INCREASED traffic on major feeder roads leading to the project, such as U.S. 74 just west of I-485. The NCDOT team found a similar inconsistency in reviewing the Wilbur Smith forecasts made in 2008. No explanation is given for this new finding, but it may be due to the hidden assumptions regarding induced land use or trip distribution.	We do not agree with the commenter's suggested difference of 7 percent between 2035 No-Build and Build scenarios forecast volumes west of I-485. The difference is forecasted to be less than 2 percent west of I-485; ((98,000-96,100)/98,000) = 2%, which would be within the tolerance range of the model and could be considered equivalent. The commenter also mischaracterizes the interoffice memorandum cited as reference 42 in the commenter's document (Draft *Monroe Bypass No-Build Traffic Forecasts Summary*, interoffice memo to Spencer Franklin, HNTB, May 6, 2013 [draft finalized November 8, 2013 with no changes]). This memorandum documents the discrepancies found in the No-Build scenario forecasts reported in the *Traffic Forecast for TIP Projects R-3329 & R-2559 Monroe Connector/Bypass* (Wilbur Smith Associates, September 2008) that led to the corrected No-Build scenario forecasts documented in *NCDOT STIP Project R-3329 & R-2559 Revised Monroe Connector Bypass No-Build Traffic Forecast Memorandum* (HNTB, March 2010). The memorandum cited in reference 42 does not specifically discuss traffic volumes west of I-485. The fact that the No-Build scenario forecasts prepared by Wilbur Smith Associates were corrected in a later document prepared by HNTB is not a new finding. The correction is explained in *Final EIS* Appendix A – Errata. A related correction to the *Final Air Quality Technical Memorandum* (PBS&J, 2009) is explained in *Draft Supplemental Final EIS* Appendix F – Errata. which did not change the discussion or conclusions presented in the *Final Air Quality Technical Memorandum*.

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14-16	Growth	37	**Traffic growth on U.S. 74 has been flat from 2000 to 2012, and is inconsistent with population growth.** Two central issues regarding the need for the Bypass is whether the traffic on U.S.74 has been growing historically, and is likely to continue to grow in the future. Careful review of the statistics for growth and traffic in the corridor suggest that neither is the case. **The DSFEIS reports incorrect population growth statistics for Union County and selectively reports Union County growth rates.** The DSFEIS asserts that Union County is the fastest growing county in the state: 49% from 2000 to 2010, or 4.9%/year. This is factually incorrect. The growth rate for Union County for 2000-2010 was 62.8%, but the growth rate for the *study area* was 49.3%.45 Further, Union County is no longer the fastest growing North Carolina county: As noted above, at least 10 other NC counties have registered more rapid growth from 2010 to 2012, while the Union County's growth rate has fallen sharply, to just 1.7%/year. It is not uncommon for counties near larger metropolitan areas to experience high "surges" of growth as the metropolitan county growth spreads out, then to decline in growth rate as growth moves elsewhere. The DSFEIS notes that "*According to the CRTPO [Charlotte area] 2035 Long-range Transportation Plan, the southern and eastern portions of Mecklenburg County, which is the area along the Union County line, is expected to be one of the most rapidly growing areas in the region.*" But the DSFEIS fails to mention that almost half of Union County's growth has been in the *southwestern* edge of the county, *substantially south of U.S. 74 and mostly outside* of the Bypass corridor. The following table demonstrates this growth pattern, using the DSFEIS data from Appendix D (Updated Census Tables).	The commenter argues that the *Draft Supplemental Final EIS* incorrectly reports population growth statistics and selectively reports growth rates for Union County. The commenter suggests that the *Draft Supplemental Final EIS* (pp.1-2 and 4-1) incorrectly states the growth rates for all of Union County versus the growth rates for the study area (Demographic Study Area). However, a review of the *Draft Supplemental Final EIS (pp. 1-4 and 4-1)* shows that all growth statistics and references are accurately. The commenter then proceeds to argue that the majority of growth in Union County has occurred outside the study corridor, in the southwest quadrant of the county, and that this growth spurt is largely attributable to the one-time growth spurt of jobs in the Ballantyne area of Mecklenburg County. The commenter cites the growth rates for Union County, the Union County portion of the DSA, the Mecklenburg County portion of the DSA, the entire DSA and the portions of Union County outside the DSA. His conclusion is that the non-DSA portions of Union County have grown twice as fast as the entire DSA (87.9% versus 49.3%, table pg. 15) and that this growth is concentrated in the southwest corner of Union County, cited in the figure on page 16. First, the commenter erroneously calculates the DSA-Union County part of the population for 2000 and the Union County NON-DSA part in his table and this leads to errors in comparing the growth rates. Correct values for all are shown in the table below, which mimics the table on page 15 of the commenter's document. **Table 1: Population Growth in Demographic Study Area (DSA) and Union County 2000 to 2010** Source: DSFEIS, Appendix D, Census Tables The main error is overestimating the Union NON-DSA part growth from 2000 to 2010. Instead of being 87.9 percent as the commenter calculates, it is actually 73.3 percent. Furthermore, in his report, the commenter compares this growth rate to the overall DSA growth rate, instead of comparing it to the DSA-Union County part, which would be a fairer comparison of how growth has been spread across Union County. Comparing growth within the DSA in Union County to growth outside the DSA in Union County shows that those areas outside the DSA have growth faster (73.3% versus 53.7%) but not exceptionally so. Additionally, the raw growth in population outside the DSA portion of Union County has outpaced the portion within the DSA by only 6,000 people from 2000 to 2010. Furthermore, the commenter fails to consider the different sizes of these areas. A more reasonable comparison of growth rates and change would have considered the widely variable differences in size of these two areas. The portion of Union County within the DSA is about 176 square miles (28 percent of the entire county) while the portion outside is 463 square miles (72 percent of the entire county). What is remarkable is that this relatively small part of the county within the DSA has captured 46 percent of the growth from 2000 to 2010 or nearly twice the amount one might expect based on its area relative to the rest of the county. As noted in the table below, despite being 2.6 times bigger, the NON-DSA portion of Union County only captured 17 percent more population growth from 2000 to 2010 compared to the portion of Union County within the DSA.

Geographic area	2000 Population	2010 Population	Difference	Percent Change from 2000-10
Union County	123,677	201,292	77,615	62.8%
DSA-Union Co. part	66,576	102,357	35,781	53.7%
DSA-Mecklenburg Co. part	13,867	17,746	3,879	28.0%
Total DSA	80,470	120,103	39,633	49.3%
Union NON-DSA part	57,101	98,935	41,834	73.3%

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Population Growth, 2000-2010, Union County and Study Area[49]
<table>
<tr><th>Geographic area</th><th>2000 Population</th><th>2010 Population</th><th>Difference</th><th>Percent Change from 2000-10</th></tr>
<tr><td>Union County</td><td>123,677</td><td>201,292</td><td>77,615</td><td>62.8</td></tr>
<tr><td>DSA-Union Co. part</td><td>66,603</td><td>102,357</td><td>35,745</td><td>53.7</td></tr>
<tr><td>DSA-Mecklenburg Co. part</td><td>13,867</td><td>17,746</td><td>3,879</td><td>28.0</td></tr>
<tr><td>Total DSA</td><td>80,470</td><td>120,103</td><td>39,633</td><td>49.3</td></tr>
<tr><td>Union NON-DSA part</td><td>43,207</td><td>81,189</td><td>37,982</td><td>87.9</td></tr>
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The table shows that the portion of Union County outside the DSA actually grew at almost twice the growth rate of the study area, almost 90% in just 10 years. The following figure (from the DSFEIS) shows the present Union County road system and the proposed future land use. Note that the growth in the southwest corner, between Indian Trail and Marvin, is on the south side of U.S. 74, and is mostly OUTSIDE the Bypass study area.
Most of this growth took place in the area south of Ballantyne (in Mecklenburg County) over 10 miles from the proposed Bypass on the south side of U.S. 74, and therefore would not be able to even use the Bypass. Essentially the DSFEIS' own data shows that recent growth has been most rapid in areas NOT served by the proposed Bypass. Therefore the rapid growth rate of Union County between 2000 and 2010, even if reported correctly, is irrelevant for evaluating the need for the project.
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Table 2: Comparison of Population Growth (2000 to 2010) and Size of DSA and Union County
<table>
<tr><th>Geographic area</th><th>Area in Sq Miles</th><th>% of Total Area</th><th>2000 Population</th><th>2010 Population</th><th>% of Population Growth Captured 2000 to 2010</th></tr>
<tr><td>Union County</td><td>639.3</td><td>100%</td><td>123,677</td><td>201,292</td><td>-</td></tr>
<tr><td>DSA-Union Co. part</td><td>176.6</td><td>28%</td><td>66,576</td><td>102,357</td><td>46%</td></tr>
<tr><td>Union NON-DSA part</td><td>462.7</td><td>72%</td><td>57,101</td><td>98,935</td><td>54%</td></tr>
<tr><td>Ratio of NON-DSA to DSA part</td><td>2.62</td><td>2.62</td><td>0.86</td><td>0.97</td><td>1.17</td></tr>
</table>
Source: DSFEIS, Appendix D, Census Tables
</td></tr>
<tr><td>16</td><td>Commuting</td><td>38</td><td>
Union County out-of-county commuting shares are declining, not increasing.
The DSFEIS states that in 2006 about 61% of Union County workers commuted outside of the County, but that in a more recent census survey (2006-09), 50% of workers commuted outside. Such wild swings in such a short time question the data's validity, but even if true it shows declining dependence, not increasing dependence, of Union County on adjacent-county jobs.
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The commenter cites the change in the percent of commuters who travel outside the County for work (61% in 2006 to 50% in 2009) as an indication that Union County residents are becoming less dependent on jobs outside the county and therefore there will be less demand to drive to Mecklenburg County and that would reduce the need for any improvements to US 74 or adjacent corridors. As the commenter himself notes, such wild swings in these data suggest it is unreliable to compare longitudinally for these data. A deeper look suggests that this substantial difference is attributable to the different data sources used for each data point. The data point cited in the Draft EIS and Final EIS showing that 61 percent of Union County commuters traveled outside Union County was derived from the Employment Security Commission of North Carolina and relied on data supplied via the Census Bureau Local Employment Dynamics which builds upon state and federal reporting for unemployment insurance, the Quarterly Census of Employment and Wages, Business Dynamics Statistics reports and other federal and state database systems to create a comprehensive assessment of local labor market conditions. The data point cited in the Draft Supplemental Final EIS showing that 50 percent of Union County commuters traveled outside Union County was derived from the Census Bureau's American Community Survey 3-Year Estimate for 2006-2009 and the ACS relies on broad surveys of the general population. Since these data were collected in entirely different methods, they are not comparable.
A more reasonable comparison would be to look at longitudinal data from both sources. Based on the Employment Security Commission of North Carolina
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				Workforce In-Depth web tool (http://esesc23.esc.state.nc.us/WorkForceInDepth/), of the 83,179 workers in Union County, 57,875 (70%) commuted out of the county to reach their jobs in 2011. This is an increase from the 61 percent (45,916 out of 75,325) reported in the 2006 report. Of those commuting outside the county, 37,836 (65%) commuted to Mecklenburg County. This is a slight decline from the 68 percent (31,211 of 45,916) noted in the 2006 report. The 2005 to 2007 ACS 3-Year Estimate of Workers by Place of Work (Table B08007) indicates that of the 82,960 workers in Union County, 41,632 (50%) worked outside the county. The 2010 to 2012 ACS 3-Year Estimate of Workers by Place of Work (Table B08007) indicates that of the 91,002 workers in Union County, 46,924 (52%) worked outside the county. Thus in both instances, the data show that the percentage of workers living in Union County but commuting outside the county for work is increasing. While the estimates of that increase diverge based on the data source, both show an upward trend. It is understandable that the commenter would reach his conclusion based on the data cited in the *Draft Supplemental Final EIS*, but as detailed above, out-of-county commuting shares are actually increasing.
16-17	Commuting	39	**The DSFEIS selectively reports trends in commuting time.** The DSFEIS states that commute times for Union County residents average 27.8 minutes, the highest of the region's counties, implying that the Bypass would somehow reduce them. The DSFEIS does NOT mention, however, that *commute times are improving, not worsening, for all counties in the region,* and that *from 2000 to 2010 Union county's average commute time fell from 29.0 minutes to 27.8 minutes*, the largest drop of the region's counties. Union County commute times are improving, not worsening, and within county employment is increasing, decreasing the share of long-distance commuting.	The commenter notes that changes in commute times cited in Appendix B to the *Indirect and Cumulative Effects Quantitative Analysis Update* (Michael Baker Engineering, Inc., November 2013) are evidence that commute times are improving and that therefore there may not be a need for the project. However, the commenter fails to note the specific caveat that is cited in Appendix B for the comparisons of 2000 to 2010 commute times. As it specifically says on page 16 of that Appendix: *The raw differences [in the reported commute times] may be misleading due to changes in survey methods the Census has instituted from 2000 to 2010, specifically, the Census changed its methods in gathering data on this question. In Census 2000, questions regarding commute lengths and modes were included on the "long form", which 1 in 6 household received. For the 2010 Census, no "long form" was used and instead the American Community Survey has replaced it. The American Community Survey reaches fewer households but surveys annually. Since the survey methodology is different, direct comparisons are less revealing.* Furthermore, the commute time data was specifically reviewed in the context of the overall growth trends for the county and the region and the conclusions of the analysis were that Union County had some of the highest average commute times and has continued to grow despite these conditions for several years. Therefore, the conclusion was that increasing commute times were not a major constraint on future growth. Lastly, while the raw drop in the minutes of commute time was the largest among the counties in the region, it is still only a 4% drop and as noted in Response 15 above, the commenter's conclusions regarding in-county employment and cross-county commute trends is inaccurate.
17-18	Traffic Growth	40	**Recent traffic growth on U.S. 74 has been flat.** In spite of Union County's now-slowing population growth since 2000, *traffic on U.S. 74 has not increased substantially since 2000*. The following table shows the NCDOT traffic counts for various sections of U.S. 74, and the DSFEIS forecast volumes.	From 2000 to 2012, U.S. 74 traffic growth has not increased substantially. The project level traffic No-Build and Build forecasts were completed in 2008 and incorporated the most current available annual average daily traffic volumes (AADT's) from 2005 and 2006 and collected field counts in 2007. These forecasts accounted for half of the 12-year period in question. The commenter fails to note this in his assessment. In either case, project level forecasts consider a longer time horizon than just 12 years and inherently account for both upturns and downturns in traffic growth by projecting out 20 to 30 years into the future using approved population and socio-economic estimates. These estimates directly relate to model raw output volumes and future growth rates used as a basis in forecasting future traffic demand on a given transportation facility. Specific to the commenter's table, he incorrectly compares raw model volumes to estimated (forecasted) volumes at the "East of Monroe", to show an inflated growth rate of 5.4% and uses this high-end growth rate to further substantiate his claim that "the implied percent changes from current volumes range from 1.3 to 5.4% per year are 5-10 times faster than the recent 12-year history." In his table, for the location "East of Monroe" where 2030 and 2035 raw model volumes are 32,200 and 41,500, respectively, he uses a forecast volume 60,600 (ID#25 from p. G-23) that is not aligned with the 2012 traffic volumes for the 2030 and 2035 raw model volumes (ID# 26 G-23). However, had the commenter used the corresponding forecast volume of 39,700 (pp. G-22 and G-23), a 2.0% annual growth rate would have been determined at this count location instead of 5.4%. See Table 4B below, Tables 2 and 5 of the *Draft Supplemental Final EIS*, and the *Traffic Forecast Summary* (HNTB, November, 2013, superseded by May, 2014) Appendix G. Tables 4A and 4B show US 74 historical growth rates and future growth rate trends for multiple locations and time periods (4-year, 10, 12, 20, 25 and 32). Overall, the historical data shows trends of longer-term sustained US 74 corridor growth rates that reasonably coincide with raw model volume growth rates

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Average Daily Traffic on U.S. 74 Parallel to the Proposed Monroe Bypass

Count Location	Historical 2000	2005	2010	2012	12-year Annual Percent Change	DSFEIS Forecast: Raw Model 2030 No Build	Raw Model 2035 No Build*	Estimated Volume 2035 No Build*	2035 Annual Percent Change, from 2012
Meck.-Union Line	56000	58000	54000	57000	**0.15**	70300	101600	89000	**2.4**
NW of Monroe	48000	48000	46000	50000	**0.35**	40000	66200	65000	**1.3**
East of Monroe	26000	27000	24000	27000	**0.32**	32200	41500	60600	**5.4**
W of Marshville	20000	21000	17000	19000	**-0.4**	23000	21000	31600	**2.9**
Anson-Union Line	15000	15000	14000	13000	**-1.1**	-	-		

*Source: NCDOT, Traffic Count Maps, and DSFEIS, Traffic Forecast Summary, November 8, 2013, Appendix G.[53]

At the Mecklenburg-Union line, just west of the project end, the traffic has grown just 0.15%/year (1.8% in 12 years), and has actually declined since 2005. Near Monroe, growth has been modest, about 0.4%/year. At the eastern edge of the project, traffic volumes are much lower and have *declined* not increased, since 2000. The DSFEIS notes that its own analysis of traffic counts from 2007 to 2012 also showed "*zero change*," but then the DSFEIS simply ignores this data and asserts that "*Based on 2008 and 2035 No-Build traffic forecasts, (HNTB, March 2010), average volumes along the U.S. 74 corridor are projected to increase approximately 34 percent*." So the whole need for the project simply ignores the last 12 years of history regarding traffic trends on U.S. 74.

"necessary" to reach forecasted No-Build volumes. In some cases, the growth rates are higher and some lower, but the overall trends are increasing at reasonably foreseeable rates consistent with a holistic view of historical growth trends and planned population and socio-economic projections. Based on a 20-year period, all five locations on US 74 have increased in the range of 0.6% to 3.4% annually, with 3.4% at the Mecklenburg-Union line. Based on a more recent 4-year period, US 74 at the Mecklenburg-Union line is growing 1.4% annually. Tables 3A and 3B illustrates that a 34 percent increase on US 74 corridor volumes (1.5% annually) from 2012 to 2035 is very realistic and is already occurring along the corridor as previously noted.

Table 3A: US 74 Growth Rates

Average Daily Traffic on U.S. 74 Parallel to the Proposed Monroe Bypass

AADT Station #	Count Location	Historical 1980	1992/ 1993	2000	2002	2005	2008	2010	2012	1980-2005 25-year Annual % Change	1980-2012 32-year Annual % Change	1992-2012 20-year Annual % Change	2000-2012 12-year Annual % Change	2002-2012 10-year Annual % Change	2008-2012 4-year Annual % Change
8900119	Meck-Union Line	22,400	34,000	56,000	57,000	58,000	54,000	54,000	57,000	6.4%	4.8%	3.4%	0.1%	0.0%	1.4%
8900081	NW of Monroe	n/a	33,000*	48,000	51,000	48,000	44,000	46,000	50,000	-	-	2.7%	0.3%	-0.2%	3.4%
8900096	East of Monroe	n/a	23,000*	29,000	29,000	29,000	n/a	27,000	27,000	-	-	0.9%	-0.6%	-0.7%	0.0%
8900073	W of Marshville	n/a	17,000*	20,000	22,000	21,000	19,000	17,000	19,000	-	-	0.6%	-0.4%	-1.4%	0.0%
8900039	Anson-Union Line	n/a	11,000*	15,000	15,000	15,000	14,000	14,000	13,000	-	-	1.0%	-1.1%	-1.3%	-1.8%

* AADT not available for 1992. 1993 AADT and 19-year growth rate calculated.

Table 3B: US 74 Growth Rates

Average Daily Traffic on U.S. 74 Parallel to the Proposed Monroe Bypass

AADT Station #	Count Location	Historical 1980	1992/ 1993	2000	2002	2005	2008	2010	2012	DSFEIS Forecast: Raw Model 2030 No-Build	Raw Model 2035 No-Build	Estimated Volume 2035 No-Build	MRM05v1.0: Raw Model 2000 No-Build	Raw Model 2030 No-Build	30-year Annual % Change	% Change, (from 2012 AADT to 2035 NB Forecast by 2035)	% Change, (from 2012 AADT to 2035 NB Forecast by 2040)
8900119	Meck-Union Line	22,400	34,000	56,000	57,000	58,000	54,000	54,000	57,000	70,300	101,600	89,100	43,200	70,300	2.1%	2.4%	2.0%
8900081	NW of Monroe	n/a	33,000*	48,000	51,000	48,000	44,000	46,000	50,000	40,000	66,200	65,000	34,174	39,965	0.6%	1.3%	1.1%
8900096	East of Monroe	n/a	23,000*	29,000	29,000	29,000	n/a	27,000	27,000	32,200	41,500	39,700	21,038	32,156	1.8%	2.0%	1.7%
8900073	W of Marshville	n/a	17,000*	20,000	22,000	21,000	19,000	17,000	19,000	23,000	21,000	31,600	15,221	25,846	2.3%	2.9%	2.4%
8900039	Anson-Union Line	n/a	11,000*	15,000	15,000	15,000	14,000	14,000	13,000	-	-	-	n/a	n/a	-	-	-

* AADT not available for 1992. 1993 AADT and 19-year growth rate calculated.

The commenter cites flat growth trends along US 74 compared to higher population growth trends as evidence that traffic may not grow as quickly as expected in the future. The commenter looks only at the AADT growth from NCDOT Traffic Count Maps for US 74 (from Anson County to Mecklenburg County). While growth in traffic on US 74 has been relatively flat by strictly comparing the past 10-year or 12-year period, the commenter fails to consider the effect that congestion on US 74 has had on shifting traffic growth to parallel corridors and sustained, positive growth rates comparing shorter and longer-term time periods.

Table 4, below, shows the AADT trends for the major corridors between Union and Mecklenburg Counties for a 4-year (2008-2012), 10-year (2002-2012) and 20-year period (1993-2012). This shows that traffic growth has increased along all these routes between the counties and that the total AADT between the counties has increased 17% (1.7% annually) to 81% (3.2% annually) over 10 and 20-year periods, respectively. Figure 2 in the memo gives a visual representation of that growth and shows that the growth in AADT has not been limited to just one or two routes in the southwest portion of Union County, but has increased at count locations north of US 74 as well. Overall, the US 74 AADT segment just west of Stallings Road shows growth in the short-term (4-

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year period 2008-2012) of 1.4% annually and long-term (20-year period) of 2.4% annually. While growth in the medium-term 10-year period at this one location along US 74 has been stagnant, overall growth rates comparing different time periods and paralleling routes show sustained long-term growth. Therefore, while traffic increases have not perfectly matched population increases, they have certainly increased when one compares US 74 AADT at the location the commenter references along with the overall travel between the counties screen lines.

It's important to note that traffic forecasts are concerned with demand on a given facility. If that particular facility is at or over capacity, it may not be exhibiting increasing traffic volumes under existing conditions, though in fact, vehicle trips in the area are being diverted from the facility to avoid congestion on it. Table 4 shows the AADT trends for the major corridors between Union and Mecklenburg Counties for 2002 to 2012. It shows that traffic growth has increased along all these routes between the counties and that the total AADT between the counties has increased 17% (1.7% annually) over ten years.

Table 4: Change in Average Annual Daily Traffic at NCDOT Count Locations near Mecklenburg and Union County Line

ROUTE	Road Name	LOCATION	1992/1993 to 2012 Change (20/19-Year Period)			2002 to 2012 Change (10-Year Period)			2008 to 2012 Change (4-Year Period)			AADT							
			AADT	% Change	Growth Rate	AADT	% Change	Growth Rate	AADT	% Change	Growth Rate	2012	2010	2008	2006	2004	2002	1993	1992
US 74	Independence Blvd	W OF SR 1365	21,000	67.6%	3.4%	0	0.0%	0.0%	3,000	5.6%	1.4%	57,000	54,000	54,000	58,000	54,000	57,000	36,000	34,000
NC 16	Providence Rd	N OF SR 1346	18,500	194.7%	10.2%	5,000	21.7%	2.2%	1,000	3.7%	3.7%	28,000	-	-	25,000	23,000	23,000	9,500	-
NC 218	Fairview Rd	W OF SR 1539	5,400	192.9%	10.2%	3,700	82.2%	8.2%	600	7.9%	2.0%	8,200	8,200	7,600	8,700	6,500	4,500	2,800	-
SR 1365	Stallings Rd	N OF SR 1524	1,200	75.0%	3.9%	600	27.3%	2.7%	-800	-22.2%	-14.3%	2,800	3,600	-	2,900	2,100	2,200	1,600	-
SR 1460	Ridge Rd	N OF SR 1009	-1,000	-41.7%	-2.2%	-100	-6.7%	-0.7%	200	16.7%	4.2%	1,400	1,100	1,200	820	850	1500	2400	-
SR 1501	Idlewild Rd	W OF SR 1524	12,700	239.6%	12.6%	5,000	38.5%	3.8%	-2,000	-10.0%	-2.5%	18,000	20,000	20,000	18,000	15,000	13,000	5,300	-
SR 3468	Weddington Rd	S OF SR 3440	7,800	185.7%	9.3%	4,300	55.8%	5.6%	-1,000	-7.7%	-1.9%	12,000	12,000	13,000	12,000	11,000	7,700	-	4,200
SR 1004	Lawyers Rd	W OF SR 1524	2,000	14.3%	1.8%	2,000	14.3%	1.8%	1,000	6.7%	1.7%	16,000	15,000	15,000	15,000	14,000	-	-	-
SR 3445	Tilley Morris Rd	E OF SR 3440	2,100	27.3%	3.4%	2,100	27.3%	3.4%	2,300	30.7%	7.7%	9,800	11,000	7,500	11,000	7,700	-	-	-
Total			69,700	81.1%	4.2%	22,600	17.3%	1.7%	4,300	0.9%	0.7%	153,200	-	148,900	151,420	134,150	130,600	84,600	83,500*
Total w/o NC 16			51,200	66.7%	3.5%	17,600	16.4%	1.6%	3,300	0.2%	0.7%	125,200	124,900	121,900	126,420	111,150	107,600	75,100	74,000*

Source: NCDOT AADT Stations Shapefile (http://www.ncdot.gov/projects/trafficsurvey/)

* County Line Total volumes and associated calculations include closest available AADT's for those segments where current year AADT is not available.

Table 5 compares 2012 AADT to general capacity ranges reaching LOS F for those facility types. Based on an individual review, all five higher volume facilities (10,000 AADT or greater) are nearing or over general capacity estimates. Overall, all facilities combine for an average daily volume to capacity ratio of 0.83 or 83 percent of capacity. Generally, when a facility reaches 80 to 90 percent V/C, high levels of congestion, delay and reduced speeds are present. Table 5 illustrates a lack of additional available capacity from Mecklenburg/Union County.

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Table 5: HCM 2010 General Facility-Type Daily Capacity Range Estimates

			Daily Capacity Range			Daily Volume to Capacity Range		
ROUTE	**Road Name**	**2012 AADT**	**High**	**Low**	**Average**	**High**	**Low**	**Average**
US 74	Independence Blvd	57,000	37,900	28,400	**33,150**	***1.50***	***2.01***	**1.76**
NC 16	Providence Rd	28,000	37,900	28,400	**33,150**	0.74	***0.99***	**0.86**
NC 218	Fairview Rd	8,200	19,900	14,900	**17,400**	0.41	0.55	**0.48**
SR 1365	Stallings Rd	2,800	19,900	14,900	**17,400**	0.14	0.19	**0.16**
SR 1460	Ridge Rd	1,400	19,900	14,900	**17,400**	0.07	0.09	**0.08**
SR 1501	Idlewild Rd	18,000	19,900	14,900	**17,400**	***0.90***	***1.21***	**1.06**
SR 3468	Weddington Rd	12,000	19,900	14,900	**17,400**	0.60	0.81	**0.70**
SR 1004	Lawyers Rd	16,000	19,900	14,900	**17,400**	0.80	***1.07***	**0.94**
SR 3445	Tilley Morris Rd	9,800	19,900	14,900	**17,400**	0.49	0.66	**0.58**
	Total	153,200	215,100	161,100	**188,100**	0.71	0.95	**0.83**
	Total w/o NC 16	125,200	177,200	132,700	**154,950**	0.71	0.94	**0.83**

** - Based on Service Volume Tables - HCM 2010 Page 10-13 and 16-27, assuming ranges of K=0.9 to 0.11 and D=0.55 to 0.60.

Based on this review of US 74 and all major county line facilities across multiple time periods, traffic volumes are growing overall. However, the lack of sustained growth on US 74 in recent years is not surprising due to the lack of available capacity. The higher levels of projected traffic demand forecasted will contribute to future growth along US 74 and other corridors. However, this additional demand may continue to be unserved, further substantiating the need for the Monroe Connector/Bypass project and additional capacity to serve existing and projected demand.

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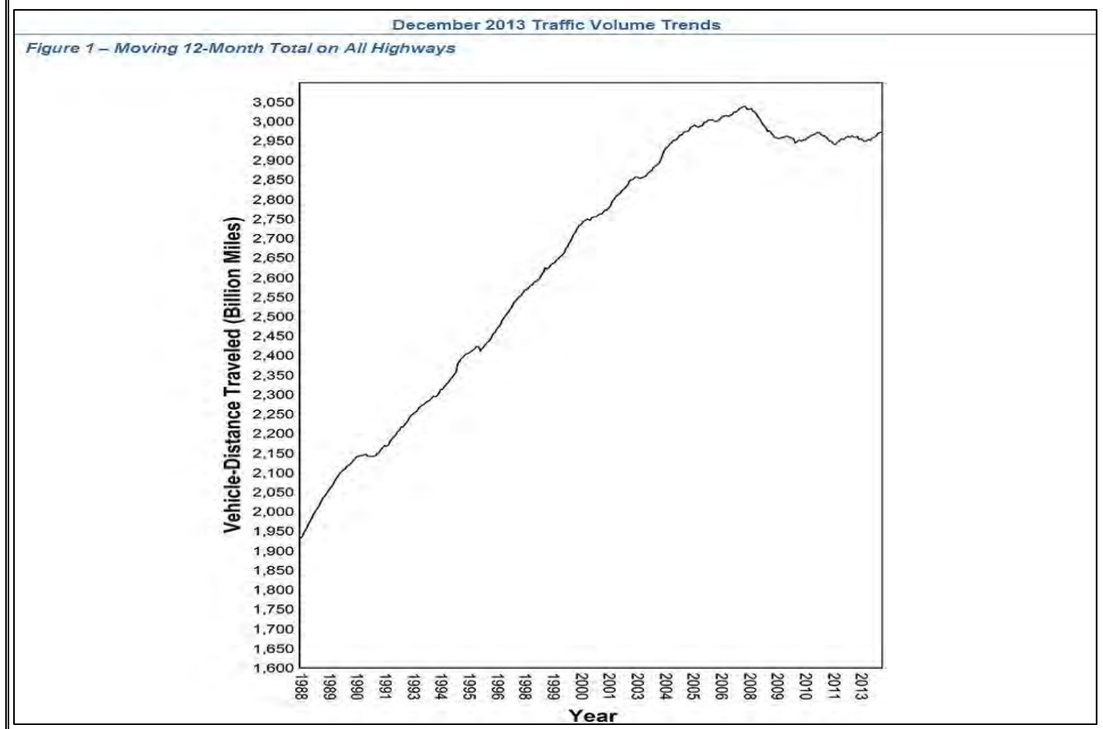
				As shown in Figure 1 below, national vehicle miles traveled (VMT) has declined since 2007 and therefore is a national trend and not just specific to the Monroe Connector/Bypass area. However, the figure also shows recent increases in national VMT indicating signs of improvement.  Source: U.S. Department of Transportation, Federal Highway Administration: https://www.fhwa.dot.gov/policyinformation/travel_monitoring/13dectvt/figure1.cfm
18	Traffic Growth	41	In Appendix G to the DSFEIS, the data show projected 2035 traffic volumes on U.S. 74 for the "no-build" alternative. The implied percent changes from current volumes range from 1.3 to 5.4% per year are 5-10 times faster than the recent 12-year history. Nowhere in the document is it explained how the traffic will grow 34% in 23 years when the past 12 years have shown "*zero change*" in traffic. One might argue that, yes traffic growth has been flat recently, but as the Recession ends it will accelerate. This argument fails to note that traffic has been flat since 2000, BEFORE the Recession. Failure to justify this highly optimistic "kink" in the traffic forecast and failure to consider recent traffic trends, while knowing that recent evidence indicates a huge change in	See response to **Comment #39** and the commenter's incorrect calculation and use of growth rates. The 5.4% growth rate is actually 2.0% which substantially changes the commenter's argument on unexplainable future growth rates. The commenter also fails to acknowledge that the project level traffic forecasts were completed in 2008 and considered available AADT data thru 2005 and collected field counts in 2007. The forecasts did not ignore this period of slowing growth but instead considered it as best as possible. Socio-economic projections indicate that Union County in the project study area will experience growth into the future. The projections show increased demand on major facilities such as US 74 and the proposed Monroe Bypass. Along US 74, 2000 to 2030 No-Build raw model volumes, which are inter-related with socioeconomic projections, project approximately 1 to 2 percent annual growth. Based on known 2012 AADT volumes (with the understanding the forecast was developed in 2007/2008, five years prior), an approximate 1 to 3 percent annual growth is "necessary" to reach estimated 2035 No-Build volumes or 1 to 2 percent annual growth by 2040, five years later. Based on a review of overall growth rates (both historical AADT and projected socio-economic rates), these growth rates seem reasonable and appropriate while accounting for periods of low and high growth. What does not seem reasonable

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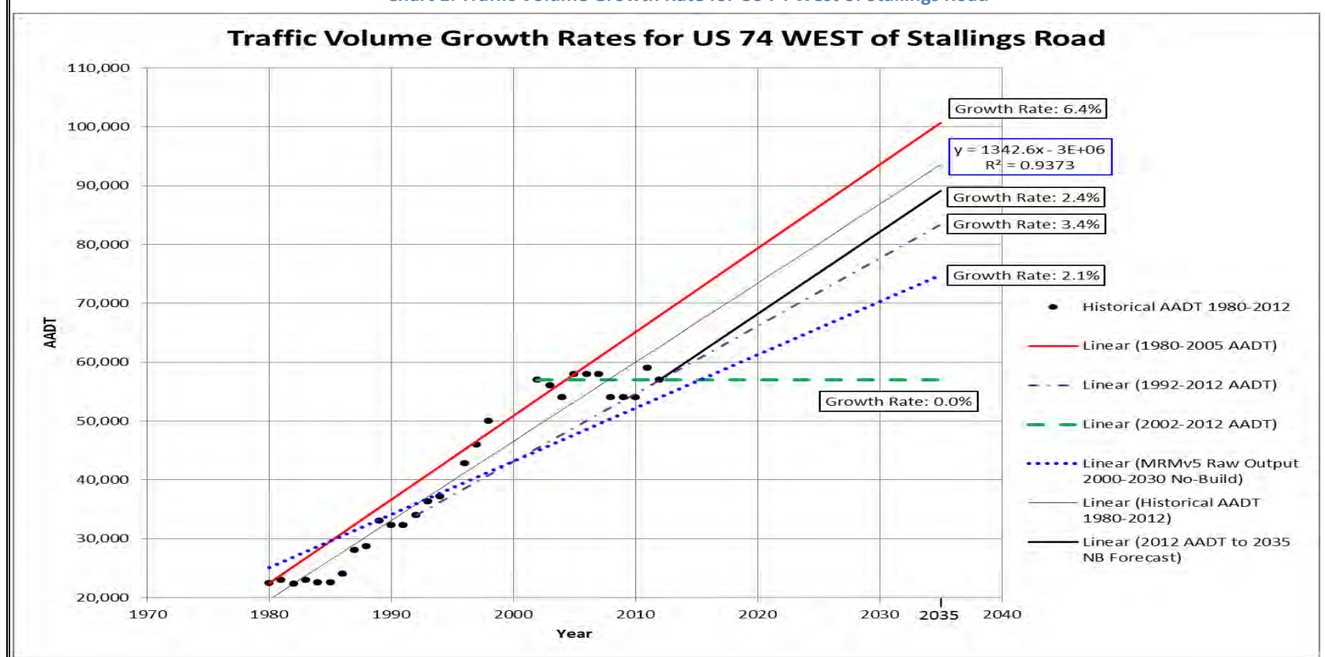
			prior trends, are serious oversights.	or prudent is the commenter's implication that a specific growth rate (approximately zero percent) over the past 12 years will continue or should be used as the basis when socioeconomic projections and longer-term AADT's show higher future growth rates. See Tables 4A and 4B in response to **Comment #40** in this table. Chart 1 , plots historical AADT volumes/trend lines and model volume growth rates on US 74 just west of Stallings Road to clearly show the overall trend of higher future traffic volumes and reasonable growth rates. The forecasted design year traffic demand is based on more than four data points at one location during a period containing two economic recessions from 2000 to 2012, one being the Great Recession, which was the most significant economic recession since the 1930's. Chart 1 shows that periods of slow or stagnant growth were also experienced from 1980-1986 and 1989-1992. The long-term growth rates incorporate and account for these periods. The model growth rate (slope) on US 74 at this location is actually less than all long-term projections further substantiating growth rates are not overly optimistic and not accounting for slowdowns in traffic growth. The project-specific forecasts are based on data including, but not limited to, the socioeconomic data and the travel demand model as developed and approved by the MPO for future years, as well as traffic counts and historic travel trends. **Chart 1: Traffic Volume Growth Rate for US 74 West of Stallings Road**  Example Linear Growth Rate Calculation: 20-year Annual % Change (1992 to 2012) = ((57,000-34,000)/34,000)/(2012-1992) = 3.4%
18	Traffic Growth	42	A serious inconsistency in the table is the magnitude of the traffic forecasts themselves. NCDOT's rated LOS D capacity of 6-lane arterials is about 55,000 ADT, but the forecast for U.S. 74 at the Mecklenburg County line is 89,000 ADT, 60% higher than a 6-lane "no-build" could	The commenter makes an incorrect comparison when he suggests there is a "serious inconsistency" in the magnitude of the traffic forecasts. He supports this incorrect assertion by stating that the planning-level LOS D capacity of a 6-lane arterial is about 55,000 ADT, but that the forecast for US 74 at the Mecklenburg County line is 89,000 ADT, "60% higher than a 6-lane "no-build" could carry." In fact, roadways can carry much more than a LOS D-level capacity thresholds, as evidenced by the frequent occurrence of worse levels of service of LOS E and LOS F in congested areas.

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			carry. Similarly, for the 4-lane section northwest of Monroe, the rated capacity is about 40,500 ADT, but the forecast for the "no build" is 61% higher, 65,000 ADT. As the congestion-decay equations of traffic forecasting models generally limit flow rates to the rated capacity (they spread out the traffic to "fit" within the road system), it is not clear how these "no-build" forecasts for U.S. 74 could be 60% higher than the rated capacities.	The MRM model includes capacity constraints, as described in the *Metrolina Model User's Guide* (July 11, 2008). An excerpt from the Guide is included in **Appendix A** in the slide titled "7. Questions Remain Concerning Details of Traffic Forecasts. (Hartgen)". As noted, in the MRM, "capacities are calculated for Level of Service (LOS) E and are calculated for each of the four time periods in the model. These capacities are used in conjunction with free-flow and loaded speeds in the model to reflect the impacts of congestion on travel times and route choices in the model." Many characteristics are used to estimate capacities and speeds for roadways in the MRM network, including but not limited to: number of lanes, speed limits, functional classification, and intersection control. However, it's important to know that the MRM model does not limit the volumes it assigns to a roadway to the roadway's estimated capacity, as the commenter incorrectly notes. In layman's terms, the MRM model will assign traffic to a roadway up to its estimated capacity, then it will begin to assign trips to other routes. The capacity value simply triggers the model to consider alternate routes for trips that desire to take the original route. As alternate routes for trips begin to 'fill up', the model will then resume assigning trips to the at-capacity routes, until all travel demand has been assigned. Therefore, in congested urban areas, it is common for roadways in the MRM to have projected volumes greater than the capacity assigned in the model, as in real life, these roadways experience, or will experience, LOS E or LOS F congested conditions.
18	Traffic Growth	43	Another anomaly in the table is the large differences between the 2035 "raw volume" (model output) forecasts and the estimated 2035 volumes. These differences are quite large, and are 46-50% higher for volumes east of Monroe. Although the DSFEIS cautions about the use of raw volumes directly in forecasting, the process used to estimate the estimated volumes is not adequately described. Differences of this magnitude, particularly at the eastern edge of the project where long-distance travel would be entering the region, and particularly on the high side (favoring the Bypass) need to be fully justified.	The methodology of incorporating raw travel demand outputs into the final traffic forecast estimates is described in the *Traffic Forecast for the No-Build Alternatives for NCDOT State TIP Project No. R-3329 and NCDOT State TIP Project No. R-2559, Monroe Connector/Bypass Study*, Martin/Alexiou/Bryson (MAB), June 2008; *Technical Memorandum for TIP Projects R-2559 & R-3329 US74 Upgrade Scenario*, Wilbur Smith Associates (WSA), June 2008; *Traffic Forecast for TIP Projects R-3329 & R-2559 Monroe Connector/Bypass*, WSA, September 2008; and *Monroe Connector/Bypass Traffic Forecast Summary*, HNTB, November, 2013, superseded by May, 2014. The difference between raw volume (model output) and forecasted volumes is not an anomaly. The forecast process considers multiple data sources and does not rely solely on raw model assignments. In the No-Build forecast (MAB), see Table 8 AADT location "HHHH" for the volume east of Monroe in question for further explanation of AADT's, field count data, model output, growth rates and selected forecast AADT. For this particular location, the existing 2007 AADT was higher than the 2000 raw model volume and slightly less than the 2030 model volume. In summary, an average final growth rate (considering the model growth rate and historical growth rate) was applied to existing 2007 AADT to forecast future year volumes. Variations between existing field conditions and raw model volumes are not uncommon nor are they expected to match for each facility or segment along a given facility or comparing different model/field-collected years. See referenced forecasts for additional details.
19-20	Traffic Growth	44	**Inconsistent historical growth data for population and traffic.** A fundamental inconsistency in the DSFEIS is the apparent inconsistency between the population growth and the corridor traffic growth. The recent history of population growth in the region is shown in the following table:	As discussed previously and in more detail in **Comment #s 37 thru 43** in this table, population and traffic growth rates have been increasing and continue to increase based on a more thorough review of available data. While these growth rates may not trend at the same rate, they are both growing and should not be described as inconsistent. Specific to US 74 corridor at the Mecklenburg/Union line, the 1980 to 2005 25-year growth rate available for the forecast was 6.4% annually and the 1992 to 2012 20-year growth rate incorporating the Great Recession was 3.4% annually, see Table 4A in response to **Comment #40** in this table. Table 3 (found in **Comment #40** response) also confirms that the average 10-year and 20-year growth rates for corridors between Union and Mecklenburg Counties is 1.7% and 4.2% annually. These growth rates confirm a positive correlation with population growth rates. The commenter also incorrectly compares county-wide population growth to location-specific traffic data sets and then inappropriately states that population growth rates are occurring "about ten times the traffic growth rates". The Purpose and Need for the project has been established and re-confirmed by re-examining items such as US 74 existing corridor travel speeds and population, socio-economic and MRM/CRTPO data that continue to project growth and increased demand. However, if one were to speculate and attempt to answer the commenter's question, the following answers may be contributing factors, but not necessary limited to these potential explanations: 1. The US 74 Corridor is at or over capacity. US 74 traffic and growth rates are slowing accordingly as demand continues to be unserved due to roadway capacity limitations. US 74 traffic is seeking alternative routes for travel when given a choice as illustrated in higher growth rates on competing facilities, per Table 3. 2. Population growth and traffic growth rates do not and do not have to trend precisely with each other. The data presented shows an overall positive

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Population Growth, 2000-2010*
<table>
<tr><th>Area</th><th>2000</th><th>2010</th><th>Percent Change 2000-10</th><th>Percent Change/year</th></tr>
<tr><td>Union County</td><td>123,677</td><td>201,292</td><td>62.8</td><td>6.3</td></tr>
<tr><td>Mecklenburg County</td><td>695,454</td><td>919,628</td><td>32.2</td><td>3.2</td></tr>
<tr><td>Project Study Area</td><td>80,470</td><td>120,103</td><td>49.3</td><td>4.9</td></tr>
</table>
*Source DSFEIS, Appendix D, Updated Census Tables.
All of these population growth rates have been much faster, per year, than the traffic growth rates shown above, about ten times the traffic growth rates. The last item, the population of the study area, is referred to several times as a key historical justification for the project's need. Yet, this raises a fundamental question: How can the traffic growth on U.S. 74 be "zero growth" when Union County and study area population is growing so fast?
This inconsistency is neither identified nor explained in the DSFEIS. It has a number of possible explanations, for instance:
1. The current traffic congestion on U.S. 74 has actually slowed its growth; with more capacity, it would have grown more.
2. The Recession slowed the traffic growth, but not the population growth.
3. Population growth is largely in areas south and west of U.S. 74, near the Mecklenburg line, and thus does not use U.S. 74. (This is suggested by the sub-area discussion above).
4. Population growth is largely locally-based and does not use regional highways.
5. Traffic data is misestimated, or population data is miscounted.
6. The traffic model used for forecasting does not capture the reasons for travel behavior.
It is not appropriate for us here to determine the reasons for this discrepancy.
Nevertheless, because the discrepancy impacts the validity of the traffic forecasts (see discussion below) it must be researched and then incorporated into the Purpose and Need for the project.
</td><td>
correlation between population and traffic growth. One potential contributor is that population located near the corridor, but not directly on the corridor, is deciding to take alternative routes for many or all trip types.
3. It is plausible that the recession did reduce the amount of travel or number of trips and people still moved to Union County, but there were less job and work-related trip growth.
4. Traffic growth is not directly tied to population growth and for this reason not all trips are "population" i.e. residential-based. The US 74 corridor has many "built-out" commercial areas and is affected by commercial work and shopping-related trips and should not be considered to be directly "tied" to population data.
5. All future traffic AADT data on US 74 is an "estimate" and the forecasts were developed by comparing/evaluating many points along US 74, other roadways and considering the information available in its totality. The forecast does not focus solely on one or two select locations, time period, or data results like the commenter's questions.
6. Traffic is growing if viewed over all locations and periods of time (longer and shorter time periods), but not necessarily at selective points and locations.
7. Historic traffic data trends do not drive future traffic forecasts data, but are one of many pieces of data considered along with socio-economic and population projections.
We disagree with commenter's statement and his creation of explanations designed to address and cast doubt on the project process for a question he created. While population and socio-economic increases positively correlate to traffic growth, they do not have to trend perfectly together nor does knowing this relationship for one specific location or point in time change the project need or conclusions. The commenter states that "It is not appropriate for us here to determine the reasons for this discrepancy.", but he continues to speculate and hypothesize. We find no discrepancies that require a change or update to the Purpose and Need of the project.
</td></tr>
<tr><td>20-23</td><td>Growth</td><td>45</td><td>The population forecasts used to forecast traffic are probably significantly over-stated.</td><td>The commenter cites a number of reasons for why the population and household forecasts used in the travel demand modeling and the quantitative indirect and cumulative effects analysis may be overstated. The commenter notes that a number of the Hammer Report assumptions may no longer be valid. First,</td></tr>
</table>

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			The process used to estimate future traffic is described in the DSFEIS and can be summarized as follows: 1. A Charlotte-region population forecast is estimated by reviewing US growth. 2. County growth to each of 35 counties/sub-areas in the region is allocated from the regional control total, using statistical relationships from 227 counties in 29 regions nationwide. 3. County population growth and "population-chasing" employment is then allocated to traffic analysis zones ("TAZs") within counties, using travel time to employment and other factors. 4. Non-population-chasing employment is estimated using expert review. 5. "Induced" growth due to the presence of the Bypass is estimated by a variety of methods. 6. TAZ-level population and employment forecasts, and non-residential growth (in acres of development) are then converted to trip ends, by purpose, and then to productions and attractions. 7. Although not explicitly discussed, external travel (leaving and entering the study area) is presumably estimated separately. 8. Trips between origins and destinations are then estimated, by purpose, and external travel origins and destination are added. 9. O-D pair trip flows, by time of day, are then assigned to the network ("build" or "no-build"), adjusting for capacity, toll rates, and value-of time. 10. The raw volumes (direct from the model) are then adjusted further for local access and "balance." The process begins with estimates of likely population growth for the region and its counties. Specifically, a Charlotte-region population forecast is estimated by reviewing US growth, and then assigning portions of that growth to each of the major regions of the US. In the next step, the total regional growth is then allocated to 35 local counties/sub-areas using historical statistical relationships from 227 counties in 29 regions nationwide. The DSFEIS reviewed this forecast, prepared in 2003, finding it in substantial agreement with the 2010 Census estimate for Union County. It then went further, suggesting that the Hammer forecasts are valid for the future because: "*Put more succinctly: 'Why would Union County have such robust growth in the absence of new transportation infrastructure?' The short answer is that the factors that caused Union County to experience higher growth than any other regional county since 1990 are still in place and are likely to continue to result in higher than average growth.*" The Baker assessment then goes even further, putting the 2030 population forecasts for Union County (adjusted for "reconciliation") near the upper range of the Hammerforecasts. While the Hammer study appeared to accurately predict the 2010 Census estimate of population, its accuracy for future years is	the commenter argues that the recent recession has dramatically altered future growth trends at the national level and those trends do not support Dr. Hammer's projections. Dr. Thomas Hammer conducted the Top-Down analysis and his report, Demographic and Economic Forecasts for the Charlotte Region, documents his methodology and results. The commenter further argues that the fact the recession was so close to 2010 to negate any valuable comparison between the projected population in 2010 and the actual Census count. While the recession has cast doubt on some of Dr. Hammer's assumptions, the projections he developed and that the MPO used were and are the adopted projections used for a variety of planning and air quality conformity purposes for the region. Furthermore, Dr. Appold worked from the MPO projections in his Traffic and Revenue study and when asked to adjust them, reduced them by only about 8% to adjust of the effects of the recession. Dr. Stephen J. Appold, had several roles that were of importance to this study including assisting in the development of the regional growth projections used in the Traffic and Revenue study. This adjustment is within the range Dr. Hammer produced and well within the typical range of error for long range projections of population and employment. Second, the commenter suggests that Dr. Hammer's assumption that the Charlotte region will outpace national growth trends is no longer valid since the recent recession hit North Carolina and the Charlotte region particularly hard. While it is true that unemployment in North Carolina and the Charlotte region peaked higher than the national rates, (10.6% nationally in January 2010, 11.9% for North Carolina in January 2010, 12.7% in the Charlotte area in February 2010), the trends for the region have returned to near the national average as of December 2013: 6.5% nationally, 6.6% in North Carolina and 6.9% in the Charlotte area. While regional employment growth may not be as robust as during the boom years, regional employment has increased to 861,012 (as of November 2013) from the trough during the recession of 760,290 in December 2009. Third, the commenter suggests that the distribution of growth within the region in the future will not be as favorable to Union County as forecasted and argues that the boom of growth in Union County in the 2000's is attributable almost entirely to the proximity to the Ballentyne area of Charlotte and is outside the study area. Again, the commenter's conclusion is invalid as his analysis of the growth the study area compared to Union County as a whole is flawed, as noted in Response 14. As the commenter notes, a sizeable portion of the growth within the county has been in the southwest area adjacent to Mecklenburg County. Nevertheless, 46% of the growth from 2000 to 2010 occurred within the DSA even though this area is only 28% of the county. The commenter is correct that growth as estimated from the American Community Survey between 2010 and 2012 has been much below the long-term forecasted growth trends. However, two years of down growth, in the midst of one of the slowest growth periods in post-World War II experience does not necessarily portend a long-term change in the overall growth patterns. Additionally, the commenter notes that the Charlotte region was hit very hard by the recession and that unemployment levels in North Carolina have exceeded US averages. Furthermore, more recent data suggests growth may be returning as the 2013 Census Population estimates shows Union County growing at a 2% rate from 2012 to 2013. Furthermore, Mecklenburg and Union County have remained among the fastest growing counties in North Carolina from July 2010 to July 2013 (based on Census Bureau estimates). Therefore, it stands to reason that when the economic recovery accelerates, growth in the Charlotte region would likely be above state averages and that growth in Union County would be among the highest in the region. Finally, the commenter argues that a highly unlikely "turn-around kink" in growth would be needed for Union County to reach the 2030 projected population of 337,000. He cites that growth rates would need to average 3.4% per year compared to the recent average of 1.7%. Presumably the commenter is using average annual growth rates for his calculations, whereas compound annual growth rates would be more appropriate. From 2010 to 2013, Union County saw a compound annual growth rate of 1.7% per year. From 1990 to 2000, Union County's compound annual growth rate was 3.9%. From 2000 to 2005 it was 5.7%. From 2005 to 2010 it was 4.3%. To reach the projected 2030 population by 2030 would require a compound annual growth rate of 2.7% per year. Thus it would not take a highly improbable "turn-around kink" in growth to reach the 2030 projected population, it would only require a return to growth rates that average about 1% higher than the growth seen during the worst recession since World War II and about 2% lower than that seen during the boom years of growth from 2000 to 2010.

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			questionable. The Hammer study, prepared in 2003, made the following critical (and as it turns out, wrong) assumptions: 1. *The US will continue to grow as in the past.* The Hammer study essentially trends the US population and economic activity forward. But the Recession of 2008-12 significantly slowed both in-migration and US growth, employment was cut by over 4 million, and recent US population increases (births – deaths + net in-migration) have slowed too. The key relationship between population and employment (percent of population that is employed) was also weakened. The current growth rates for the US are now 1/3-1/2 what was estimated just 10 years ago, and the employment/population ratio is the lowest in 50 years. Further, virtually all of the 2000-2010 Census population growth for Union County was already "in place" by 2009, when the Recession hit hard, and so the 2010 census estimate was largely unaffected by the Recession. But as noted above, the recent (2010-12population growth rate for Union County has been much slower, just 1.7%/year. 2. *The Charlotte region will continue to excel relative to other regions*. The Hammer study assumed that the Charlotte region will continue to exceed the national growth rates. But North Carolina and the Charlotte region was very hard-hit in the Recession, with large banks and other employers shedding jobs inordinately, and unemployment remains significantly above the US and NC levels. This effect has slowed the local employment growth to a crawl. This "inconvenient truth" is ignored by the Baker review. 3. *Union County will attract a relatively large share of regional growth*. The Hammer study allocated growth to the region's 35 county and sub-county areas based on employment-population-economy relationships developed from around the US. *But in the 2000's, most of the growth in Union County was driven not by local county economic activity but by proximity to Charlotte, particularly in the Ballantyne area, which is not even in the study area. Essentially, Union County's growth in population was a "population" boom near to another county's "job" boom,* which has now slowed. The Hammer study and the recent Baker review do not discuss the location of that growth *within* Union County, and thus overlook the fact that the most of the Union County growth has been outside of the Bypass study area. Dr. Hammer's estimates were reviewed by the UNC Kenan School, which found them to be too high. The Kenan review recommended an 8.7% reduction in the 2030 corridor growth for "national" trends, and a re-allocation of some growth within the County to zones in the Bypass corridor. *Therefore, Dr. Hammer's forecast of population and employment for*	

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			Union County is likely to be significantly over-stated, as are Baker forecasts made from it. Of course, in 2003-04 Dr. Hammer could not have foreseen the 2008-12 Recession or its disproportionate impact on banking sector employment. That is exactly the point: *If one is to believe Dr. Hammer's 2030 forecast now, one must now assume an equally unlikely upward "turn-around kink" in population for the region and particularly for Union County. To reach the projected 337,000 population by 2030 from its current (2012) level of 208,000, Union County would have to average 3.4% growth annually, twice its recent growth rate of 1.7%. Assuming this would mean justifying the Bypass on an unsupported future turn-around in growth for the Charlotte region, and a return to a rapid growth spurt for Union County, events as unlikely as was the recent Recession.*	
23	Socio-economic data	46	**The Hammer population forecasts are then used to forecast traffic.** Unfortunately from a modeling perspective, Dr. Hammer's assumptions about future Union County population growth are also used as the basis for the subarea allocation to zones (the Smith study and refinements to it). The Smith study is described as allocating the county-level population and "population chasing employment" control totals to TAZs based on vacant residential acres and travel time to employment. The DSFEIS apparently continues to use the county-level control totals in making these TAZ allocations. In other words, the higher-level population forecasts are then used to estimate zonal population and employment, which are then used for estimating local traffic growth. This means that, if the Hammer-based forecasts of population growth by county are high, then the TAZ forecasts will be high in the same proportion.	The commenter's conclusions regarding how Dr. Hammer and Mr. Smith allocated population and employment from the region to the TAZ does not reflect the extensive inputs and calculations that were used to develop the MRM model and serves as an overly broad generalization. See section 3.2 of the Indirect and Cumulative Effects Quantitative Analysis Update (DSFEIS Appendix E). The processes used to develop traffic forecasts are fully detailed in the *Monroe Connector/Bypass Traffic Forecast Summary Memo (*HNTB, November, 2013, superseded by May, 2014).
23	Socio-economic data	47	***The Smith re-study incredulously found no impact of the Bypass on population growth***. According to the DSFEIS, the original Smith study completed in 2004, allocated county-level control totals to TAZs using vacant residential acres and travel time to employment. In 2012 Mr. Smith re-analyzed the impact of the Bypass on population and "population-chasing employment," and found *no change in growth forecasts for any of the TAZs*. This result is not believable given the projected change in access that the proposed Bypass would create, particularly in those TAZs both near the Bypass and close to the Mecklenburg line. This suggests that the original allocations prepared by Smith did not consider the key factors that affect regional population growth. For example, the Smith study	The commenter is incredulous that the analysis of Paul Smith's travel time to employment factor discussed in the *Monroe Connector/Bypass (R-3329/R-2559) Indirect and Cumulative Effects Quantitative Analysis Update* (Michael Baker Engineering, Inc., November 2013) (Quantitative ICE Update)shows that that factor was unaffected by the presence of the Monroe Connector/Bypass in the travel time model used. The commenter concludes that Mr. Smith's model must be inadequate as it "did not consider that the whole study area growth might slow if US 74 became congested to the extent predicted elsewhere in this DSFEIS". Mr. Smith's model was designed to try and capture a multitude of factors, including many factors the commenter suggests are critical: "school quality, sewer and water availability, zoning density restrictions, improved road access, rising congestion on existing roads, crime rates, average housing values and neighborhood incomes . . . ." (pp. 23-24). Specifically, Mr. Smith's model included the availability of developable land (estimated using available land and zoning restrictions), redevelopable land (estimated using zoning restrictions), water and sewer availability, recent population change, growth policies, expert panel input and travel time to employment centers. Thus, most of the variables that the commenter cites were accounted for in Mr. Smith's analysis and those that were not directly accounted for (crime rates, neighborhood incomes, shopping and retail access) were among the considerations of the expert panel during their input. However, it is important to note that as documented in Appendix B of the *Quantitative ICE Update*, the presence or absence of a major highway such as the Monroe Connector/Bypass does not necessarily have a major impact on county-wide growth trends. In fact, as documented by Dr. Hammer, such supply side considerations typically have very localized impacts on growth. The purpose of the re-analysis of Mr. Smith's travel time to employment center factor was to determine the extent, if any, that the inclusion of the Monroe Connector/Bypass had on that factor

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			did not consider that the whole study area growth might slow if U.S. 74 became congested to the extent predicted elsewhere in this DSFEIS.	to determine the most reasonable use of the forecasts within the context of an indirect and cumulative effects analysis.
23-24	ICE	48	***The revised DSFEIS shows a modest impact of the Monroe Bypass on induced growth***. Later in the discussion, the Michael Baker team indicated dissatisfaction with the Smith study on the precisely those grounds — that it did not show a difference in development for the "build" vs. the "no build" forecast. Among the obvious factors that might have been included in a more careful assessment of potential growth would be school quality, sewer and water availability, zoning density restrictions, improved road access, rising congestion on existing roads, crime rates, average housing values and neighborhood incomes, provisions for and distance to shopping and retail, etc. The Baker study then uses other methods to estimate induced *residential* growth (about 1%). A method developed by this author (Hartgen) in 2000 is also used to estimate *induced commercial growth* at Bypass interchanges. Other methods are also used to estimate the impact of the Bypass on industrial, transportation, and other uses. Overall, the review found modest estimates of induced growth, about 3.4% overall (a difference of 3200 acres, "build" vs. "no-build" (128,200 vs. 125,000), from a base of 95,200 acres of development. The report does not indicate what markets this "nonresidential" growth would serve, but it seems unlikely that they would be other than the nearby new population. However, as noted below, this difference does not seem to have been actually used to make new traffic forecasts.	The commenter's discussion in this section does not suggest that the conclusions on induced growth are incorrect. The commenter suggests that "the Michael Baker team indicated dissatisfaction with the Smith study on the precisely those grounds — that it did not show a difference in development for the "build" vs. the "no build" forecast". The Michael Baker Team expressed no dissatisfaction with Mr. Smith's work. The team simply used different methods to assess the specific induced growth effects of the one project in question. These methods were naturally different than the methods used by Mr. Smith in a regional growth disaggregation modeling process. See response to **Comment #43** in this table for additional discussion of traffic forecasts.

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24	Calibration	49	**The Regional Travel Model and the traffic operations model appear to have been insufficiently calibrated.** It is widely agreed that the use of a traffic model in forecasting first requires that it is well calibrated, that is, it matches reasonably well existing traffic counts, travel times, and speeds in the base year. This elementary step is intended to ensure that the model, when used for forecasting, will not require inordinate adjustments to raw traffic forecasts. Standards for model calibration accuracy are detailed nationally. The general rule of for regional model calibration accuracy is that estimated base-year traffic for roads with volumes over 50,000 ADT should be within ±20% of observed counts, and within ±30% of observed counts for roads with volumes between 50,000 and 10,000 ADT, with most roads showing considerably less error. And of course, if a specific project is being studied, such as U.S. 74, estimated base-year traffic volumes on that road should be close to actual ground counts. In addition to this limited standard, for major studies such as this one good practice is also to calibrate the models by cut-line in-out balance, geographic region, road functional class, time-of-day and direction to a similar or tighter level of accuracy, for greater confidence in forecasting. In addition, travel times and speeds through the base-year network should correspond closely to observed field data.	The Metrolina Regional Travel Demand Model (MRM) was developed as the primary tool for evaluating existing and future travel demand in the greater Charlotte area. The MRM is governed by a Memorandum of Agreement (MOA) through an Executive Committee and a Planning & Oversight Committee. The region's four MPOs and two RPOs are signatories to the MOA, along with the North Carolina and South Carolina Departments of Transportation. The MRM base year models used for the traffic forecasts were/are appropriately calibrated to standards that allow their use for region-wide applications. Per the *Metrolina Model User's Guide* (July 11th, 2008), Documentation Revision 2.0, page 3-11, Table 3.1, notes a minimum of 10 extensive surveys and studies were performed at a cost of nearly $2.5 million to "serve as a basis for model equations, settings, and calibration targets". The *Metrolina Regional Travel Demand Model Technical Documentation*, dated May 31, 2006 and developed by the Charlotte Department of Transportation Planning Division, the North Carolina Department of Transportation (Transportation Planning Branch) and AECOM Consultants provides details of the MRM calibration process in the model calibration report. The traffic forecast documents discuss in detail the modifications, adjustments, and enhancements made to the MRM to allow for its appropriate use in the project-level traffic forecast process. (See *Traffic Forecast for the No-Build Alternatives for NCDOT State TIP Project No. R-3329 and NCDOT State TIP Project No. R-2559, Monroe Connector/Bypass Study,* Martin/Alexiou/Bryson (MAB), June 2008; *Technical Memorandum for TIP Projects R-2559 & R-3329 US74 Upgrade Scenario*, Wilbur Smith Associates (WSA), June 2008; *Traffic Forecast for TIP Projects R-3329 & R-2559 Monroe Connector/Bypass*, WSA, September 2008.)
25	Calibration	50	**The calibration of the Metrolina Regional Model ("MRM") used for this study has not been demonstrated.** In prior documentation of the regional modeling effort for this study, the consultant (Wilbur Smith Associates, now CDM Smith) states that: "*The base-year model was calibrated in the immediate project area to achieve the best traffic volume assignments compared to observed traffic counts and observed speeds from speed-delay runs conducted for the traffic and revenue analysis. . . . The base year 2008 model was run using inputs supplied by the MPO.... A series of traffic assignments were compared with ground counts supplied by the NCDOT and those collected specifically for the traffic and revenue study...Adjustments were made to input network speeds and trip tables in the study area in order to improve the calibration of the model in comparison with ground counts for the specific corridor area. After calibration was obtained, a series of traffic*	Beyond the level of effort involved in creating and calibrating the Base Year MRM models, the Monroe Connector/Bypass project-level traffic forecasts were developed based on data including, but not limited to, traffic counts, historic travel trends, the MUMPO Long-Range Transportation Plan (LRTP), the calibrated MRM, and existing roadway network operations. Thus, additional information was utilized in producing base year project-level forecasts that were better "calibrated" to local traffic conditions along US 74. The individual data sources are not intended to be traffic forecasts and do not include the level of detail ultimately developed in the traffic forecast. For example, the MRM does not include all the roadways within the study area. Therefore, those roadways are included in the traffic forecast through analyzing traffic counts or other available data sources. Another example of source data are Annual Average Daily Traffic (AADT) volumes, which are developed by annualizing traffic counts collected at one point in time. The *Monroe Connector/Bypass Traffic Forecast Summary Memorandum* (HNTB, November, 2013, superseded by May, 2014) summarizes the traffic forecasts and references historical traffic data, socioeconomic data and MRM data developed throughout the Monroe Connector/Bypass project development process and concludes that the project forecasts are still valid for the purposes for which they were developed and used.

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			assignments to the highway network were made for years of 2008, 2010, 2015, 2020, and 2030 under No-Build, Toll-free, and Tolled conditions." This statement admits the presence of initial calibration errors which were (apparently) "improved" by changes to network speed and trip tables. But no data comparing "observed" vs. "estimated" or "improved" traffic is provided, no chart showing either regional or study area agreement by link type or volume is provided, and no calibration statistics by cut-line are given. No reference is made to time-of-day or directional agreement. As the MRM was not updated for the DSFEIS, the possibility of remaining errors, such as those caused by inadequate calibration, is a distinct possibility.	
25	Calibration	51	**The current DSFEIS does not discuss calibration.** The DSFEIS contains no discussion of calibration, but instead asserts that prior modeling is adequate for the purpose of environmental assessment. Therefore, one is left to assume that the current traffic forecasts are based on an adequately calibrated model, which as noted above has not been demonstrated. Given that recent traffic has not grown to the extent forecast in 2008, the MRM should probably have been re-calibrated.	See response to **Comment #49** in this table.
25-26	Calibration	52	**Errors in calibration will be carried forward into future estimates.** If the original MRM was not adequately calibrated, traffic forecasts are in serious doubt as calibration errors on specific road links are therefore carried forward into future tests. Essentially, if traffic for a specific road section is over-estimated in the base year, it is likely to be also over-estimated in the future year as well. The problem is particularly severe for calibration of U.S. 74 traffic volumes, which, as noted below, are clearly open to question since U.S. 74 apparently was modeled with too-high volumes, and with too-slow speeds relative to actual INRIX travel speeds. The accuracy of traffic forecasts for new roads is also open to question. This also affects estimates of traffic diversion and revenue for toll roads. In addition, errors in calibration carried forward in forecasts, are also likely to impact other key elements of the EIS, particularly noise, air quality and stream runoff, bringing large portions of the EIS into serious question. In short, the use of poorly calibrated traffic models to make forecasts is a serious mistake in traffic modeling that must be corrected BEFORE the resulting traffic forecast can be used in	See responses to **Comment #s 49 and 50** in this table**.**

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<tr><td></td><td></td><td></td><td>decision- making.</td><td></td></tr>
<tr><td>26-27</td><td>Calibration</td><td>53</td><td>
The traffic operations simulation model (SIMTraffic) also appears not to be well calibrated.
The study uses a traffic operations simulation model (SIMTraffic) to simulate traffic operations for existing and no-build future traffic on U.S. 74. Good planning practice dictates that these models also be “calibrated” in the field, that is, they replicate existing travel times and speeds before being used for forecasting. According to the consultant’s documentation, in 2008 calibration was undertaken by driving 4 runs through the project section, 2 in the AM and 2 in the PM peaks. The reported (average of the 2 runs in each direction?) travel times in 2008 was 41 minutes (30 mph) eastbound in the PM peak, and 40 minutes (30 mph) westbound in the AM peak. The SIMTraffic model for the same conditions yielded 47 minutes, at 29 mph (westbound) and 50 minutes at 24 mph eastbound, that is, the SIMTraffic tests showed significantly higher travel times and (according to the consultant) “slightly lower speeds” than the travel time runs. The consultants attributed these differences to different input traffic volumes (the SIMTraffic volumes were taken from the regional travel demand model and were higher than the 2007 field volumes), and so the consultant considered the SIMTraffic model “calibrated.” The following table summarizes their findings:
<table>
<tr><th colspan="5">Travel Time Calibration Runs on U.S. 74, 2008 (PBSJ)</th></tr>
<tr><th></th><th colspan="2">Travel Time Runs</th><th colspan="2">SIMTraffic</th></tr>
<tr><td></td><td>Minutes</td><td>Speed</td><td>Minutes</td><td>Speed</td></tr>
<tr><td>Westbound PM Peak</td><td>41</td><td>30</td><td>47</td><td>29</td></tr>
<tr><td>Eastbound AM Peak</td><td>40</td><td>30</td><td>50</td><td>24</td></tr>
</table>
The consultant’s conclusion that this is adequate calibration is not believable. First, the use of just 4 travel time runs to prepare a baseline for calibration is wholly inadequate, as traffic varies considerably just day-to-day, let alone on weekends or by time-of-day or direction. A much larger set of runs, perhaps 30 for each time/direction, would be needed for statistical accuracy and for obtaining data for travel time reliability (see discussion
</td><td>See response to Comment #35 in this table.</td></tr>
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			below). Further, setting aside the obvious miscalculation of speed (47 minutes through a 19.7- mile section is 25 mph, not 29 mph), the large differences in travel time between the field runs and the simulation model could not possibly have been caused by different traffic volumes as the volumes were virtually unchanged between 2007 and 2008. Either the traffic volumes used to calibrate the model were way too high — a serious error as one should always use field- measured volumes for calibration — or the model's performance was understated. Either way, the SIMTraffic model clearly underestimated the 2007 speeds on U.S. 74.	
27-28	Calibration	54	Further, recent analysis (in early 2013) of new travel time runs on U.S. 74 and INRIX data also suggests that speeds on U.S. 74 are significantly higher now than in 2007. NCDOT re-did the travel time runs on U.S. 74 in March 2013, this time with (apparently) three runs in each direction/time period. They found average speeds of 39.1-43.9 mph, about 10 miles per hour faster than the runs made in 2007! In other words, the NCDOT's own tests showed that travel speeds had improved significantly between 2007 and 2012. Using a new source of data provided by INRIX, which tracked the speeds of hundreds (perhaps thousands) of actual road users between January 1 and Feb 28, 2013, the INRIX analysis also found that the actual operating speeds were even higher — between 44.2 and 44.9 mph, than in the upward-revised field runs. Both these sources say the same thing: *Travel speeds on the present U.S. 74 have improved substantially over the past 7 years, and are MUCH HGHER (by 10-15 mph) than the speeds used to calibrate the SIMTraffic operations model.* No explanation is given for these findings, but they are likely a combination of poor initial model calibration and recent improvements to U.S. 74 to smooth and speed its operation. *Errors of this magnitude in calibration cannot be ignored. If not revised to accurately reflect current operating conditions, the SIMTraffic model used for studying flow on U.S. 74 is likely to significantly overstate congestion and travel time through the section, and therefore overstate the potential for diversion to a proposed Bypass.* To correct the above problems, several steps should be undertaken. First, road capacities should be updated in both the simulation model and the regional travel model. The new Highway Capacity Manual (2010) revises procedures for	As described in Section 1.2.4 of the *Draft Supplemental Final EIS*, FHWA and NCDOT collected new travel time information to update travel performance along the existing corridor and did not use a computer model to evaluate travel performance along the existing corridor. Based on the data, which is from actual travel speeds as reported by INRIX for 2011, 2012, and 2013, average travel speeds along the US 74 corridor are still below 50 mph. As stated in response to **Comment #35**, improvements made along the US 74 corridor between 2007 and 2013 likely contribute to the speed improvements that the commenter notes. However, the 2013 INRIX data, see 2013 eastbound and westbound speed tables and diagrams below, that he bases his own assertions on also shows quite clearly that multiple segments of US 74 have reported speeds in the 20-35 mph range for multiple hours throughout a typical weekday (see the *INRIX US 74 Corridor Travel Speeds* memorandum (HNTB, April, 2014)). Whether or not there is a perceived "magnitude of error" in the SimTraffic model does not refute the fact that travel speeds along the corridor are lower, when examined at the segment level, than at the "gross" corridor-level as presented by the commenter. It is also vital to note that any calibration procedures or perceived errors in a traffic simulation model used for evaluating the performance of alternatives at any time in the project process has NO bearing on calibration procedures used in the development or validation of travel demand models used in the traffic forecast. The models, and calibration procedures for each, are two entirely different things. No input or result from a SimTraffic microsimulation model was used to predict diversion to a proposed Bypass – this would be a feature utilized in a travel demand model. The commenter appears confused about the proper application and processes of travel demand models versus microsimulation models For comments related to the commenter's discussion of road capacities and travel demand model calibration, see details in response to **Comment #s 49 and 50.**

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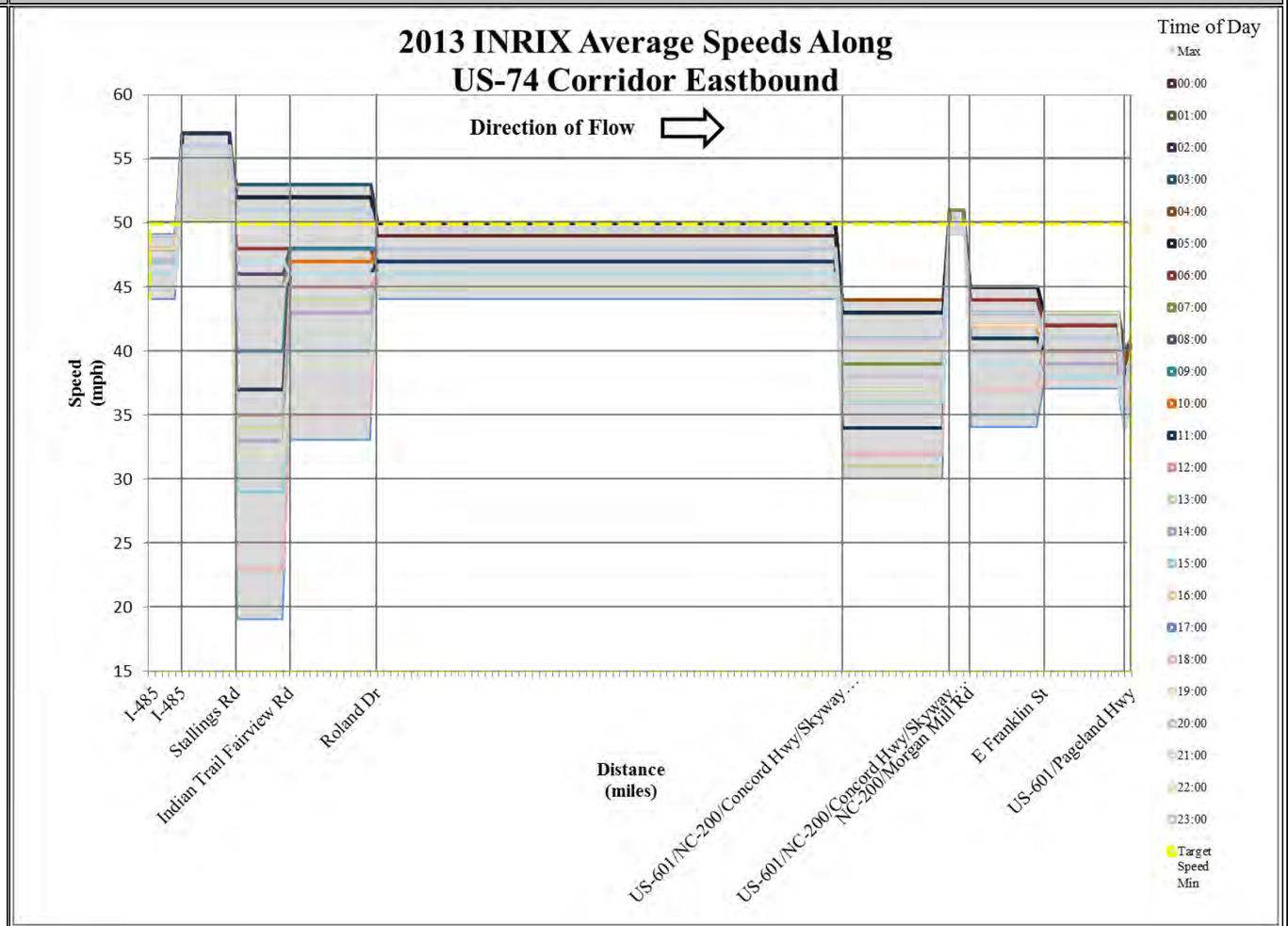
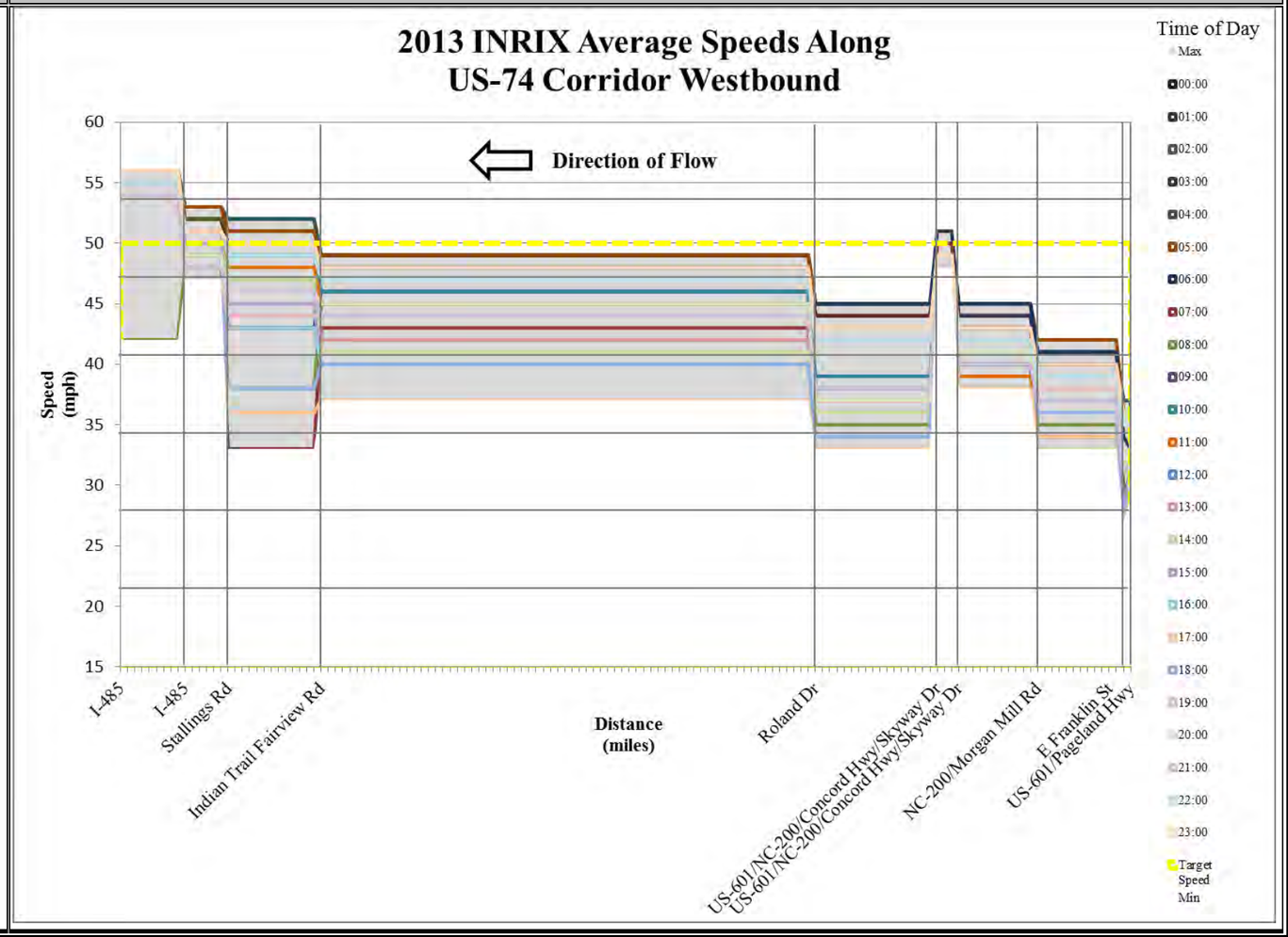
			calculation of capacity for both arterials and for freeways, which in some cases results in higher capacity estimates. Failure to use the 2010 Highway Capacity Manual in such cases would therefore bias the traffic forecasts against the no-build alternative by underestimating its ability to carry traffic. Second, the regional travel model should be calibrated sufficiently to show (at the very least) FHWA-standard agreement with existing volumes by direction and time of day. Third, the simulation operation model should be re-calibrated to show close agreement with INRIX travel times and speeds through the section, also by direction and time of day. These elemental steps must be undertaken BEFORE either model is used in forecasting.	**Table 5 - US 74 Corridor INRIX Average Speed Data** **2013, Tuesday - Thursday** **Average Speed for US 74 from I-485 to NC 205 (Elm St.)** **Eastbound US 74 Corridor Average Speed**

TMC CODE	SEGMENT NAME	LENGTH (MILES)	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
125+07488	NC-205/Elm St	8.54	49	49	49	49	50	49	49	49	48	49	49	48	48	48	48	47	48	47	48	48	48	48	49	49
125P05822	US-601/Pageland Hwy	0.02	41	41	41	41	41	39	38	36	36	34	35	34	33	33	33	36	36	36	37	36	37	36	39	40
125+05822	US-601/Pageland Hwy	0.12	39	39	39	40	39	38	37	35	35	32	31	30	29	29	29	33	34	34	35	35	35	34	36	37
125+07487	E Franklin St	1.21	42	43	42	43	43	43	42	39	38	40	40	40	39	39	39	37	38	37	40	43	41	38	41	41
125+07486	NC-200/Morgan Mill Rd	1.11	43	44	44	44	45	45	44	41	40	42	42	41	39	40	40	35	34	34	37	39	40	39	42	43
125P05821	US-601/NC-200/Concord Hwy/Skyway Dr	0.35	51	50	50	51	51	51	51	51	50	50	50	50	49	49	50	50	49	49	50	49	50	49	50	50
125+05821	US-601/NC-200/Concord Hwy/Skyway Dr	1.58	43	43	44	44	44	43	41	39	37	36	36	34	33	31	32	30	30	30	32	37	39	36	40	41
125+05820	Roland Dr	6.86	49	50	50	50	50	50	48	46	47	48	48	47	46	45	46	46	45	44	46	45	46	46	48	48
125+05819	Indian Trail Fairview Rd	1.27	52	52	52	53	52	52	48	48	48	48	47	46	45	44	43	40	35	32	35	38	46	46	50	51
125+05818	Stallings Rd	0.75	52	52	52	53	52	52	48	45	46	40	37	37	25	24	28	29	29	19	23	36	45	47	50	51
125P05817	I-485	0.76	56	56	56	56	57	56	57	56	57	57	57	57	56	56	56	56	53	50	53	53	55	56	56	56
125+05817	I-485	0.44	49	49	49	49	49	48	48	48	48	48	48	47	46	46	46	47	46	44	46	45	46	46	48	49
125+05816	Matthews Mint Hill Rd	0.26	47	47	47	46	46	44	43	40	41	39	40	39	36	36	35	35	34	31	36	37	39	41	45	46
	Avg speed US-601 to NC 205		49	49	49	49	50	49	49	49	48	49	49	48	48	48	48	47	48	47	48	48	48	48	49	49
	Avg speed I-485 to Fowler Secrest		50	51	51	51	51	51	49	47	48	48	48	47	46	45	45	45	43	41	43	44	46	47	49	49
	Avg speed Fowler Secrest to US-601		43	44	44	44	44	44	43	40	39	40	40	39	37	37	37	35	35	35	37	40	40	38	41	42
	Average US 74 EB Corridor Speed (mph)		48	49	49	49	49	49	48	46	46	47	47	46	45	44	45	44	43	42	44	45	46	46	48	48

Average Speed for US 74 from NC 205 (Elm St.) to I-485
Westbound US 74 Corridor Average Speed

TMC CODE	SEGMENT NAME	LENGTH (MILES)	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
125-05816	Matthews Mint Hill Rd	0.43	47	47	47	48	48	46	41	29	25	32	36	34	29	31	32	32	32	30	31	37	40	41	46	47
125N05817	I-485	0.91	56	55	55	56	56	56	54	42	42	55	56	56	55	55	56	55	55	54	54	54	54	54	55	56
125-05817	I-485	0.61	52	52	52	53	53	53	49	47	48	50	51	51	50	50	50	50	49	47	47	47	49	48	51	51
125-05818	Stallings Rd	1.26	50	50	51	52	52	51	43	34	38	47	49	48	47	47	47	45	43	36	36	44	46	46	49	50
125-05819	Indian Trail Fairview Rd	6.86	48	49	49	49	49	49	46	43	45	46	46	45	42	42	41	40	40	37	40	44	45	44	47	48
125-05820	Roland Dr	1.66	44	44	45	45	45	45	45	37	35	38	39	37	36	36	36	35	34	31	34	37	37	38	42	43
125N05821	US-601/NC-200/Concord Hwy/Skyway Dr	0.30	49	49	49	49	50	50	51	50	49	49	49	49	48	49	49	49	49	48	49	49	49	48	49	49
125-05821	US-601/NC-200/Concord Hwy/Skyway Dr	1.07	44	44	44	44	45	45	45	43	42	40	40	39	38	38	38	38	38	38	41	42	41	40	42	43
125-07486	NC-200/Morgan Mill Rd	1.22	40	41	41	41	41	42	41	37	35	34	34	34	33	33	33	34	34	34	36	38	37	37	39	40
125-07487	E Franklin St	0.11	36	36	37	36	37	36	34	30	28	29	29	28	27	27	27	27	27	28	28	31	31	31	35	38
125N05822	US-601/Pageland Hwy	0.01	36	36	37	36	37	36	33	30	28	31	31	30	29	29	29	30	31	31	31	34	33	32	35	36
125-05822	US-601/Pageland Hwy	8.55	48	48	48	48	49	48	48	47	46	47	47	47	47	47	47	47	47	47	47	48	47	47	48	48
	Avg speed Marshville to US-601 intersection		48	48	48	48	49	48	48	47	46	47	47	47	47	47	47	47	47	47	47	48	47	47	48	48
	Avg speed US-601 to Roland Dr		43	43	44	44	44	44	44	39	38	38	38	37	36	36	36	35	36	35	37	39	39	39	41	42
	Avg speed Roland to Matthews Mint Hill		49	50	50	50	50	50	46	41	43	47	47	46	44	44	43	42	42	39	41	45	46	45	48	49
	Average US 74 WB Corridor Speed (mph)		48	48	48	48	49	48	47	43	43	45	45	45	44	44	43	43	43	41	43	45	45	45	47	47

Hartgen Report Page	General Topic	Comment #	Comment (Observation #5)	Response
				

Hartgen Report Page	General Topic	Comment #	Comment (Observation #5)	Response
				

Hartgen Report Page	General Topic	Comment #	Comment (Observation #6)	Response
28	Induced Travel	55	**The DSFEIS leaves unanswered key questions regarding induced travel.** The DSFEIS describes methods and results for an estimate of "induced land use development." This estimate, about 3.4% (an increase of development from 125,000 acres "no-build" to 128,200 acres "build," compared with a base-year value of 95,200 acres), includes induced-growth impacts for residential, commercial, industrial, and other land uses. A variety of methods are used to make this estimate, including one developed by this reviewer (Hartgen) in 2000, a review of estimated industrial land use impacts, and a review of development forecasts in the original EIS.	The NCDOT considered how changes in socio-economic data related to the project's indirect and cumulative effects could affect the traffic forecasts for the Monroe Connector/Bypass. This question is considered in detail in the *Monroe Connector/Bypass Traffic Forecast Summary Memorandum*, HNTB (November, 2013, superseded by May, 2014). 2030 Build MRM11v1.1 model runs using 2009 Socioeconomic (SE) data and 2009 ICE SE data were prepared to assess potential impacts to raw model output volumes using the four-step modeling process. As discussed in Section 2.5.2 of the *Draft Supplemental Final EIS*, a sensitivity analysis was conducted using the most current version of the MRM (MRM 11v1.1) available at the time of the *Draft Supplemental Final EIS* to see how raw model output would change between the 2009 socioeconomic (SE) data used in the model and a modified 2009 SE data set that includes the potential induced growth forecasts from the *Monroe Connector/Bypass (R-3329/R-2559) Indirect and Cumulative Effects Quantitative Analysis Update* (Michael Baker Engineering, Inc., November 2013) (*Quantitative ICE Update*). After extensive review of model outputs, it was determined that changes in SE data (between the baseline SE and ICE SE data sets) caused relatively minor changes in raw output traffic volumes in the MRM model runs. Maps 16 thru 19 from the *Quantitative ICE Update* comparing 2030 No-Build and Build land use scenarios are referenced on slides 11 thru 14 in **Appendix A**. Based on the comparison of 2030 Build MRM11v1.1 model runs using 2009 SE data and 2009 ICE SE data, the volume changes and percent changes are not substantial. The change in VMT and VHT in Union County is 3 percent and 4 percent respectively, while changes in Mecklenburg County and across the MRM network are approximately zero percent. It was concluded that these minor variations in raw model daily volume assignment will not affect the conclusions of the traffic forecasting development process. It was concluded that since the travel demand model outputs are just one of many factors considered in the development of a project specific traffic forecast, it can be reasonably concluded that changes in the socioeconomic data due to potential induced growth from the Monroe Connector/Bypass would not substantially or significantly alter the future Build scenario traffic forecasts for the project study area. As documented in the *Monroe Connector/Bypass Traffic Forecast Summary* (HNTB, November, 2013, superseded by May, 2014), MRM14v1.0 output provided by CRTPO (Charlotte Regional Transportation Planning Organization formerly MUMPO) on February 3, 2014 was considered. The raw model daily volume assignment data from a run of MRM06v1.1, that was used in the development of the No-Build and Build traffic forecasts used in the May 2010 FEIS, was compared to a model run using the MRM14v1.0 (with 2013 SE data). Overall corridor VMT results indicate that, even with an updated model network (MRM14v1.0), SE data (2013), and methodology, the Monroe Connector/Bypass is still generally attracting similar levels of demand as MRM06v1.1 and 2005 SE data used in the 2030 Build forecast. In addition, the MRM14v1.0 is predicting more demand for the existing US 74 corridor. Thus, it is reasonable to conclude that the MRM14v1.0 assigns similar magnitudes of raw travel demand model daily volume assignment to the Monroe Connector/Bypass and US 74 compared to MRM06v1.1. Indirect and cumulative impacts to traffic are also considered in Section 5.8 of the *Monroe Connector/Bypass (R-3329/R-2559) Indirect and Cumulative Effects Quantitative Analysis Update* (Michael Baker Engineering, Inc., November 2013). The evaluation concludes that overall, induced growth impacts of the proposed project will add to the total volume of traffic in Union County and to the total vehicle miles traveled and vehicle hours traveled. Roads that connect to the Monroe Connector/Bypass will likely see some increases in traffic. However, the increases in traffic are modest and would not likely create substantial congestion issues within the design year of the project, particularly given that the impacts will be spread across the many miles of transportation facilities throughout Union County. Thus, the traffic impacts of induced growth do not appear to be substantial enough to result in indirect or cumulative effects to roadway congestion or overall traffic levels. As documented in the *Review of Draft CRTPO Socioeconomic Projections Memorandum* (Baker, March 20, 2014), the Charlotte Regional Transportation Planning Organization (CRTPO) socioeconomic projections developed for the 2040 Metropolitan Transportation Plan (MTP) was compared to the projections used in the Indirect and Cumulative Effects (ICE) Quantitative Analysis Update (Quantitative Analysis Update) for the Monroe Connector/Bypass (R-3329/R-2559) completed by Baker in November of 2013. This comparison determined that a reanalysis of the indirect and cumulative effects using the new 2014 Projections would likely lead to similar conclusions regarding the indirect and cumulative effects of the Monroe Connector/Bypass.

Hartgen Report Page	General Topic	Comment #	Comment (Observation #6)	Response
28	Land Use Forecasts	56	**Are there different land use forecasts for each alternative?** The documentation of the changes in land use forecasts do not specifically address the question of whether separate land use forecasts were prepared for all alternatives, or (more likely) for just one Build alternative, a generic "corridor" alternative, and the No-build. This raises the question of whether, for modeling purposes, the induced impacts of *other alternatives* (e.g., an "on-current alignment" upgrade of U.S. 74) should also have been studied.	The commenter is incorrect. It is not necessary to study in detail the induced impacts of alternatives that have been eliminated from detailed study, such as the Improve Existing Roadways Alternatives. A qualitative *Indirect and Cumulative Effects Assessment* (HNTB, February 2009) was prepared for the Detailed Study Alternatives (DSAs), as summarized in Section 7 of the *Draft EIS*. The qualitative assessment identified areas of potential growth or land use change under the No-Build and New Location scenarios. There would be no substantial differences between new location Detailed Study Alternatives. In addition, see response to **Comment #55** in this table.
28	Land Use Forecasts	57	**Are the land use forecasts carried into the modeling, through trip generation, trip distribution and assignment steps?** Nowhere in the material submitted is it specifically stated that the different land use forecasts were then used to re-estimate trip generation, trip distribution, and then assignments of estimated traffic. This might be implied by the discussion of "raw model volumes," but the report does not actually explain how the adjusted volumes were calculated. Elsewhere (Appendix C- 3, section 6.7) the description of the method seems to imply that standard traffic forecasting methods (trip generation, distribution, and assignment) were NOT used in the revised EIS. So, which is it? Was a standard 4-step model used for the DSFEIS, or not?	Specific model modifications and runs completed for the quantitative indirect and cumulative effects analysis are described in response to Comment #55 in this table. As documented in the *Monroe Connector/Bypass Traffic Forecast Summary* (HNTB, November, 2013, superseded by May, 2014), a standard 4-step model approach, using the Metrolina Regional Model, MRM11v1.1 as the base model, was used to develop raw trip generation, trip distribution, and then daily volume assignment. The raw model daily volume assignment were developed and compared for the 2035 No-Build and Build conditions utilizing the appropriate available socioeconomic data sets (2005 SE, 2008 Interim, 2009 SE and 2009 ICE SE data). Based on a direct comparison of these raw model daily volume assignments It is reasonable to conclude that the differences between these sets of socioeconomic data would not substantially change the traffic forecast.
29	Model Assignment	58	**Do the trip distribution and assignment steps in the traffic forecast for the "no-build" alternative now exclude "project-induced travel" development and exclude the Bypass in the No-build forecast?** It is still not clear if the land use, trip generation, trip distribution and assignment steps described in the DSFEIS include the project's effect. For instance, even if the land use forecasts were found to be the same for "build" and "no-build" scenarios, the trip distributions from them would certainly NOT be the same since they undoubtedly included the Bypass in distributing trips between TAZs. If the trip distributions for the no-build alternative included the proposed Bypass in the network, then that would incorrectly forecast the traffic using the no-build network.	The No-Build MRM model runs did not initially include the effects of induced travel/development, as those effects were captured in separate model runs for the Build Alternative as described in response to **Comments #55 and #56** above.
29	Induced Development	59	**If not, how do the traffic forecasts actually reflect the induced development?** The DSFEIS needs to state clearly, in professional "modeling" language that can be reviewed by independent experts, exactly how the revised traffic forecasts for the "build" and the "no build"	See response to **Comment #55** in this table.

Hartgen Report Page	General Topic	Comment #	Comment (Observation #6)	Response
			were prepared.	

<table>
<tr><th>Hartgen Report Page</th><th>General Topic</th><th>Comment #</th><th>Comment (Observation #7)</th><th>Response</th></tr>
<tr><td>29</td><td>Traffic Forecasts</td><td>60</td><td>Questions remain concerning details of traffic forecasts.
The extensive coverage of induced traffic issues in the DSFEIS does not contain a commensurate discussion of the traffic forecasting method itself, so the reader is left to understand that the assumptions in the original traffic model forecast remain valid.</td><td>See response to Comment #s 61 through 68 in this table.
Exhibit 1 provides a timeline of project-related socioeconomic projections, traffic forecasts and traffic & revenue studies.
Exhibit 1: Traffic Forecast & Socioeconomic Projections Timeline
 
</td></tr>
<tr><td>29-30</td><td>Land Use Forecasts</td><td>61</td><td>Was the MRM used with the updated ICE land use forecasts to estimate future traffic volumes?
The DSFEIS states that changes were made to land use to account for the induced effects, and "then the [Metrolina Regional] Model was run…" implying that the full generation-distribution-assignment sequence was used. The technical documentation further reports an 3.5% increase of VMT in</td><td>The question of "if the traffic forecasts that were used in the May 2010 FEIS are still valid" was documented in the Monroe Connector/Bypass Traffic Forecast Summary (HNTB, November, 2013, superseded by May, 2014). Based on that assessment of 2012 NCDOT AADT volumes, the Metrolina Regional Travel Demand Model (MRM06v1.1, MRM11v1.1 and MRM14v1.0), a comparison of available socioeconomic data sets (2005 SE, 2008 Interim, 2009 SE and 2009 ICE SE data), and existing US 74 corridor travel time runs, it was determined the No-Build and Build traffic forecasts used in the May 2010 FEIS are still valid for the purposes they were used and the development of additional project level traffic forecasts were not required.</td></tr>
</table>

Hartgen Report Page	General Topic	Comment #	Comment (Observation #7)	Response
			Union County as a result. But elsewhere, the Traffic Forecast Memo Appendix (Nov. 8, 2013) states: "*This approach uses the original accepted forecasts and base data assumptions to mathematically calculate traffic estimates and redistributions of traffic for conditions not included or known at the time of the initial forecast. This methodology is appropriate because the differences being considered do not change the original forecast, assumptions, methodology or base data. The interpolation and extrapolation process is a method for developing new data points for years not considered in the base forecast but within the range of volumes established by the base forecast.*" And at a later point the documentation says: "*Based on a meeting with NCDOT Transportation Planning Branch (TPB) on March 21,2013 and the document Guidelines to Determine When to Request an Updated Traffic Forecast 2 (NCDOT TPB, February 24, 2009), the current Build traffic forecasts meet the guidelines that indicate the existing forecast is valid and an updated forecast is not warranted. All of these guidelines are met since no new alternatives have been identified, the current let date of the project is less than the Future Forecast Year plus 20 years, the study area is not experiencing growth not previously considered in the forecast, and the traffic forecast is not five years older than the Base Year.*" These different statements make it unclear as to exactly whether new traffic forecasts were prepared using the MRM, or by some other method, or not at all.	
30	Truck percentage	62	**Truck percentages.** It is well known that truck traffic forecasting is one of the weakest elements of traffic modeling. For proposed toll roads, the issue is doubly important as trucks constitute typically 5-10% of traffic but pay 20-40% of toll revenue. Nowhere in the report does it clearly state the assumptions for truck forecasts, but most studies generally use current truck percentages and apply them to future ADT estimates. This simple "take down percent" for regional truck forecasts is probably inappropriate if it has not been updated since the Recession, because the Recession significantly affected truck travel too.	See pages C3-4 and C3-5 of the *Draft Supplemental Final EIS* regarding projected truck traffic on the project and existing US 74.
30	Time of day percent	63	**Time of day percentages.** In standard modeling practice, time-of-day percentages (so-called K factors for peak hour travel) are assumed to be about 9-	Then NCDOT methodology was followed in the traffic forecasting process for the Monroe Bypass by using ground count data to initially develop the associated K Factors". Model data was not directly used in the development of the K Factors, although the MRM assigns traffic in multi-hour (peak period, off peak) blocks of time to account for peak hour spreading effects.

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			10 percent of ADT, based on historical traffic counts. However, in many regions peak periods are lengthening as commuters shift start times to avoid congestion, and work trips are declining as a percentage of total travel. In more advanced models these effects are accounted for by feedbacks between time-of-day assumptions and traffic assignment. The MRM does not apparently account for such trends, either through feedbacks or by increasing the length of peak hours.	Per the *Project Level Traffic Forecasting Administrative Procedures Handbook* (NCDOT, May 2011), "Design K Factor (K) – The K factor is the DHV expressed as a percentage of the AADT, or K=DHV/AADT. K factors differ by location and facility type. NCDOT has automatic traffic recorders located throughout the state which count traffic for all hours of the year. From these counts, the K factor can be calculated. Typically the K factor is estimated by examining traffic counts taken for the specific forecast, and additionally comparing with related sites which do have automated traffic recorder stations."
30	Traffic and revenue	64	**The value of time used for modeling is unclear.** The Traffic and Revenue Study states the values of time for trip classes, $7- 22/hr for trucks, and $7-8/hr for cars. These values seem low for both cars and trucks, given national studies. Elsewhere in this review we note that a high value of time, about $18/hr, would seem to be necessary to create substantial diversion. A high value of time for trucks would similarly be needed for substantial truck diversion. As the estimated toll for trucks on the proposed Bypass would be over $10, the value of time for trucks would seem to be too low to induce much diversion	The *Final Report Proposed Monroe Connector/Bypass Comprehensive Traffic & Revenue Study* (Wilbur Smith Associates, October 2010) clearly discusses value of time used in the study. The commenter alludes to the fact that the traffic and revenue study values for time seem low, which would be a conservative way to approach the issue so as not to over-predict trip diversion. The commenter then returns to his estimation of a high value of time necessary to create diversion, but only referencing current travel conditions. No analysis is made by the commenter for future conditions when US 74 would be more congested and the time savings would be much greater – regardless of the value placed on time savings.
31	Travel time	65	**The *reliability* of travel time has not been considered in diversion or benefits.** Recent research on travel time reliability (the value that travelers place on the *certainty* of arriving within a given time window) suggests that this value is quite high, perhaps higher than the value of time itself. Several national studies have developed guidelines for including reliability in traffic forecasting, and how improved operations affect reliability. These methods have not been incorporated into the analysis of the Monroe Connector/Bypass or its alternatives.	Travel time reliability is not currently a metric that is required to be incorporated or replicated in the travel demand modeling or traffic forecasting process in North Carolina. However, its use as a metric to assess project benefits would add to the viability of the Build Alternative, since reliability of travel times decreases in congested conditions that are predicted for the existing US 74 corridor in the No-Build scenario.
31	Capacity	66	**Road capacities have not been updated.** The DSFEIS forecasts rely on regional networks that use estimates of highway capacity from the 2000 Highway Capacity Manual. The new Highway Capacity Manual generally raises highway capacities for various road classes, and significantly changes the capacity estimation and level-of-service procedure for urban and rural arterials such as U.S. 74. In particular, the new method for estimating capacity for signalized arterials includes signal progression, access points, and traffic volumes, all of which are obviously relevant for study of U.S. 74. These updated capacities have apparently not been used in	Development of the MRM travel demand model is based on the latest available information and factors other than the Highway Capacity Manual (HCM). HCM 2010 information was not readily available until 2012, after the model was developed. In either case, the commenter is overstating the changes between HCM 2000 and 2010 with regards to certain capacity methodologies and does not provide an explanation for his opinion that the incorporation of the HCM 2010 would have an effect on the MRM results.

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			the traffic modeling. If the estimates of capacity for U.S. 74 are too low, the effect would be to over-state future congestion estimates on U.S. 74, and thus over-state diversion to the Bypass, and also under-state the viability of other alternatives.	
31	Capture Rate	67	**Market capture rates (40-50%) seem very high.** While the percentage of non-local traffic was not calculated as part of the traffic forecasts for the project, given that less than half of the traffic on U.S. 74 is appears to be non-local, the overall capture rate of around 50% suggested by the traffic forecasts seems very optimistic indeed. Assuming a generous capture rate of 50% of non-local trips, an overall capture rate less than 25% seems more likely, and even that might be too high if the diverters are infrequent rather than every-day diverters, as the forecast assumes.	See response to **Comment #33** in this table.
31	Traffic forecast	68	**Earlier errors in the 2030 and 2035 traffic forecasts reduce confidence in current estimates.** The report notes that earlier traffic forecasts, by Wilbur Smith Associates (now CDM Smith) contained errors resulting in higher traffic forecasts. This revelation raises questions about whether the current traffic estimates can also be trusted.	We disagree with the commenter's assertion. For the *Draft Supplemental Final EIS*, NCDOT systematically re-visited all of the traffic forecasts to determine whether they were still valid and reliable. Based on additional review, analysis and comparison, it was determined that the existing traffic forecasts remain valid and reliable and it was unnecessary to perform new traffic forecasts, as explained in Section 2.5.2 and Appendix G of the *Draft Supplemental Final EIS*.

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32	Costs	69	**Project cost and cost-effectiveness are not detailed.** Environmental impact statements generally contain comparative estimates of cost for viable alternatives. The DSFEIS reports an estimated cost range of $845-923 million (in year of expenditure, assuming award in October 2014 and opening in October 2018). But the discussion of costs for the Monroe Connector/Bypass is incomplete: • If the construction of the road is delayed significantly, which might happen given environmental and financing issues, this cost estimate is likely to be higher. • No data is provided for maintenance and operation costs after construction but during service life, converted to present worth, for various alternatives. • No costs are shown for other alternatives, particularly those for various upgrades of U.S. 74. This appears to violate NEPA regulations that require comparable evaluation of viable alternatives. • No data is provided on the relative cost-effectiveness of the alternatives. Most EISs show costs, benefits and cost-effectiveness, using such measures as benefit-cost ratios, for various alternatives, not just for the recommended alternative. • The DSFEIS contains no summary table that compares the impacts, costs, benefits, and other features of the viable alternatives.	The NCDOT undertook a detailed investigation of the project cost information included in the *Draft Supplemental Final EIS* and determined the values shown should be revised to most accurately reflect remaining project costs. The *Draft Supplemental Final EIS* cost data did not consider the design build contract awarded, the work completed, or the right of way purchased since the original 2010 *Final EIS*. The delays experienced by the project were also not considered. Updated costs are presented in the *Final Supplemental Final EIS*. The assertion that the cost was not considered for the other project alternatives studied is simply incorrect. Construction costs were developed and compared for all preliminary study alternatives as presented in Table 2-4 of the 2009 *Draft EIS*. The NCDOT's original approach to financing the project is documented in the *Monroe Connector/ Bypass Project Initial Financial Plan*, submitted to FHWA on September 27, 2011. It is important to note the *Initial Financial Plan* was developed after the issuance of the previous *Record of Decision* (ROD) and the procurement and opening of design-build contract price proposal to construct the project. Due to the legal challenge, the previous ROD has been rescinded and the project construction has been put on hold. The ultimate impact to the project schedule is still undetermined at this time. Therefore, the information needed to determine the true impact to the financial plan is not available. Based on the cost information developed for the *Final Supplemental Final EIS*, funds will be available in the State Transportation Improvement Plan (STIP) to cover the estimated increase in the project cost. Regarding monetary cost-benefit ratios and analysis, as stated in 40 CFR 1502.23: "For purposes of complying with the Act [NEPA], the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations." An exception is cited in 23 CFR 650.809 for moveable span bridges: "If there are social, economic, environmental or engineering reasons which favor the selection of a movable bridge, a cost benefit analysis to support the need for the movable bridge shall be prepared as a part of the preliminary plans." A movable span bridge is not proposed as part of the Monroe Connector/Bypass.

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<tr><th>Hartgen Report Page</th><th>General Topic</th><th>Comment #</th><th>Comment (Observation #9)</th><th>Response</th></tr>
<tr><td>32-3</td><td>External Trips/Trucks</td><td>70</td><td>

External traffic forecasts for U.S. 74 and other roads is not discussed.

In modeling terminology, “external traffic” is that traffic which leaves, enters or goes through the study area. The issue of how to forecast external traffic is particularly severe for proposed projects on the edges of regions, such as the proposed Monroe Connector/Bypass, which ends at the far eastern edge of the MRM coverage area. Specifically, the traffic on U.S. 74 just east of the proposed project terminus is treated as “external” traffic, and therefore is not forecast directly using the MRM. Instead, external traffic is forecast separately using a variety of methods such as trend-lining, statewide modeling, or inter-regional modeling. It is then typically added to the internal (within the Model) forecast of trip ends, or is added to trip OD matrices, or is added directly to network volumes as a “pre-load.” In each case, the separate treatment of external traffic is in addition to that of within-region traffic modeling. In some cases, such as on U.S. 74 just east of the project, external traffic could be as much as 30-40% of traffic volume. This includes truck traffic, which is often a significant portion of smaller-region external traffic.

In the case of the proposed Bypass, our review of recent traffic count history at the far eastern edge of the region (Union-Anson County line) shows that the *external traffic has actually been declining* in recent years.

U.S. 74 Average Daily Traffic at the Union-Anson County Line

<table>
<tr><th>Count Location</th><th>2000</th><th>2005</th><th>2010</th><th>2012</th><th>12-year Percent Change per year</th></tr>
<tr><td>Anson-Union Line</td><td>15000</td><td>15000</td><td>14000</td><td>13000</td><td>-1.1</td></tr>
</table>

Source: NCDOT Traffic Count Maps, *available at* www.NCDOT.gov.

Neither the DSFEIS nor the earlier documentation we looked at contains references to external traffic, leaving the reader completely in the dark as to how it was forecast, whether the current count history was considered or the 2009-12 Recession was accounted for. However, given the huge changes in recent US economic activity, it is likely that any forecasts of external traffic prepared before the Recession would now have to be substantially revised.

</td><td>

As part of the MRM development process, the Metrolina Region External Travel Survey (May 2003) was conducted. One of the data collection points was located at US 74, east of Wesley Chapel Road, which lies within the project study area. The results of this study were used in the development of the MRM to develop the travel demand model.

The MRM was used in the development of project-specific forecasts to calculate future growth within the study area (i.e. 2035). While recent growth trends have been slightly impacted by the recession, future long-term growth trends are still projected to increase over existing conditions, further substantiating the need for the Monroe Connector/Bypass project. It is important to note that the traffic volumes are not forecasted to grow evenly along the corridor. The west end of the study area is forecasted to grow almost three times faster than the east end. It is to be expected that growth rates will fluctuate from year to year.

The commenter incorrectly draws conclusions based on four data points over a 12-year period. As described in the NCDOT Transportation Planning Branch *Project Level Traffic Forecasting Administrative Procedures Handbook*, dated May 3, 2011, long-term (20 years) historical travel data should be considered. This was done in the development of the project level traffic forecasts for the Monroe Connector/Bypass project. (See Table 3 of the *Traffic Forecast for the No-Build Alternatives for NCDOT State TIP Project No. R-3329 and NCDOT State TIP Project No. R-2559*, *Monroe Connector/Bypass Study,* Martin/Alexiou/Bryson (MAB), June 2008; *Technical Memorandum for TIP Projects R-2559 & R-3329 US74 Upgrade Scenario*, Wilbur Smith Associates (WSA), June 2008; Exhibit 3 of the *Traffic Forecast for TIP Projects R-3329 & R-2559 Monroe Connector/Bypass*, WSA, September 2008). The MAB and WSA forecast considered over 600 data points over a 26 year period and over 500 data points over a 20 year period respectively in the development of their project level traffic forecasts, cited above.

</td></tr>
</table>

Hartgen Report Page	General Topic	Comment #	Comment (Observation #10)	Response
33-34	Modeling Uncertainty	71	**Considerable uncertainty exists in traffic modeling.** Traffic modeling and forecasting is a craft, not an art or a science. The process is fraught with uncertainty throughout because each step in the process involves the use of critical and generally not-verifiable assumptions concerning the nature of growth or traffic. Uncertainties in the myriad assumptions that must be made in virtually all of its steps have the effect of making "output" uncertainties substantial. The DSFEIS supporting documents recognize this uncertainty, but only for land use inputs, noting that errors in population and land use forecasts can be very high. "*For county level projections of 25 years, the typical mean algebraic percentage errors are about 30 percent while for census tracts (which are typically larger than TAZs) errors are typically 45 percent for the same period. Thus, <u>despite the best efforts of</u> <u>researchers and forecasters, the error rates for long-range projections are still quite</u> <u>high and thus any projection or estimate of induced and cumulative effects must be</u> <u>considered the best estimate within a wide range of error</u>. The accuracy of projected growth under any future scenario could be affected by many variables. These include individual owner or developer actions, the timing of or changes in utility provision, changes in local or state regulations on land use and, most importantly, changes in national or regional economic conditions. While the potential for error is high, the techniques used by the MPO are the best available and provide the best available data for projecting population and employment conditions in the future.*" Such "input" errors and also errors in model calibration are also carried forward into traffic forecasts. However, just because the techniques of land use forecasting are the "best available" does not mean that their results can be trusted for decision-making. In addition to large errors in inputs, and errors in calibration (discussed above) recent studies have found wide variations in the accuracy of modeled traffic forecasts, and the errors can be either an "under" or an "over" forecast. A study of 20-year traffic forecasts for Minnesota found that freeway traffic was *under*-forecast by about 5%, while forecasts for other roads were *over*-forecast by 14-29%. On the other hand, a US national review of toll road forecasts found that for 15 US toll roads, the actual traffic averaged 35% *under* the predicted traffic. In England, the Department for Transport found that 90% of major road traffic forecasts were within 43% of actual traffic — a very wide spread for policy making. In another study of 104 toll roads worldwide, Bain found that after correcting for "optimism bias" the average 20-year- out actual traffic was about 20% *under* the predicted traffic. Also worldwide, Flyvbjerg and colleagues found in a review of 258 road and transit projects that the actual road traffic averaged about 17% *under* the forecast traffic, but actual costs were 250% *over* the forecast cost, with toll roads in particular having larger errors. *In short, the limited reviews so far have found that the average error in 20-year forecasts of road traffic range from ±20% upwards to ±30-40%, with most actual traffic coming in substantially under the forecast traffic.* The errors are also substantially higher for toll roads, leading some observers to suggest that "optimism bias" may be substantially inherent in forecasts prepared on behalf of project advocates. This author (Hartgen) has recently reviewed the topic and has found that the overall accuracy of traffic forecasts is likely to be so large that he recommends considerable caution in their use and less reliance on traffic forecasts for transportation decision-making.	Discussion provided in this section by the commenter supports the overall project process and comment responses discussed in previous sections. The traffic results and conclusions made for this project are not certain, since they are forecasts of the future, but they are the product of a detailed, approved methodology and standard process used for project-level traffic forecasting and analysis in North Carolina, and meet the requirements under 40 CFR 1502.24. The results and conclusions have gone through a detailed review and update process to ensure that uncertainty was considered and accounted for, as deemed reasonable and necessary, using the latest available data.

Hartgen Report Page	General Topic	Comment #	Comment (Observation #10)	Response
34-35	Modeling Uncertainty	72	The DSFEIS partially recognizes this uncertainty (at least in inputs) and employs sensitivity tests to evaluate the range of its results. However, the range of variation in the assumptions (for instance assumption concerning population forecasts, a 20% difference for value-of-time, a 30% difference in economic growth, the use of electronic toll collection, and 5% difference in fuel prices) do not seem to be extreme enough given recent history. The recent experiences of South Carolina's Southern Connector, in bankruptcy, the New York court case regarding toll-road forecasts in Detroit and Alabama, and North Carolina's Triangle Expressway — built 6-lanes wide but carrying just 20,000 ADT near I-40 and 4,000-6,000 ADT elsewhere — all encourage extreme caution in the use of traffic and revenue forecasts for decision-making, particularly for proposed toll roads where project risk is shifted to distant investors, or if fiscal failure occurs, to the People of North Carolina.	The range of variation applied in sensitivity tests of variables employed in the traffic and revenue forecasts for the Monroe Connector/Bypass follows toll industry standards for evaluation of projected traffic demand, given a conservative range of potential variation. It is the commenter's own opinion, with no citation to any published source or reference, that these sensitivity ranges are not "extreme" enough to encapsulate what would be a multitude of possible outcomes. Proper caution has been exercised through the traffic and revenue forecast, project-level traffic forecast, and in all travel demand models utilized for the project to capture, to the extent practicable, all potential unknowns related to variation in the forecast. The commenter's example of the Triangle Expressway as a "cautionary tale" related to traffic forecasting for toll facilities – using data showing what he alludes to be "low" traffic volumes – completely ignores the fact that the facility has only recently been open to traffic and has shown steady increases in traffic volumes and transponder sales while meeting or exceeding projections for both.

Appendix C – *2012 NCDOT Superstreet Analysis Results* (Reese, November 5, 2012)

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STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

BEVERLY EAVES PERDUE
GOVERNOR

November 5, 2012

EUGENE A. CONTI, JR.
SECRETARY

Project: SP-2012-35
Division: 10
County: Union
Description: Indian Trail – US 74 Corridor from E of I-485 to SR 1515 (Sardis Church Road)

NORTH CAROLINA PROFESSIONAL SEAL 027401 ENGINEER MICHAEL REESE

Michael Reese
5 NOV 2012

MEMORANDUM

To: Sean M. Epperson, Deputy Division Traffic Engineer
Division 10

From: Michael P. Reese, P.E., Western Region Project Engineer
Congestion Management Section

Subject: US 74 Corridor Superstreet and Traditional Intersection Capacity Analysis

As requested, the Congestion Management Section has completed a review of the subject vicinity to compare the existing traditional intersections to if a superstreet (paired directional crossovers with median U-turns) were installed along the corridor. We performed capacity analysis for the following intersections based on base year AM/PM peak hours using Synchro/SimTraffic, version 7.

1. US 74 and SR 1365 (Stallings Road) (4-leg signal)
2. US 74 and SR 1520/1008 (Indian Trail-Fairview Road) (4-leg signal)
3. US 74 and SR 1367 (Unionville-Indian Trail Road) (4-leg signal)
4. US 74 and SR 3014 (Faith Church Road)/Harris Teeter Distribution Center (4-leg signal)
5. US 74 and SR 1515 (Sardis Church Road)/SR 1377 (Wesley Chapel-Stouts Road) (4-leg signal)

Recent NCDOT Average Annual Daily Traffic Maps indicate that traffic volumes have been steady along US 74 in the last ten years, therefore no traffic volume growth was used. This analysis is based on year 2007 traffic volumes from the March 2008 Draft Traffic Tech Memo for the Monroe Connector/Bypass (TIP Projects R-3329 and R-2559) by PBS&J. Traffic counts have been conducted at these intersections in 2010, 2011, and 2012, but the 2007 volumes were primarily used since they are balanced along the corridor and generally higher than the counts. Six percent trucks were used along the entire corridor, except 50% trucks were used for all movements to and from the Harris Teeter Distribution Center. The following comments and recommendations are based on our analysis.

This analysis compares two scenarios: 1) Existing all-movement signalized intersections including some new or extended turn lanes as needed (shown in attached Figure 2); and 2) Conversion of the corridor to a superstreet with all intersections and U-turn points signalized (shown in attached Figure

MAILING ADDRESS:
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750 NORTH GREENFIELD PARKWAY
GARNER NC 27529

1). Base year analysis results and general recommendations comparing the two scenarios are shown in the following attachments:

1. Geometric recommendations
2. Arterial, intersection, and intersection approach levels of service (LOS) and volume-to-capacity (v/c) ratios
3. Maximum queuing along the corridor
4. Table comparing network operations

The superstreet analysis indicates some approaches would continue to operate at LOS F with some intersections operating over capacity (v/c > 1) and some significant queuing, but improved corridor operations can be attained with implementation of a superstreet without significant geometric improvements. Regardless of whether a superstreet is installed, widening of US 74 will be needed in the near future as traffic volumes grow along this corridor, but a superstreet can be installed in the existing median now with any future US 74 widening to the outside. In addition, superstreets separate and reduce conflict points providing improved safety compared to traditional all-movement intersections.

Therefore compared to the existing all-movement intersections, **we recommend implementation of a superstreet along this corridor**. Compared to traditional intersections, a superstreet can improve both current conditions and future traffic operations when US 74 is widened to a six-lane section.

If you have questions regarding this analysis, or if additional analysis or information is needed, please contact me or Congestion Management Project Design Engineer Mohammad S. Islam, P.E., at (919) 773-2800.

MPR/msi

Attachments

cc: J. S. Cole, P.E.,
J. K. Lacy, P.E., C.P.M.
D. D. Galloway, P.E.
M. P. Butler, P.E.
J. H. Dunlop, P.E.
M. S. Islam, P.E.

Superstreet (Signalized):

SP-2012-35 (US 74 near Indian Trail Road)

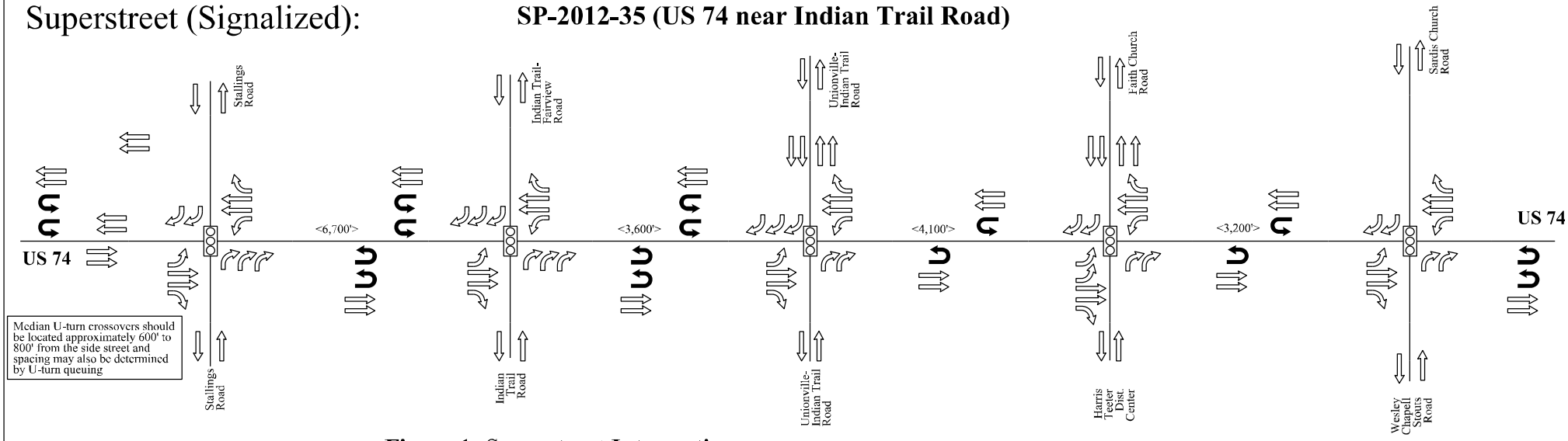


Figure 1: Superstreet Intersections

E4-79

Existing (Signalized):

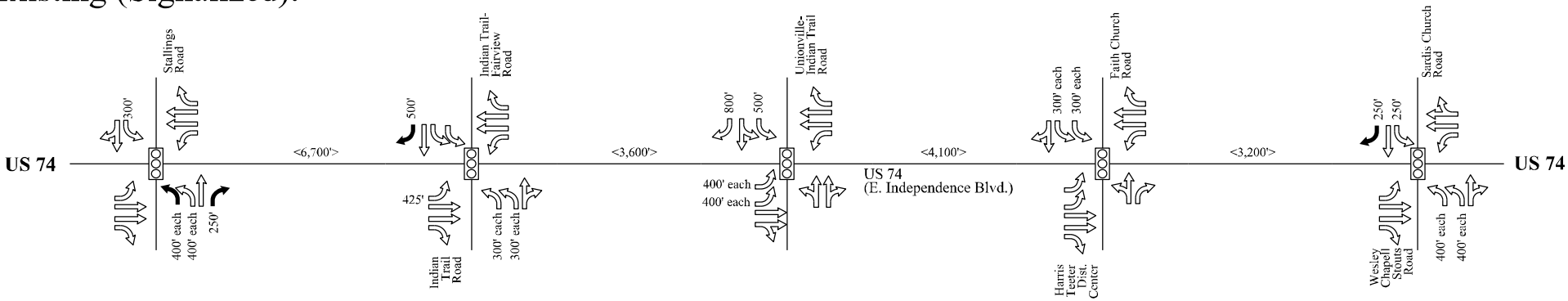


Figure 2: Traditional Intersections (with Improvements)

NOTE: In Figure 2, storage lanes length indicates extended turn-lanes storage and/or adding turn-lanes

10/18/2012 Mohammad Islam, PE

SP-2012-35
US 74 near Indian Trail - Union County

Existing Laneage
Proposed Laneage
Existing Signal
XXX New or extended storage

<XXX> Distance Between Intersections

All Distances in Feet
Drawing Not to Scale
Not for Construction

SP-2012-35 (US 74 near Indian Trail Road)

Superstreet (Signalized):

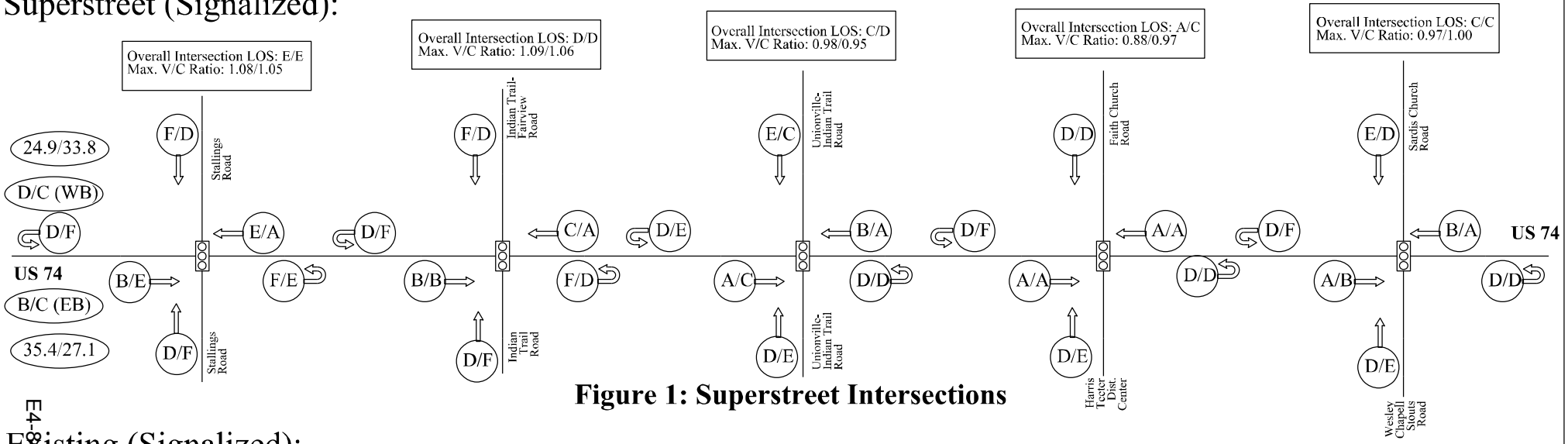


Figure 1: Superstreet Intersections

Existing (Signalized):

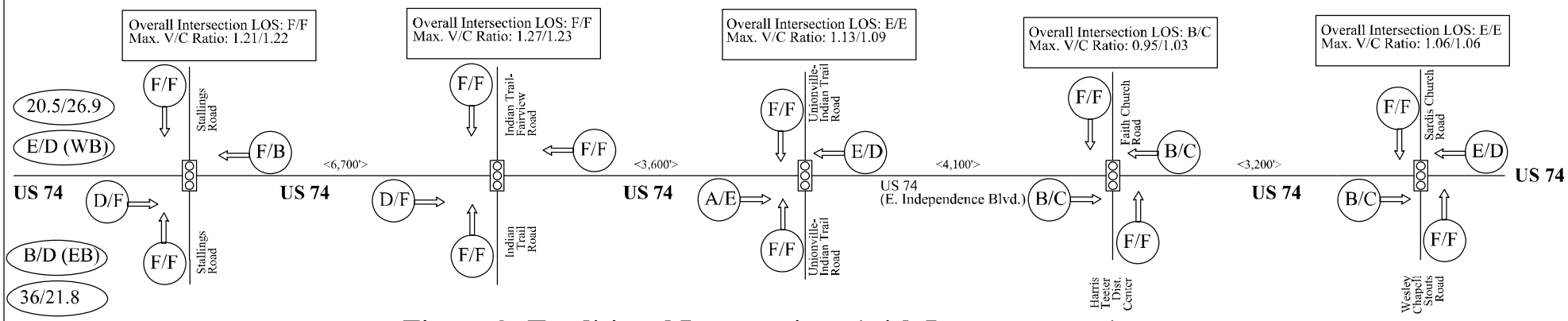


Figure 2: Traditional Intersections (with Improvements)

NOTE: Approach Levels of Service (LOS) AM/PM

Intersection LOS (AM/PM) and maximum Volume-to-Capacity (V/C) Ratio AM/PM

Arterial LOS and Speed AM/PM — Median U-turn Superstreet LOS AM/PM

10/18/2012 Mohammad Islam, PE

SP-2012-35
US 74 near Indian Trail - Union County

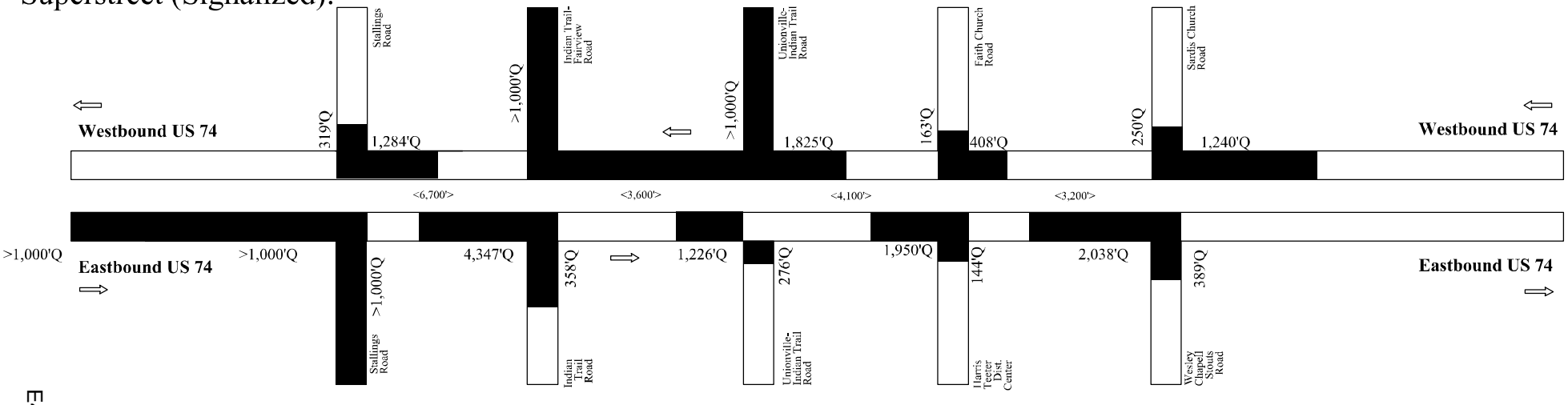
Existing Lanage
Proposed Laneage
Existing Signal
XXX New or extended storage

<XXX> Distance Between Intersections

All Distances in Feet
Drawing Not to Scale
Not for Construction

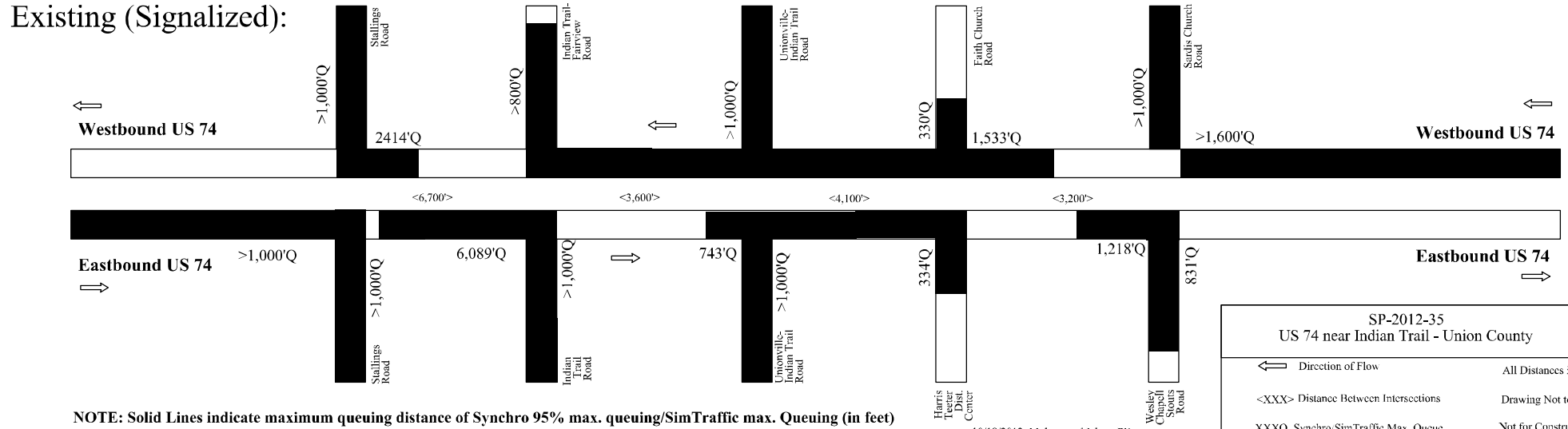
SP-2012-35 (US 74 near Indian Trail Road)
(Maximum Queue Distance in Solid)

Superstreet (Signalized):



NOTE: Solid Lines indicate maximum queuing distance of Synchro 95% max. queuing/SimTraffic max. Queuing (in feet)

Existing (Signalized):



NOTE: Solid Lines indicate maximum queuing distance of Synchro 95% max. queuing/SimTraffic max. Queuing (in feet)

10/18/2012 Mohammad Islam, PE

SP-2012-35
US 74 near Indian Trail - Union County

⇦ Direction of Flow	All Distances in Feet
<XXX> Distance Between Intersections	Drawing Not to Scale
XXXQ Synchro/SimTraffic Max. Queue	Not for Construction

US 74 from Stallings Road to Sardis Church Road - Stallings/Indian Trail - Union County

Base Year Full Network (4-Lane) Delay Analysis (Traditional vs Superstreet) *Congestion Management Section (SP-2012-35) - October 17, 2012*						
	AM			PM		
	Traditional	Superstreet	% Change	Traditional	Superstreet	% Change
Vehicles Exited (veh / hr)	7,479	8,315	11.18%	7,660	8,298	8.33%
Vehicles Entered (veh / hr)	8,209	8,763	6.75%	8,219	8,831	7.45%
Travel Distance (mi)	17,099	23,202	35.69%	16,955	22,630	33.47%
Travel Time (hr)	1,340	1,062	-20.76%	1,551	1,094	-29.50%
Total Delay (hr)	1,000	586	-41.35%	1,211	629	-48.07%
Total Stops	31,492	34,281	8.86%	28,082	37,072	32.01%
Fuel Useage (gal)	779	885	13.69%	823	883	7.40%
Per Veh. Distance (mi)	2.29	2.79	22.05%	2.21	2.73	23.21%
Per Veh. Time (hr)	0.18	0.13	-28.73%	0.20	0.13	-34.92%
Per Veh. Delay (hr)	0.13	0.07	-47.25%	0.16	0.08	-52.06%
Per Veh. Stops	4.21	4.12	-2.09%	3.67	4.47	21.86%
Per Veh. Fuel (gal)	0.10	0.11	2.26%	0.11	0.11	-0.85%
Synchro US 74 Eastbound Arterial Speed (mph)	36.0	35.4	-1.67%	21.8	27.1	24.31%
Synchro US 74 Westbound Arterial Speed (mph)	20.5	24.9	21.46%	26.9	33.8	25.65%

Appendix D – *Review of Traffic Forecasting: Monroe Connector/Bypass Draft Supplemental Final EIS* (Hartgen Report) with brackets denoting the numbered response

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Review of Traffic Forecasting:
Monroe Connector/Bypass
Draft Supplemental Final EIS, November 2013

By

David T. Hartgen, Ph.D., P.E.
The Hartgen Group
9700 Research Drive, Suite 150
Charlotte NC 28262
www.hartgengroup.net

December 26, 2013

A Report Prepared for the
Southern Environmental Law Center
Chapel Hill, NC 27516
www.southernenvironment.org

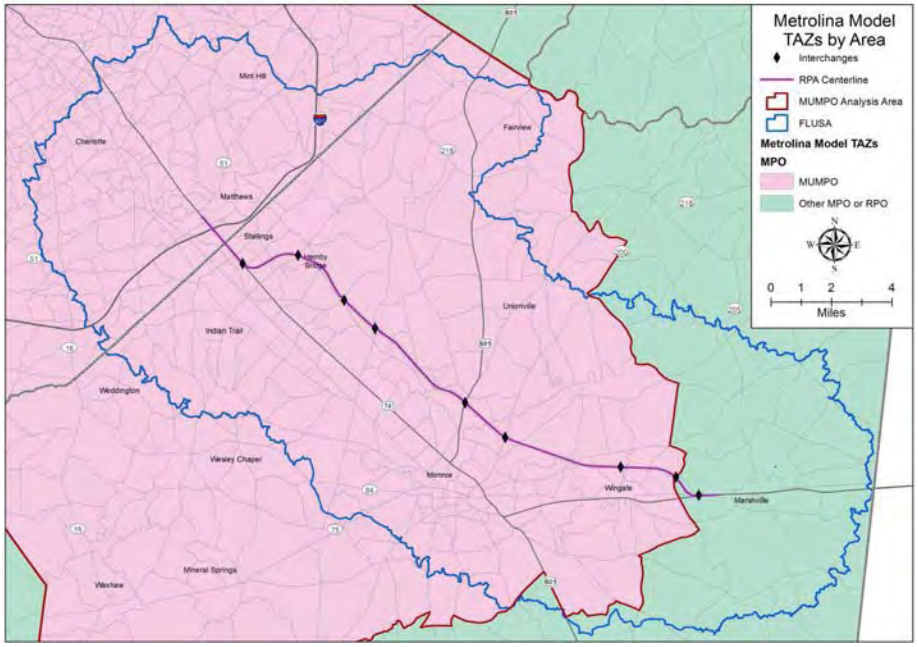
Review of Traffic Forecasting: Monroe Connector/Bypass Draft Supplemental Final EIS, November 2013

Contents

Summary of Review

The Monroe Connector/Bypass is proposed as 4 to 6 lane high-speed connector that would be sited about 1-2 miles north of present U.S. 74, its primary alternative. It would begin on U.S. 74 about 1 mile southeast of the present I-485, bypass Monroe, and re-join U.S. 74 about 1 mile west of Marshville, in eastern Union County. The approximate length is 19.7 miles. The project is estimated to cost $ 845-$923 million, funded partially by tolls. Construction would start in October 2014, with a planned opening in 2018. The following map shows the general location of the proposed road.

Proposed Monroe Connector/Bypass, Union County



The Southern Environmental Law Center has asked me to review the Draft Supplemental Final Environmental Impact Statement ("DSFEIS") for the Monroe Connector/Bypass, dated November 2013,[1] with particular focus on the traffic forecasts for the proposed Connector and U.S. 74. This memorandum documents my review of the methods used in forecasting traffic on the proposed Monroe Connector/Bypass and U.S. 74 as described in the DSFEIS and other documents.

A summary of my primary observations regarding the DSFEIS is as follows:

1. The stated Purpose and Need for the Bypass appear to have been written narrowly so that only alternatives on new alignment satisfy the stated Purpose and Need.
2. The alternatives considered appear to be inappropriately biased against upgrades to U.S. 74.
3. Traffic forecasts for 2035 were not re-computed for some alternatives, thus possibly over-stating future Bypass traffic and under-stating traffic improvements for some alternatives. Some of the recently completed and planned future improvements to U.S. 74 and their effect on traffic forecasts have not been included in the traffic forecasts, and their effect on Bypass traffic therefore appears to be under-stated.
4. Traffic growth on U.S. 74 has been flat from 2000 to 2012 and is inconsistent with population growth trends. The DSFEIS simply ignores these inconsistencies. Moreover, the forecast of population, which drives the traffic forecast, is based on a pre-Recession projection; recent population growth has slowed markedly. Essentially the entire justification for the project rests on traffic forecasts that ignore 12 years of recent history, recent economic upheaval, and slower population growth.
5. The regional travel demand model (used to forecast Bypass traffic) and the traffic operations simulation model (used to study traffic flow on U.S. 74) both appear to have been insufficiently calibrated.
6. The DSFEIS attempts to addresses the directive of the 4th Circuit Court, but leaves key questions regarding induced traffic unanswered.
7. Questions remain concerning details of the traffic forecasts. The three key assumptions of the traffic forecasts (growth of the area population, percentage diversion, and magnitude of long-distance travel) all appear to be overly optimistic.
8. Project costs and cost-effectiveness are not sufficiently detailed.
9. External traffic forecasts are undocumented.
10. Inherent uncertainty in traffic forecasts has not been sufficiently considered.

[1] NCDOT, Monroe Connector/Bypass Administrative Action, Draft Supplemental Final Environmental Impact Statement (Nov.13, 2013), *available at* www.ncdot.gov/projects/monroeconnector/download/.

11 In summary, based on these and other issues described below, my review finds that the traffic forecasts presented in the DSFEIS are too uncertain and insufficiently supported to be the basis for decision-making regarding the Monroe Connector/Bypass.

My qualifications for this review include 23 years in transportation planning and traffic forecasting at New York DOT, 18 years as Professor of Transportation Studies at UNC Charlotte, and seven years as president of The Hartgen Group, a transportation planning consultancy. In addition, I am familiar with the U.S. 74 corridor. The Appendix to this memo provides a brief overview of my qualifications. The remainder of this memo discusses my findings in more detail.

1. The stated Purpose and Need for the Bypass appears to have been written narrowly.

12 According to the DSFEIS, the purpose of the project is to: "*improve mobility and capacity within the project study area by providing a facility for the U.S. 74 corridor from near I-485 in Mecklenburg County to between the towns of Wingate and Marshville in Union County that allows for high-speed regional travel consistent with the designations of the North Carolina SHC program and the North Carolina Intrastate System, while maintaining access to properties along existing U.S. 74*."[2] This statement implies that congestion within the study area is long-distance in character, that a high-speed long-distance facility will increase study-area mobility, and that the system designations of the Legislature are inviolate. None of these assumptions are the case. Indeed, the North Carolina General Assembly has recently (2013) repealed the Intrastate System legislation.

- **The DSFEIS focuses on the second and third stated purposes, not the first**.

13 Focusing on the second and third purposes, and not the first, leads to the consideration of alternatives that are largely on new alignment, that is, off existing U.S. 74's current location. This is inconsistent with the requirements of the National Environmental Policy Act ("NEPA") and virtually all of transportation economics, in which the objective is to evaluate proposed projects by their benefits versus their costs.

- **Congestion on U.S. 74 is largely locally-based, not long-distance.**

14 The DSFEIS says that congestion on U.S. 74 is uniform throughout the day and by direction: "*Based on these field travel time runs, corridor average travel speeds are approximately 40 mph eastbound and westbound during all three peak periods.*"[3] The NCDOT travel time runs and recent INRIX data show that travel speeds are essentially uniform by direction and AM peak-lunch-PM peak (DOT 40 mph, INRIX 43-44 mph). This suggests that most of the traffic on U.S. 74 is locally-based traffic (otherwise the congestion would be more severe in peaks and nearer to Charlotte, where traffic volumes are

[2] DSFEIS at 1-3 (underlining added).
[3] *Id.* at 1-7.

14 higher). A further observation is that there is a *reduction* in traffic volume on U.S. 74 between Monroe and the Mecklenburg County line, also suggesting that the traffic congestion around Monroe is locally-based, and is not headed to Charlotte. A third point is that **t**he location of the facility, about 2 miles north of U.S. 74, means that local traffic on U.S. 74 would be unlikely to use the proposed Bypass as such use would require driving farther and out of the way for many local short trips, *and* paying a toll, to save (or perhaps even lose) travel time by using the Connector.

15 • **Long-distance traffic is low in volume.**
Traffic volumes on U.S. 74 fall off sharply at the eastern edge of Monroe, from about 38,000 ADT[4] in the vicinity of the Medical Center, to just 24,000 ADT at eastern edge of the study area, and about 19,000 ADT at Forest Hill Road, where the proposed Connector would rejoin U.S. 74.[5] Although no data on external traffic (leaving the study area) is provided, probably only 1/3 of the 19,000 ADT at the study area's eastern edge is long-distance traffic (the ADT at the Anson County line, further east, is just 13,000 and some of that is local). Even if 1/2 of the 19000 ADT were to divert to the Bypass (an optimistic assumption), the resulting drop in traffic on U.S. 74 (about 8500) would be about 6-7%, less than the typical daily variation in traffic volume. Therefore the primary justification for the Bypass, long-distance traffic, is also relatively low in volume.

16 • **The proposed Bypass is unlikely to reduce congestion on U.S. 74.**
The above two factors — most traffic on U.S. 74 is local, and long-distance traffic is quite low and might not divert — suggest that it is almost entirely local traffic, not long distance traffic or the lack of a high-speed bypass, that causes the present congestion on U.S. 74. If most congestion is locally-based, then provision of a bypass will not alleviate it. It is therefore not likely that the proposed Connector would significantly reduce congestion on U.S. 74 or improve mobility in the study area.

17 • **The DSFEIS misrepresents the availability of "sufficient funds."**
The DSFEIS states that "S*imilar to previous state and local TIPs and the conclusion in the Final EIS, current fiscally constrained planning documents do not have* <u>*sufficient funds*</u> *available from traditional sources in the foreseeable future to construct all priority projects in the state*."[6] This statement ignores the Governor's new Strategic Transportation Investment ("STI") Plan (2013), an effort to prioritize and fund highway projects by worthiness. The statement therefore pre-judges that the Monroe Bypass would not "pass muster" under the new statewide transportation prioritization formula, and therefore needs more funds in the form of tolls. But elementary

[4] ADT, Average Daily Traffic, is an estimate of traffic volume, in vehicles per day, widely used in transportation planning.
[5] NCDOT, Traffic Count Maps (2012), *available at* www.ncdot.org.
[6] DSFEIS at 1-1 (underlining added).

transportation economics teaches that a project's worthiness should be determined WITHOUT regard to its funding sources. The Monroe Bypass should be subjected to the same worthiness criteria as virtually all other projects in the state, and if found sufficiently worthy it could then be funded
17 without tolls. But no data on the project's cost-effectiveness is provided.

The Monroe Connector/Bypass is the only yet-to-be-built road project presently authorized to be directly funded by the NC General Assembly through the NC Turnpike Authority; other projects previously permitted (the Garden Parkway, the Cape Fear Skyway, and the Mid-Currituck Bridge) have been removed from toll-authorized funding.

- **The DSFEIS misstates the end point of the project**.
The DSFEIS states that "*On the western end, the project would begin at I-485, another controlled-access facility*."[7] This is factually not the case (it ends on U.S. 74, about 1 mile from the present I-485). Though the Draft recognizes
18 the facility's true end point elsewhere, this inaccurate statement at the beginning of the document, in the summary of its purpose and need, wrongly implies that the project extends the Interstate system by providing for long-distance travel, whereas the project's asserted justification is the reduction of congestion.

- **The DSFEIS inappropriately introduces the issue of fairness.**
The DSFEIS states: "*Although Union County is the fastest growing county in the State, it is the only county adjacent to Mecklenburg County that does not have a high-speed interstate-type facility connecting it to Mecklenburg County*."[8] This statement is factually incorrect. Union County is no longer the fastest growing county in North Carolina. At least 10 counties, led by Onslow, reported faster growth rates between 2010 and 2012 than Union County's 3.3%, or 1.7/%/year.[9] Also, Lancaster County, SC, adjacent to Mecklenburg County, has no high-speed connection to Mecklenburg County.
19

The statement further implies wrongly that all "adjacent" counties to metropolitan areas somehow deserve a high-speed "interstate-type" connection to the metropolitan county. This criterion is not one used by the STI program to evaluate projects. The STI criteria require that all highway projects be evaluated by cost-effectiveness and congestion reduction, among other factors, but not by geographic proximity or design lever. Further, NCDOT is already upgrading existing U.S. 74 in Mecklenburg County to high-speed design standards, and this upgrade could be continued into Union County. If this criterion were added to the STI, then counties adjacent to

[7] *Id.*
[8] *Id.*
[9] US Census, Certified County Population Estimates, 2012, *available at* http://www.osbm.state.nc.us/ncosbm/facts_and_figures/socioeconomic_data/population_estimates/county_estimates.shtm.

19 Wake, Guilford, Forsythe, Cumberland, Buncombe, New Hanover, and Durham should also have their connections upgraded raised to "interstate-type."

20
- **Neither beach access nor weekend traffic is mentioned in the document.** It is commonly thought that travel times from Charlotte to the North Carolina beaches are hampered by congestion on U.S. 74, and that as a result, beach-going weekend traffic is often stuck in congestion between Charlotte and Monroe. Yet the DSFEIS does not study, review or even mention local or long-distance *weekend* traffic.[10] The proposed Monroe Bypass might serve an additional *unmentioned* purpose of providing faster access across Union County for Charlotte-area beach-goers — in other words, a major unmentioned beneficiary of the Bypass would be the occasional (largely weekend) users from an adjacent county! If these factors are part of the project's justification, they must be spelled out and evaluated on their merits using appropriate traffic analysis methods. This oversight demonstrates either unfamiliarity with an unstated key "purpose and need" of the project, or (worse) implies that stating this additional purpose would reduce the project's political support.

21
2. The alternatives considered appear to be inappropriately biased against U.S. 74 upgrades.

NEPA requires that the alternatives considered for road projects include the "no-build" alternative, a TSM/TDM alternative, and a variety of "build" alternatives. While the ranges of alternatives to be considered vary widely from project to project, the intent of NEPA is to ensure that a wide range is considered. Alternatives found to be viable must then be evaluated to equivalent levels of detail in terms of benefits, impacts and costs. This does not appear to be the case for the Monroe Connector/Bypass.

22
- **The DSFEIS limits the alternatives to those that were judged to fit a biased Purpose and Need.** The DSFEIS describes the three-stage winnowing process used to identify feasible alternatives.[11] In the first step, a wide range of alternatives were considered, including:
  - *No-Build or No-Action Alternative*
  - *Transportation Demand Management Alternative*
  - *Transportation System Management Alternative*
  - *Mass Transit and Multi-Modal Alternatives*
  - *"Build" Alternatives, including Upgrading Existing Roadways and New Location Alternatives*[12]

[10] Traffic counts, speed runs and traffic forecasts in the study are for *weekday* traffic only.
[11] DSFEIS at 2-2.
[12] *Id.*

22 The DSFEIS then states that three criteria, based on the purpose and need, were applied to each alternative:

- *Does the alternative address the need to enhance mobility and increase capacity in the U.S. 74 corridor?*
- *Is the alternative consistent with the NC Strategic Highway Corridor program and the NC Intrastate System (i.e. does it allow for high-speed regional travel)?*
- *Does the alternative maintain access to properties along existing U.S. 74?*[13]

But as detailed above, because the stated "Purpose and Need" is biased toward inappropriate criteria, the alternatives developed to meet those criteria are not judged on the right set of criteria.

23 • **Elimination of "frontage road" and "not maintaining property access" alternatives arbitrarily restricts the options.**
The DSFEIS eliminates several alternatives based on their asserted failure to provide access to existing U.S. 74 properties. It notes that "*However, as part of the purpose and need criteria for the project, there is a need to maintain access to existing properties along existing U.S. 74, so frontage roads would be needed for the Upgrade Existing U.S. 74 Alternatives under either a toll or non-toll scenario to provide property access.*"[14] But the alternatives apparently do not include various "frontage road" options, either separately or in combination with other features such as Superstreets,[15] reversible lanes, or signal optimization. Essentially, by restricting the review to those alternatives that are asserted to *strictly* meet the biased Purpose and Need, the DSFEIS arbitrarily eliminates a wide range of other feasible options. Partial frontage roads for some sections and not others are also not explored fully. Partial freeway upgrades along with partial upgraded arterial treatment is another option that is clearly possible but is not explored. Neither do the alternatives apparently consider options that take a minimal, or minor, number of existing properties along existing U.S. 74, while the proposed Bypass would take 95 households, 47 businesses and 499 acres of active agricultural land.[16] Failure to adequately consider "on-current-alignment" options is also surprising as upgrades to U.S. 74 in Mecklenburg County include on-current-alignment upgrades. If NCDOT could pursue this alternative to improve U.S. 74 in one county, then why not in the adjacent county?

24 • **Tolling availability further restricts the options to those off U.S. 74.**
Tolling options are not permitted in North Carolina without the express approval of the Legislature. As of this writing, only one un-built road, the Monroe Connector/Bypass, is presently approved for tolling. The presence of

[13] *Id.* at p. 2-3 (underlining added).
[14] *Id.* at 2-4.
[15] So-called "Superstreets" are arterials that are upgraded for higher speeds and flows by a variety of engineering/designs that restrict some movements and limit some conflicts.
[16] DSFEIS at 3-4 to 3-5.

the tolling option for the Monroe Connector/Bypass, not permitted for other projects in the state, biases the review of alternatives towards those that rely on additional traffic-generated revenue, rather than on the usual funding options. Although the DSFEIS states that "*the tolling aspect of the project had no influence on the concepts identified for detailed study and little influence on the roadway preliminary design*,"[17] the screening process
24 nevertheless eliminated all options except tolling options: "*All [25] PSAs [preliminary screening alternatives] assumed that toll collection would be made using an open road tolling technology, which allows for tolls to be collected at highway speeds and eliminates the need for conventional toll plazas.*"[18] This is either a remarkable coincidence, or a result of a process that pre-judges the range of feasible options.

- **The DSFEIS ignores MAP-21's focus on projects "within operational right-of-way."**

The new federal highway act, MAP-21, passed in August 2012, specifically streamlines the environmental review process for projects "within the
25 operational right-of-way."[19] This new law, not mentioned in the DSFEIS, is intended to rapidly progress projects that have minimal or little environment impact, speeding their construction.[20] By ignoring this opportunity, the DSFEIS eliminates a wide variety of options that could be progressed faster, and possibly cheaper, than the proposed Monroe Connector/Bypass.

- **Other alternatives, particularly upgrading U.S. 74 using "Superstreets," providing frontage roads while upgrading U.S. 74 to freeway status, and/or consolidating intersections should have been evaluated.**

The DSFEIS discusses the effectiveness of one lately-added alternative, "TSM
26 Alternative Concept 2" that would improve traffic flow on U.S. 74 over the short term (to 2015).[21] The DSFEIS concludes that "*by implementing the improvements listed in Table 3-5 of the Final EIS, an overall Level-of-Service*[22] *D in 2015 could be attained at the intersections along the U.S. 74 study corridor, except for the intersection of U.S. 74 at Rocky River Road (SR*

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[17] *Id.* at 2-4.
[18] *Id.* at 2-6.
[19] Public Law No. 112-141, 1316.
[20] The Moving Ahead for Progress in the 21st Century Act ("MAP–21," PL112–141, 126 Stat. 405) was signed into law on July 6, 2012. Sections 1316 and 1317 require the Secretary of Transportation to promulgate regulations designating two types of actions as categorically excluded under 23 C.F.R. 771.117(c) from the requirement under 40 C.F.R. 1508.4 to prepare an environmental assessment ("EA") or environmental impact statement ("EIS"): (1) Any project (as defined in 23 U.S.C. 101(a)) *within an existing operational right-of-way*. Proposed rules implementing this requirement were issued on Feb 28, 2013 (FR 78:40, p. 13609 ff).
[21] DSFEIS at 2-9.
[22] Level of service (LOS) is a term referring to the quality of operational service provided to road users, given traffic, design and environmental circumstances. It varies from LOS A (free flow) to LOS F (stop-and-go traffic). LOS D (moderate congestion) is the generally accepted NCDOT level that balances cost and motorist delay.

1514)."[23] The DSFEIS relies on 2007 estimates projecting that implementing these improvements would result in an average 2015 peak travel speed of between 29-30 mph.[24] However, after implementing just some of these solutions, NCDOT has observed average peak travel speeds well above these projections, as high as 45 mph.[25] This finding is then dismissed because the alternative does not meet the need for "high speed travel" through the corridor, even though it is estimated to result in improved operation (LOS D) on U.S. 74.

26 The DSFEIS also states that assuming the 2035 traffic volumes, the option is not feasible: *"A comparison of the year 2015 traffic volumes used in the U.S. 74 Corridor Study to the year 2035 No-Build volumes developed in Revised Monroe Connector/Bypass No-Build Traffic Forecast Memo (HNTB, March 2010), shows that <u>the volumes in 2035 along U.S. 74 would generally be significantly higher.</u> Therefore, the levels of service at the intersections in 2035 would be expected to degrade to below LOS D and travel speeds based on the computer model also would decrease*."[26] However, given the admitted success of the recent improvements in improving LOS, the highly uncertain traffic forecasts (see below) and the flat recent traffic counts (discussed below), this is clearly a premature conclusion.

- **An additional option, widening U.S. 74 *without* tolls, was also eliminated prematurely.**

27 The DSFEIS also notes that based on questions raised by the Corps of Engineers, the option of an "on-current location" was revisited. The review concluded that "*[I]n the design year 2035, U.S. 74 under all four scenarios is expected to exceed LOS D in the majority of the corridor…. The Superstreet 6-Lane scenario option provided the highest corridor capacity compared to the other three scenarios.*"[27] This statement finds that U.S. 74's level of service will be unsatisfactory (LOS D is the NCDOT standard for operation) with any of these options, but (in apparent conflict with its own recommendation for a Bypass) NCDOT has moved to implement a "Superstreet" improvement along a 2.7 mile section of the existing U.S. 74 through Indian Trail.[28] Therefore it is unclear, to say the least, why a "Superstreet" option was eliminated from the feasible alternatives. This appears to be a violation of NEPA which requires comparable evaluation of viable options. At the least, prudence would dictate that the "Superstreet" option now being implemented on a portion of U.S. 74 should be reviewed for effectiveness, and additional Superstreet improvements be considered in

[23] DSFEIS at 2-9.
[24] *See id.*
[25] *Id.* at 1-7 – 1-8.
[26] *Id.* at 2-9.
[27] *Id*. at 2-10.
[28] *Id.* at 2-11.

27 combination with other improvements in the corridor, BEFORE a decision to build the Bypass is made.

28 • **No discussion of "flexible work schedules" or "work-at-home" as an alternative.**
Even though NCDOT's own data show no large variations in travel time by time of day or direction, and that most of the traffic using the facility is local, there is no discussion of other alternatives such as staggered work schedules, increased work-at-home, or other similar options for reducing traffic loads at specific intersections. The percentage of Union County residents working at home *doubled* from 3.4% in 2000, to 6.9% in 2012.[29] The TDM alternatives considered did not significantly explore this issue.

29 • **The DSFEIS does not contain key comparative data for all alternatives**.
Most EISs contain detailed comparative data, by impact, for all viable alternatives, INCLUDING the no-build and other "improve existing road" alternatives. This information is missing from the DSFEIS, raising the question of whether it violates NEPA requirements that all alternatives be investigated and described to an equivalent level of detail.

30 **3. Travel time improvements on U.S. 74 and their effect on traffic forecasts for the Monroe Connector/Bypass appear to be under-estimated.**

For a variety of reasons detailed below, the impacts of improvements to U.S. 74 on traffic flow appear to have been under-estimated. This likely over-states the expected diversion to a future Bypass.

31 • **The DSFEIS uses the wrong speed criterion for setting road performance.**
There is no *requirement* that Interstate, NCSTI or STRAHNET routes have operational travel speeds that are equal to the posted speeds.[30] If that were the case then virtually all of state-owned urban arterials in North Carolina would need upgrades, widenings or bypasses. NCDOT standards for LOS D (moderate congestion) typically have traffic operating speeds 5-15 miles below the posted speed. Even if speeds are accepted for a criterion, the standard for speed study is the 85th percentile, not the average speed. As, according to the INRIX data, the reported average (close to 50th percentile) operating speed on U.S. 74 is 44 mph, using the 85th percentile would raise the current operating speeds on U.S. 74 even further, probably to the 48-50 mph range. This reduces the need for the project and the potential time savings.

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[29] US Census, at http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_12_5YR_B08101&prodType=table, for 2012; http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_00_SF3_P030&prodType=table, for 2000.
[30] DSFEIS at 1-6.

32

- **Possible misuse of speed measurement data.**
  The 2013 INRIX data show an average travel speed through the corridor of 44 mph, 10% (4 mph) higher than the NCDOT's travel time runs.[31] In other words, drivers now are averaging faster speeds than the DOT speed-run tests. This 10% difference is so large that it calls into question the accuracy of the travel time savings from the model.[32] Later it is noted that the speed runs appear to be based on just three runs in each direction/time period[33] which is a very small sample. The INRIX data, on the other hand, are based on observed speeds of hundreds (perhaps thousands) of actual drivers over a *2-month period, 24 hours a day, Tues-Thurs*.[34] This is a huge amount of data that is a much more realistic description of actual corridor operation than just a few speed runs. Therefore, the INRIX actual operating speeds, not the travel time runs or posted speeds, should be used as the basis for the traffic forecasts on U.S. 74. Without this correction, estimates of future traffic speeds on U.S. 74 (build and no-build) will continue to be too low, and diversion to the proposed Bypass will continue to be over-stated.

33

- **The suggested diversion to the Bypass (40-50%) would require a very high value of time.**
  Traffic diversion (assignment) models operate by assigning traffic to the path with the shortest "generalized cost," considering travel time, reliability, congestion, and tolls. The fundamental principle underlying most modeling systems is that users choose that path which has the lowest generalized cost, spreading out by route (and time-of-day in advanced models) such that no traveler can improve his generalized cost by changing paths.[35] To estimate total generalized cost, tolls must be converted into time units using a traveler value of time, which is generally assumed to vary by location, trip purpose and vehicle class. Values of time vary by region, but most *value-of-time studies put it at about ½ the average wage rate, or about $9/hr*. That is about ½ the prevailing median wage rate for Union County, $18.48/hr.[36]

  Using the reported INRIX actual speeds for U.S. 74, the average 44-mph travel time through the 19.7-mile U.S. 74 section (between the approximate end points of the proposed Bypass) is now about 26.9 minutes, and at 65 mph the average travel time between the same points using the Bypass, would be

[31] *Id*.
[32] *Id.* at 1-7.
[33] The data are for March 19-21, 2013. *See* Memorandum from Bradley Reynolds, HNTB, to Jennifer Harris, NCDOT, *RE: U.S. 74 Travel Time Comparison* (April 18, 2013, updated Oct. 24, 2013).
[34] DSFEIS at 1-6.
[35] In traffic modeling this is referred to as "user equilibrium," or "stochastic user equilibrium" if probabilistic route choices are made. The Metrolina Regional Model used in this study is operated with TransCAD software, which is a quite sophisticated package, but many of its advanced features appear not to have been used in the study.
[36] US Department of Commerce, Southeast Division, County employment and wages in North Carolina, 4th Quarter 2012, *available at* http://www.bls.gov/ro4/qcewnc.htm. Calculated as $739 per week/40 hrs/week.

33 18.2 minutes.[37] To be worth paying the proposed $2.58 average toll, the average savings in time (8.7 minutes) would have to be worth about $17.80/hour.[38] This is a high value of time for traffic modeling, almost twice the commonly used rate, and about twice the value of time that the NCDOT found in its own stated preference survey. This means that, if local residents value their travel time at less than $17.80/hour, the traffic estimate for the Bypass is likely to be significantly overstated. Another implication is that Bypass use might be *infrequent* rather than regular, for trips when time is valued highly, but not for most trips.

34 • **The DSFEIS downplays the effectiveness of prior and planned actions on U.S. 74.**
The DSFEIS notes that some improvements to U.S. 74 have been implemented.[39] But these improvements have not been incorporated into the 2035 traffic forecasts, which were created in 2007 and have not been updated in the DSFEIS. In fact these improvements post-date the 2035 forecasts — occurring mostly between 2010 and the present — and so have of course not been included. Additionally, the 2035 forecasts do not factor in additional improvements such as the four Superstreets that are now planned in the next couple of years. It is likely that the improvements made so far helped to improve the current operating speeds in the 44-mph range, given that traffic volumes have not increased and INRIX speeds show an increase over time.[40] Additional future improvements (e.g. partial Superstreet treatment, shutting off some access, better signal timing, or even upgrading more of U.S. 74 to freeway status) might also be equally effective. But at the very least, the planned improvements should be coded into the regional network and used as the basis for all forecasts.

35 • **An inappropriate traffic forecast was used for the operations simulation model**.
Instead of using just one traffic forecast predicted to use U.S. 74 in the local simulation model (SIMTraffic, which estimates future driving speeds based on a forecast of traffic), the consultant should have also tested the operation of U.S. 74 with lower more-realistic future traffic volumes, as discussed below.

36 • **Inconsistent traffic forecasts for U.S. 74 *WEST* of the project.**
The DSFEIS asserts that "*Year 2035 traffic volumes on U.S. 74 west of I-485 are projected to be <u>lower</u> with the proposed project than under the No-Build alternative.*"[41] The difference is about 7% lower, quite a large amount. This

[37] 19.7 miles*60 min/hr/44 miles/hr = 26.9 min; 19.7*60/65 = 18.2 minutes.
[38] $2.58*60 min/hour/8.7 minutes = $17.80. The value of time would have to be even higher for shorter trips that have to go out-of-the-way to use the Bypass, but might be lower accounting for congestion on U.S. 74.
[39] DSFEIS at 2-11.
[40] *Id.* at 1-6.
[41] DSFEIS, Appendix F, Errata (underlining added).

finding is inconsistent with traffic modeling theory which predicts that improvements in travel time caused by new roads will also result in INCREASED traffic on major feeder roads leading to the project, such as U.S. 74 just west of I-485. The NCDOT team found a similar inconsistency in reviewing the Wilbur Smith forecasts made in 2008.[42] No explanation is given for this new finding, but it may be due to the hidden assumptions regarding induced land use or trip distribution.

36

4. Traffic growth on U.S. 74 has been flat from 2000 to 2012, and is inconsistent with population growth.

Two central issues regarding the need for the Bypass is whether the traffic on U.S. 74 has been growing historically, and is likely to continue to grow in the future. Careful review of the statistics for growth and traffic in the corridor suggest that neither is the case.

- **The DSFEIS reports incorrect population growth statistics for Union County and selectively reports Union County growth rates.** The DSFEIS asserts that Union County is the fastest growing county in the state: 49% from 2000 to 2010, or 4.9%/year.[43] This is factually incorrect. The growth rate for Union County for 2000-2010 was 62.8%,[44] but the growth rate for the *study area* was 49.3%.[45] Further, Union County is no longer the fastest growing North Carolina county: As noted above, at least 10 other NC counties have registered more rapid growth from 2010 to 2012, while the Union County's growth rate has fallen sharply, to just 1.7%/year.[46] It is not uncommon for counties near larger metropolitan areas to experience high "surges" of growth as the metropolitan county growth spreads out, then to decline in growth rate as growth moves elsewhere.

37

The DSFEIS notes that "*According to the CRTPO [Charlotte area] 2035 Long-range Transportation Plan, the southern and eastern portions of Mecklenburg County, which is the area along the Union County line, is expected to be one of the most rapidly growing areas in the region.*"[47] But the DSFEIS fails to mention that almost half of Union County's growth has been in the *southwestern* edge of the county, *substantially south of U.S. 74 and mostly outside* of the Bypass corridor.[48] The following table demonstrates this growth pattern, using the DSFEIS data from Appendix D (Updated Census Tables).

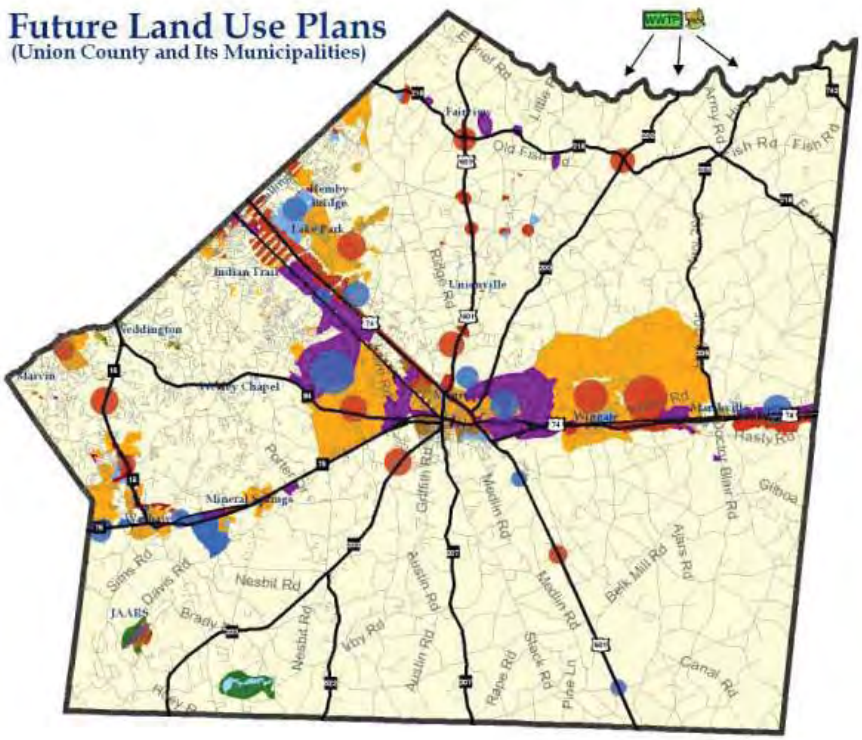
[42] C. Scheffler, *Monroe Bypass no-build traffic forecast summary*, interoffice memo to Spencer Franklin, NCTA (May 6, 2013).
[43] DSFEIS at 1-2.
[44] 2010 US Census, *available at* www.census.gov.
[45] DSFEIS at 4-1.
[46] US Census, population counts, 2012. (207,896-201,294)/201,294/2 = 1.7%/year.
[47] DSFEIS at 1-1.
[48] US Census, 2010, and DSFEIS, Appendix D, Updated Census Tables.

Population Growth, 2000-2010, Union County and Study Area[49]

Geographic area	2000 Population	2010 Population	Difference	Percent Change from 2000-10
Union County	123,677	201,292	77,615	62.8
DSA-Union Co. part	66,603	102,357	35,745	53.7
DSA-Mecklenburg Co. part	13,867	17,746	3,879	28.0
Total DSA	80,470	120,103	39,633	**49.3**
Union NON-DSA part	43,207	81,189	37,982	**87.9**

37 The table shows that the *portion of Union County outside the DSA actually grew at almost twice the growth rate of the study area, almost 90% in just 10 years.* The following figure (from the DSFEIS) shows the present Union County road system and the proposed future land use. Note that the *growth in the southwest corner, between Indian Trail and Marvin, is on the south side of U.S. 74, and is mostly OUTSIDE the Bypass study area.*

[49] DSFEIS at Appendix D (Updated Census Tables).



37 Most of this growth took place in the area south of Ballantyne (in Mecklenburg County) over 10 miles from the proposed Bypass on the south side of U.S. 74, and therefore would not be able to even use the Bypass. Essentially the DSFEIS' own data shows that recent growth has been most rapid in areas NOT served by the proposed Bypass. Therefore the rapid growth rate of Union County between 2000 and 2010, even if reported correctly, is irrelevant for evaluating the need for the project.

38 • **Union County out-of-county commuting shares are declining, not increasing**.
The DSFEIS states that in 2006 about 61% of Union County workers commuted outside of the County, but that in a more recent census survey (2006-09), 50% of workers commuted outside.[50] Such wild swings in such a short time question the data's validity, but even if true it shows *declining dependence, not increasing dependence, of Union County on adjacent-county jobs.*

39 • **The DSFEIS selectively reports trends in commuting time.**
The DSFEIS states that commute times for Union County residents average 27.8 minutes, the highest of the region's counties, implying that the Bypass

[50] DSFIES at 1-4.

would somehow reduce them.[51] The DSFEIS does NOT mention, however, that *commute times are improving, not worsening, for all counties in the region*, and that *from 2000 to 2010 Union county's average commute time fell from 29.0 minutes to 27.8 minutes*, the largest drop of the region's counties.[52] Union County commute times are improving, not worsening, and within-county employment is increasing, decreasing the share of long-distance commuting.

39

- **Recent traffic growth on U.S. 74 has been flat.**
  In spite of Union County's now-slowing population growth since 2000, *traffic on U.S. 74 has not increased substantially since 2000.* The following table shows the NCDOT traffic counts for various sections of U.S. 74, and the DSFEIS forecast volumes.

40

Average Daily Traffic on U.S. 74 Parallel to the Proposed Monroe Bypass									
	Historical					**DSFEIS Forecast**			
Count Location	**2000**	**2005**	**2010**	**2012**	**12-year Annual Percent Change**	**Raw Model 2030 No Build**	**Raw Model 2035 No Build***	**Estimated Volume 2035 No Build***	**2035 Annual Percent Change, from 2012**
Meck.-Union Line	56000	58000	54000	57000	**0.15**	70300	101600	89000	**2.4**
NW of Monroe	48000	48000	46000	50000	**0.35**	40000	66200	65000	**1.3**
East of Monroe	26000	27000	24000	27000	**0.32**	32200	41500	60600	**5.4**
W of Marshville	20000	21000	17000	19000	**-0.4**	23000	21000	31600	**2.9**
Anson-Union Line	15000	15000	14000	13000	**-1.1**	-	-		

*Source: NCDOT, Traffic Count Maps, and DSFEIS, Traffic Forecast Summary, November 8, 2013, Appendix G.[53]

At the Mecklenburg-Union line, just west of the project end, the traffic has grown just 0.15%/year (1.8% in 12 years), and has actually declined since 2005. Near Monroe, growth has been modest, about 0.4%/year. At the eastern edge of the project, traffic volumes are much lower and have *declined*

[51] Michael Baker Consultants, Monroe Connector/Bypass, *Union County Growth Factors Technical Report*, at 16 (November 2013).
[52] US Census, 2000 and 2010.
[53] DSFEIS at G-21– G-23.

40 not increased, since 2000. The DSFEIS notes that its own analysis of traffic counts from 2007 to 2012 also showed "*zero change*,"[54] but then the DSFEIS simply ignores this data and asserts that "*Based on 2008 and 2035 No-Build traffic forecasts, (HNTB, March 2010), average volumes along the U.S. 74 corridor are projected to increase approximately 34 percent*."[55] So the whole need for the project simply ignores the last 12 years of history regarding traffic trends on U.S. 74.

41 In Appendix G to the DSFEIS, the data show projected 2035 traffic volumes on U.S. 74 for the "no-build" alternative. The implied percent changes from current volumes range from 1.3 to 5.4% per year are 5-10 times faster than the recent 12-year history. Nowhere in the document is it explained how the traffic will grow 34% in 23 years when the past 12 years have shown "*zero change*" in traffic.[56] One might argue that, yes traffic growth has been flat recently, but as the Recession ends it will accelerate. This argument fails to note that traffic has been flat since 2000, BEFORE the Recession. Failure to justify this highly optimistic "kink" in the traffic forecast and failure to consider recent traffic trends, while knowing that recent evidence indicates a huge change in prior trends, are serious oversights.

42 A serious inconsistency in the table is the magnitude of the traffic forecasts themselves. NCDOT's rated LOS D capacity of 6-lane arterials is about 55,000 ADT,[57] but the forecast for U.S. 74 at the Mecklenburg County line is 89,000 ADT, 60% higher than a 6-lane "no-build" could carry. Similarly, for the 4-lane section northwest of Monroe, the rated capacity is about 40,500 ADT,[58] but the forecast for the "no build" is 61% higher, 65,000 ADT. As the congestion-decay equations of traffic forecasting models generally limit flow rates to the rated capacity (they spread out the traffic to "fit" within the road system), it is not clear how these "no-build" forecasts for U.S. 74 could be 60% higher than the rated capacities.

43 Another anomaly in the table is the large differences between the 2035 "raw volume" (model output) forecasts and the estimated 2035 volumes. These differences are quite large, and are 46-50% higher for volumes east of Monroe. Although the DSFEIS cautions about the use of raw volumes directly in forecasting, the process used to estimate the estimated volumes is not adequately described. Differences of this magnitude, particularly at the eastern edge of the project where long-distance travel would be entering the region, and particularly on the high side (favoring the Bypass) need to be fully justified.

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[54] *Id*. at 4-20.
[55] *Id.* at 1-13.
[56] *Id.* at G-9.
[57] NCDOT, Transportation Planning Branch, LOS D [traffic volume] standards for systems planning (October 14, 2011). Calculated for "boulevards," piedmont area, suburban location, 45 mph.
[58] *Id.*

- **Inconsistent historical growth data for population and traffic.**
  A fundamental inconsistency in the DSFEIS is the apparent inconsistency between the population growth and the corridor traffic growth. The recent history of population growth in the region is shown in the following table:

Population Growth, 2000-2010*

Area	2000	2010	Percent Change 2000-10	Percent Change/year
Union County	123,677	201,292	62.8	6.3
Mecklenburg County	695,454	919,628	32.2	3.2
Project Study Area	80,470	120,103	49.3	4.9

44

*Source DSFEIS, Appendix D, Updated Census Tables.

All of these population growth rates have been much faster, per year, than the traffic growth rates shown above, about ten times the traffic growth rates. The last item, the population of the study area, is referred to several times as a key historical justification for the project's need. Yet, this raises a fundamental question: *How can the traffic growth on U.S. 74 be "zero growth" when Union County and study area population is growing so fast?*

This inconsistency is neither identified nor explained in the DSFEIS. It has a number of possible explanations, for instance:

1. The current traffic congestion on U.S. 74 has actually slowed its growth; with more capacity, it would have grown more.
2. The Recession slowed the traffic growth, but not the population growth.
3. Population growth is largely in areas south and west of U.S. 74, near the Mecklenburg line, and thus does not use U.S. 74. (This is suggested by the sub-area discussion above).
4. Population growth is largely locally-based and does not use regional highways.
5. Traffic data is misestimated, or population data is miscounted.

6. The traffic model used for forecasting does not capture the reasons for travel behavior.

44 It is not appropriate for us here to determine the reasons for this discrepancy. Nevertheless, because the discrepancy impacts the validity of the traffic forecasts (see discussion below) it must be researched and then incorporated into the Purpose and Need for the project.

- **The population forecasts used to forecast traffic are probably significantly over-stated.**

  The process used to estimate future traffic is described in the DSFEIS[59] and can be summarized as follows:

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1. A Charlotte-region population forecast is estimated by reviewing US growth.[60]
2. County growth to each of 35 counties/sub-areas in the region is allocated from the regional control total, using statistical relationships from 227 counties in 29 regions nationwide.[61]
3. County population growth and "population-chasing" employment is then allocated to traffic analysis zones ("TAZs") within counties, using travel time to employment and other factors.[62]
4. Non-population-chasing employment is estimated using expert review.[63]
5. "Induced" growth due to the presence of the Bypass is estimated by a variety of methods.[64]
6. TAZ-level population and employment forecasts, and non-residential growth (in acres of development) are then converted to trip ends, by purpose, and then to productions and attractions.[65]
7. Although not explicitly discussed, external travel (leaving and entering the study area) is presumably estimated separately.[66]
8. Trips between origins and destinations are then estimated, by purpose, and external travel origins and destination are added.[67]
9. O-D pair trip flows, by time of day, are then assigned to the network ("build" or "no-build"), adjusting for capacity, toll rates, and value-of-time.[68]

[59] DSFEIS Section 2 (Alternatives Considered) and Appendix G (Traffic Forecast Summary)
[60] DSFEIS at 2-15, 4-25; see also Hammer, Demographic and Economic Forecasts for the Charlotte Region (2003).
[61] DSFEIS at 2-15, 4-25; see also Hammer, Demographic and Economic Forecasts for the Charlotte Region (2003).
[62] DSFEIS at 2-15, 4-25.
[63] *Id*. at 2-15, 4-25.
[64] *Id*. at 2-17–2-18, 4-27, 4-29.
[65] *Id.* at 2-15, 4-25 – 4-27.
[66] There is no reference to external travel in any of the documents we reviewed.
[67] DSFEIS at 2-15; Comprehensive Traffic & Revenue Study (October 2010) at Chapter 3.
[68] *Id*. at 2-15; Comprehensive Traffic & Revenue Study (October 2010) at Chapter 3.

10. The raw volumes (direct from the model) are then adjusted further for local access and "balance."[69]

The process begins with estimates of likely population growth for the region and its counties. Specifically, a Charlotte-region population forecast is estimated by reviewing US growth, and then assigning portions of that growth to each of the major regions of the US.[70] In the next step, the total regional growth is then allocated to 35 local counties/sub-areas using historical statistical relationships from 227 counties in 29 regions nationwide.[71] The DSFEIS reviewed this forecast, prepared in 2003, finding it in substantial agreement with the 2010 Census estimate for Union County.[72] It then went further, suggesting that the Hammer forecasts are valid for the future because: "*Put more succinctly: 'Why would Union County have such robust growth in the absence of new transportation infrastructure?' The short answer is that the factors that caused Union County to experience higher growth than any other regional county since 1990 are still in place and are likely to continue to*
45 *result in higher than average growth.*"[73] The Baker assessment then goes even further, putting the 2030 population forecasts for Union County (adjusted for "reconciliation") near the upper range of the Hammer forecasts.[74]

While the Hammer study appeared to accurately predict the 2010 Census estimate of population, its accuracy for future years is questionable. The Hammer study, prepared in 2003, made the following critical (and as it turns out, wrong) assumptions:

1. *The US will continue to grow as in the past.* The Hammer study essentially trends the US population and economic activity forward. But the Recession of 2008-12 significantly slowed both in-migration and US growth, employment was cut by over 4 million, and recent US population increases (births – deaths + net in-migration) have slowed too. The key relationship between population and employment (percent of population that is employed) was also weakened. The current growth rates for the US are now 1/3-1/2 what was estimated just 10 years ago, and the employment/population ratio is the lowest in 50 years. Further, virtually all of the 2000-2010 Census population growth for Union County was already "in place" by 2009, when the

[69] *Id*. at 2-15 to 2-16.
[70] *Id*. at 2-15, 4-25; *see also* Hammer, *Demographic and Economic Forecasts for the Charlotte Region* (2003).
[71] DSFEIS at 2-15, 4-25; Indirect and Cumulative Effects Quantitative Effects Quantitative Analysis Update (November 2013) at 32; see also Hammer, *Demographic and Economic Forecasts for the Charlotte Region* (2003).
[72] Michael Baker Consultants, Monroe Connector/Bypass, *Union County Growth Factors Technical Report* (November 2013).
[73] *Id.* at 5.
[74] *Id.*

Recession hit hard, and so the 2010 census estimate was largely unaffected by the Recession. But as noted above, the recent (2010-12 population growth rate for Union County has been much slower, just 1.7%/year.

2. *The Charlotte region will continue to excel relative to other regions*. The Hammer study assumed that the Charlotte region will continue to exceed the national growth rates.[75] But North Carolina and the Charlotte region was very hard-hit in the Recession, with large banks and other employers shedding jobs inordinately, and unemployment remains significantly above the US and NC levels. This effect has slowed the local employment growth to a crawl. This "inconvenient truth" is ignored by the Baker review.
3. *Union County will attract a relatively large share of regional growth*. The Hammer study allocated growth to the region's 35 county and sub-county areas based on employment-population-economy relationships developed from around the US.[76] *But in the 2000's, most of the growth in Union County was driven not by local county economic activity but by proximity to Charlotte, particularly in the Ballantyne area, which is not even in the study area. Essentially, Union County's growth in population was a "population" boom near to another county's "job" boom,* which has now slowed. The Hammer study and the recent Baker review do not discuss the location of that growth *within* Union County, and thus overlook the fact that the most of the Union County growth has been outside of the Bypass study area.

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Dr. Hammer's estimates were reviewed by the UNC Kenan School, which found them to be too high. The Kenan review recommended an 8.7% reduction in the 2030 corridor growth for "national" trends, and a re-allocation of some growth within the County to zones in the Bypass corridor.[77] *Therefore, Dr. Hammer's forecast of population and employment for Union County is likely to be significantly over-stated, as are Baker forecasts made from it.*

Of course, in 2003-04 Dr. Hammer could not have foreseen the 2008-12 Recession or its disproportionate impact on banking sector employment. That is exactly the point: *If one is to believe Dr. Hammer's 2030 forecast now, one must now assume an equally unlikely upward "turn-around kink" in population for the region and particularly for Union County. To reach the projected 337,000 population by 2030 from its current (2012) level of 208,000, Union County would have to average 3.4% growth annually, twice its recent growth rate of 1.7%. Assuming this would mean justifying the Bypass on an unsupported future turn-around in growth for the Charlotte*

[75] Hammer, Demographic and Economic Forecasts for the Charlotte Region (2003), at 6.
[76] *Id.* at 6-7.
[77] Quantitative ICE Report at 43.

45 *region, and a return to a rapid growth spurt for Union County, events as unlikely as was the recent Recession.*

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- **The Hammer population forecasts are then used to forecast traffic.**
  Unfortunately from a modeling perspective, Dr. Hammer's assumptions about future Union County population growth are also used as the basis for the sub-area allocation to zones (the Smith study and refinements to it). The Smith study is described as allocating the county-level population and "population-chasing employment" control totals to TAZs based on vacant residential acres and travel time to employment.[78] The DSFEIS apparently continues to use the county-level control totals in making these TAZ allocations.[79] In other words, the higher-level population forecasts are then used to estimate zonal population and employment, which are then used for estimating local traffic growth. This means that, if the Hammer-based forecasts of population growth by county are high, then the TAZ forecasts will be high in the same proportion.

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- ***The Smith re-study incredulously found no impact of the Bypass on population growth***.
  According to the DSFEIS, the original Smith study completed in 2004, allocated county-level control totals to TAZs using vacant residential acres and travel time to employment.[80] In 2012 Mr. Smith re-analyzed the impact of the Bypass on population and "population-chasing employment," and found *no change in growth forecasts for any of the TAZs*.[81] This result is not believable given the projected change in access that the proposed Bypass would create, particularly in those TAZs both near the Bypass and close to the Mecklenburg line. This suggests that the original allocations prepared by Smith did not consider the key factors that affect regional population growth. For example, the Smith study did not consider that the whole study area growth might slow if U.S. 74 became congested to the extent predicted elsewhere in this DSFEIS.

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- ***The revised DSFEIS shows a modest impact of the Monroe Bypass on induced growth***.
  Later in the discussion, the Michael Baker team indicated dissatisfaction with the Smith study on the precisely those grounds — that it did not show a difference in development for the "build" vs. the "no build" forecast.[82] Among the obvious factors that might have been included in a more careful assessment of potential growth would be school quality, sewer and water availability, zoning density restrictions, improved road access, rising

[78] DSFEIS at 2-15, 4-25.
[79] *Id.* at 2-15, 4-25.
[80] DSFEIS, Indirect and Cumulative Effects Quantitative Effects Quantitative Analysis Update (Nov. 2013).
[81] *Id.* at 41.
[82] *Id.* at p. 52.

congestion on existing roads, crime rates, average housing values and neighborhood incomes, provisions for and distance to shopping and retail, etc. The Baker study then uses other methods to estimate induced *residential* growth (about 1%). A method developed by this author (Hartgen) in 2000 is also used to estimate *induced commercial growth* at Bypass interchanges.[83] Other methods are also used to estimate the impact of the Bypass on
48 industrial, transportation, and other uses. Overall, the review found modest estimates of induced growth, about 3.4% overall (a difference of 3200 acres, "build" vs. "no-build" (128,200 vs. 125,000), from a base of 95,200 acres of development.[84] The report does not indicate what markets this "non-residential" growth would serve, but it seems unlikely that they would be other than the nearby new population. However, as noted below, this difference does not seem to have been actually used to make new traffic forecasts.

5. The Regional Travel Model and the traffic operations model appear to have been insufficiently calibrated.

It is widely agreed that the use of a traffic model in forecasting first requires that it is well calibrated, that is, it matches reasonably well existing traffic counts, travel times, and speeds in the base year. This elementary step is intended to ensure that the model, when used for forecasting, will not require inordinate adjustments to raw traffic forecasts.

Standards for model calibration accuracy are detailed nationally. The general rule of
49 for regional model calibration accuracy is that estimated base-year traffic for roads with volumes over 50,000 ADT should be within ±20% of observed counts, and within ±30% of observed counts for roads with volumes between 50,000 and 10,000 ADT, with most roads showing considerably less error.[85] And of course, if a specific project is being studied, such as U.S. 74, estimated base-year traffic volumes on that road should be close to actual ground counts. In addition to this limited standard, for major studies such as this one good practice is also to calibrate the models by cut-line in-out balance, geographic region, road functional class, time-of-day and direction to a similar or tighter level of accuracy, for greater confidence in forecasting. In addition, travel times and speeds through the base-year network should correspond closely to observed field data.

[83] *Id.* at 59.
[84] DSFEIS at 4-30.
[85] Federal Highway Administration, Travel Model Reasonableness Checking Manual, Travel Model Improvement Program (2010).

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- **The calibration of the Metrolina Regional Model ("MRM") used for this study has not been demonstrated**.
  In prior documentation of the regional modeling effort for this study,[86] the consultant (Wilbur Smith Associates, now CDM Smith) states that: "*The base-year model was calibrated in the immediate project area to achieve the best traffic volume assignments compared to observed traffic counts and observed speeds from speed-delay runs conducted for the traffic and revenue analysis. . . . The base year 2008 model was run using inputs supplied by the MPO. . . . A series of traffic assignments were compared with ground counts supplied by the NCDOT and those collected specifically for the traffic and revenue study...Adjustments were made to input network speeds and trip tables in the study area in order to improve the calibration of the model in comparison with ground counts for the specific corridor area. After calibration was obtained, a series of traffic assignments to the highway network were made for years of 2008, 2010, 2015, 2020, and 2030 under No-Build, Toll-free, and Tolled conditions.*"[87] This statement admits the presence of initial calibration errors which were (apparently) "improved" by changes to network speed and trip tables. But no data comparing "observed" vs. "estimated" or "improved" traffic is provided, no chart showing either regional or study area agreement by link type or volume is provided, and no calibration statistics by cut-line are given. No reference is made to time-of-day or directional agreement. As the MRM was not updated for the DSFEIS, the possibility of remaining errors, such as those caused by inadequate calibration, is a distinct possibility.

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- **The current DSFEIS does not discuss calibration**.
  The DSFEIS contains no discussion of calibration, but instead asserts that prior modeling is adequate for the purpose of environmental assessment. Therefore, one is left to assume that the current traffic forecasts are based on an adequately calibrated model, which as noted above has not been demonstrated. Given that recent traffic has not grown to the extent forecast in 2008, the MRM should probably have been re-calibrated.

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- **Errors in calibration will be carried forward into future estimates.**
  If the original MRM was not adequately calibrated, traffic forecasts are in serious doubt as calibration errors on specific road links are therefore carried forward into future tests. Essentially, if traffic for a specific road section is over-estimated in the base year, it is likely to be also over-estimated in the future year as well. The problem is particularly severe for calibration of U.S. 74 traffic volumes, which, as noted below, are clearly open to question since U.S. 74 apparently was modeled with too-high volumes, and with too-slow speeds relative to actual INRIX travel speeds. The accuracy of traffic forecasts for new roads is also open to question. This also affects estimates of

[86] Wilbur Smith Associates, Traffic forecasting for TIP Projects R-3229 and R-2559 Monroe Connector/Bypass (Sept. 19, 2008).
[87] *Id.* at 9 (underlining added).

52 traffic diversion and revenue for toll roads. In addition, errors in calibration carried forward in forecasts, are also likely to impact other key elements of the EIS, particularly noise, air quality and stream runoff, bringing large portions of the EIS into serious question. In short, the use of poorly calibrated traffic models to make forecasts is a serious mistake in traffic modeling that must be corrected BEFORE the resulting traffic forecast can be used in decision-making.

53 • **The traffic operations simulation model (SIMTraffic) also appears not to be well calibrated.**
The study uses a traffic operations simulation model (SIMTraffic) to simulate traffic operations for existing and no-build future traffic on U.S. 74. Good planning practice dictates that these models also be "calibrated" in the field, that is, they replicate existing travel times and speeds before being used for forecasting. According to the consultant's documentation, in 2008 calibration was undertaken by driving 4 runs through the project section, 2 in the AM and 2 in the PM peaks.[88] The reported (average of the 2 runs in each direction?) travel times in 2008 was 41 minutes (30 mph) eastbound in the PM peak, and 40 minutes (30 mph) westbound in the AM peak.[89] The SIMTraffic model for the same conditions yielded 47 minutes, at 29 mph (westbound) and 50 minutes at 24 mph eastbound, that is, the *SIMTraffic tests showed significantly higher travel times and (according to the consultant) "slightly lower speeds" than the travel time runs*.[90] The consultants attributed these differences to different input traffic volumes (the SIMTraffic volumes were taken from the regional travel demand model and were higher than the 2007 field volumes), and so the consultant considered the SIMTraffic model "calibrated."[91] The following table summarizes their findings:

Travel Time Calibration Runs on U.S. 74, 2008 (PBSJ)

	Travel Time Runs		**SIMTraffic**	
	Minutes	Speed	Minutes	Speed
Westbound PM Peak	41	**30**	47	**29**
Eastbound AM Peak	40	**30**	50	**24**

The consultant's conclusion that this is adequate calibration is not believable. First, the use of just 4 travel time runs to prepare a baseline for calibration is wholly inadequate, as traffic varies considerably just day-to-day, let alone on

[88] PBSJ, Draft Existing and Year 2030 No-Build Traffic Operations Technical Memorandum (March 2008), at 12.
[89] *Id.*
[90] *Id.*
[91] *Id.*

weekends or by time-of-day or direction. A much larger set of runs, perhaps 30 for each time/direction, would be needed for statistical accuracy and for obtaining data for travel time reliability (see discussion below). Further, setting aside the obvious miscalculation of speed (47 minutes through a 19.7-mile section is 25 mph, not 29 mph), the large differences in travel time
53 between the field runs and the simulation model could not possibly have been caused by different traffic volumes as the volumes were virtually unchanged between 2007 and 2008. Either the traffic volumes used to calibrate the model were way too high — a serious error as one should always use field-measured volumes for calibration — or the model's performance was understated. Either way, the SIMTraffic model clearly underestimated the 2007 speeds on U.S. 74.

Further, recent analysis (in early 2013) of new travel time runs on U.S. 74 and INRIX data also suggests that speeds on U.S. 74 are significantly higher now than in 2007. NCDOT re-did the travel time runs on U.S. 74 in March 2013, this time with (apparently) three runs in each direction/time period. They found average speeds of 39.1-43.9 mph, about 10 miles per hour faster than the runs made in 2007![92] In other words, the NCDOT's own tests showed that travel speeds had improved significantly between 2007 and 2012. Using a new source of data provided by INRIX, which tracked the speeds of hundreds (perhaps thousands) of actual road users between January 1 and Feb 28, 2013, the INRIX analysis also found that the actual operating speeds were even higher — between 44.2 and 44.9 mph, than in the upward-revised field runs. Both these sources say the same thing: *Travel speeds on the present U.S. 74*
54 *have improved substantially over the past 7 years, and are MUCH HGHER (by 10-15 mph) than the speeds used to calibrate the SIMTraffic operations model.* No explanation is given for these findings, but they are likely a combination of poor initial model calibration and recent improvements to U.S. 74 to smooth and speed its operation.

Errors of this magnitude in calibration cannot be ignored. If not revised to accurately reflect current operating conditions, the SIMTraffic model used for studying flow on U.S. 74 is likely to significantly overstate congestion and travel time through the section, and therefore overstate the potential for diversion to a proposed Bypass.

To correct the above problems, several steps should be undertaken. First, road capacities should be updated in both the simulation model and the regional travel model. The new Highway Capacity Manual (2010)[93] revises procedures for calculation of capacity for both arterials and for freeways, which in some cases results in higher capacity estimates. Failure to use the 2010 Highway

[92] Memorandum from Bradley Reynolds, HNTB, to Jennifer Harris, NCDOT, RE: *U.S. 74 Corridor Travel Time Improvement* (April 8, 2013).
[93] Transportation Research Board, HIGHWAY CAPACITY MANUAL 2010, National Research Board (2010).

Capacity Manual in such cases would therefore bias the traffic forecasts against the no-build alternative by underestimating its ability to carry traffic.

Second, the regional travel model should be calibrated sufficiently to show (at the very least) FHWA-standard agreement with existing volumes by direction
54 and time of day.

Third, the simulation operation model should be re-calibrated to show close agreement with INRIX travel times and speeds through the section, also by direction and time of day. These elemental steps must be undertaken BEFORE either model is used in forecasting.

6. The DSFEIS leaves unanswered key questions regarding induced travel.

The DSFEIS describes methods and results for an estimate of "induced land use development."[94] This estimate, about 3.4% (an increase of development from 125,000
55 acres "no-build" to 128,200 acres "build," compared with a base-year value of 95,200 acres), includes induced-growth impacts for residential, commercial, industrial, and other land uses.[95] A variety of methods are used to make this estimate, including one developed by this reviewer (Hartgen) in 2000, a review of estimated industrial land use impacts, and a review of development forecasts in the original EIS.[96]

However, some additional questions remain. Among them are:

- **Are there different land use forecasts for each alternative?**
  The documentation of the changes in land use forecasts do not specifically
  56 address the question of whether separate land use forecasts were prepared for all alternatives, or (more likely) for just one Build alternative, a generic "corridor" alternative, and the No-build. This raises the question of whether, for modeling purposes, the induced impacts of *other alternatives* (e.g., an "on-current alignment" upgrade of U.S. 74) should also have been studied.

- **Are the land use forecasts carried into the modeling, through trip generation, trip distribution and assignment steps?**
  Nowhere in the material submitted is it specifically stated that the different land use forecasts were then used to re-estimate trip generation, trip distribution, and then assignments of estimated traffic. This might be implied
  57 by the discussion of "raw model volumes," but the report does not actually explain how the adjusted volumes were calculated. Elsewhere (Appendix C-3, section 6.7) the description of the method seems to imply that standard traffic forecasting methods (trip generation, distribution, and assignment) were NOT used in the revised EIS. So, which is it? Was a standard 4-step model used for the DSFEIS, or not?

[94] DSFEIS at 4-29.
[95] *Id.* at 4-30.
[96] *Id.* at 4-29.

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- **Do the trip distribution and assignment steps in the traffic forecast for the "no-build" alternative now exclude "project-induced travel" development and exclude the Bypass in the No-build forecast?**
  It is still not clear if the land use, trip generation, trip distribution and assignment steps described in the DSFEIS include the project's effect. For instance, even if the land use forecasts were found to be the same for "build" and "no-build" scenarios, the trip distributions from them would certainly NOT be the same since they undoubtedly included the Bypass in distributing trips between TAZs. If the trip distributions for the no-build alternative included the proposed Bypass in the network, then that would incorrectly forecast the traffic using the no-build network.

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- **If not, how do the traffic forecasts actually reflect the induced development?**
  The DSFEIS needs to state clearly, in professional "modeling" language that can be reviewed by independent experts, exactly how the revised traffic forecasts for the "build" and the "no build" were prepared.

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7. Questions remain concerning details of traffic forecasts.

The extensive coverage of induced traffic issues in the DSFEIS does not contain a commensurate discussion of the traffic forecasting method itself, so the reader is left to understand that the assumptions in the original traffic model forecast remain valid. This raises numerous questions regarding various issues, including:

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- **Was the MRM used with the updated ICE land use forecasts to estimate future traffic volumes?**
  The DSFEIS states that changes were made to land use to account for the induced effects, and "*then the [Metrolina Regional] Model was run…*" implying that the full generation-distribution-assignment sequence was used.[97] The technical documentation further reports an 3.5% increase of VMT in Union County as a result.[98] But elsewhere, the Traffic Forecast Memo Appendix (Nov. 8, 2013) states: "*This approach uses the original accepted forecasts and base data assumptions to mathematically calculate traffic estimates and redistributions of traffic for conditions not included or known at the time of the initial forecast. This methodology is appropriate <u>because the differences being considered do not change the original forecast, assumptions, methodology or base data</u>. The interpolation and extrapolation process is a method for developing new data points for years not considered in the base forecast but within the range of volumes established by the base forecast.*"[99] And at a later point the documentation says: "*Based on a meeting with NCDOT Transportation Planning Branch (TPB) on March 21,*

[97] DSFEIS Appendix C-3, at Section 6-7.
[98] C. Scheffler, op. cit. Table 5.
[99] DSFEIS at G-9.

61 *2013 and the document Guidelines to Determine When to Request an Updated Traffic Forecast 2 (NCDOT TPB, February 24, 2009), the current Build traffic forecasts meet the guidelines that indicate the existing forecast is valid and an updated forecast is not warranted. All of these guidelines are met since no new alternatives have been identified, the current let date of the project is less than the Future Forecast Year plus 20 years, the study area is not experiencing growth not previously considered in the forecast, and the traffic forecast is not five years older than the Base Year.*"[100] These different statements make it unclear as to exactly whether new traffic forecasts were prepared using the MRM, or by some other method, or not at all.

62 • **Truck percentages**.
It is well known that truck traffic forecasting is one of the weakest elements of traffic modeling. For proposed toll roads, the issue is doubly important as trucks constitute typically 5-10% of traffic but pay 20-40% of toll revenue. Nowhere in the report does it clearly state the assumptions for truck forecasts, but most studies generally use current truck percentages and apply them to future ADT estimates. This simple "take down percent" for regional truck forecasts is probably inappropriate if it has not been updated since the Recession, because the Recession significantly affected truck travel too.

63 • **Time of day percentages.**
In standard modeling practice, time-of-day percentages (so-called K factors for peak hour travel) are assumed to be about 9-10 percent of ADT, based on historical traffic counts. However, in many regions peak periods are lengthening as commuters shift start times to avoid congestion, and work trips are declining as a percentage of total travel. In more advanced models these effects are accounted for by feedbacks between time-of-day assumptions and traffic assignment. The MRM does not apparently account for such trends, either through feedbacks or by increasing the length of peak hours.

64 • **The value of time used for modeling is unclear.**
The Traffic and Revenue Study states the values of time for trip classes, $7-22/hr for trucks, and $7-8/hr for cars.[101] These values seem low for both cars and trucks, given national studies. Elsewhere in this review we note that a high value of time, about $18/hr, would seem to be necessary to create substantial diversion. A high value of time for trucks would similarly be needed for substantial truck diversion. As the estimated toll for trucks on the proposed Bypass would be over $10,[102] the value of time for trucks would seem to be too low to induce much diversion.

[100] *Id.* at 14.
[101] Comprehensive Traffic & Revenue Study (October 2010), at 6-3, 4-9.
[102] *Id.* at Figure 6-3.

65 • **The *reliability* of travel time has not been considered in diversion or benefits.**
Recent research on travel time reliability (the value that travelers place on the *certainty* of arriving within a given time window) suggests that this value is quite high, perhaps higher than the value of time itself. Several national studies[103] have developed guidelines for including reliability in traffic forecasting, and how improved operations affect reliability. These methods have not been incorporated into the analysis of the Monroe Connector/Bypass or its alternatives.

66 • **Road capacities have not been updated**.
The DSFEIS forecasts rely on regional networks that use estimates of highway capacity from the 2000 Highway Capacity Manual.[104] The new Highway Capacity Manual generally raises highway capacities for various road classes, and significantly changes the capacity estimation and level-of-service procedure for urban and rural arterials such as U.S. 74. In particular, the new method for estimating capacity for signalized arterials includes signal progression, access points, and traffic volumes, all of which are obviously relevant for study of U.S. 74. These updated capacities have apparently not been used in the traffic modeling. If the estimates of capacity for U.S. 74 are too low, the effect would be to over-state future congestion estimates on U.S. 74, and thus over-state diversion to the Bypass, and also under-state the viability of other alternatives.

67 • **Market capture rates (40-50%) seem very high.**
While the percentage of non-local traffic was not calculated as part of the traffic forecasts for the project, given that less than half of the traffic on U.S. 74 is appears to be non-local,[105] the overall capture rate of around 50% suggested by the traffic forecasts seems very optimistic indeed. Assuming a generous capture rate of 50% of non-local trips, an overall capture rate less than 25% seems more likely, and even that might be too high if the diverters are infrequent rather than every-day diverters, as the forecast assumes.

68 • **Earlier errors in the 2030 and 2035 traffic forecasts reduce confidence in current estimates**.
The report notes that earlier traffic forecasts, by Wilbur Smith Associates (now CDM Smith) contained errors resulting in higher traffic forecasts.[106] This revelation raises questions about whether the current traffic estimates can also be trusted.

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[103] For instance, Kittleson and Associates, *Evaluating Alternative Operations Strategies to Improve Travel Time Reliability*, National Cooperative Highway Research Program, Report S2-L11, Transportation Research Board (2013), *available at* www.trb.org.
[104] *See* Transportation Research Board, HIGHWAY CAPACITY MANUAL 2000, National Research Council (2000).
[105] *See* Part 1, above.
[106] *See, e.g.*, C. Scheffler, op. cit. Table 5.

8. Project cost and cost-effectiveness are not detailed.

Environmental impact statements generally contain comparative estimates of cost for viable alternatives. The DSFEIS reports an estimated cost range of $845-923 million (in year of expenditure, assuming award in October 2014 and opening in October 2018).[107] But the discussion of costs for the Monroe Connector/Bypass is incomplete:

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- If the construction of the road is delayed significantly, which might happen given environmental and financing issues, this cost estimate is likely to be higher.
- No data is provided for maintenance and operation costs after construction but during service life, converted to present worth, for various alternatives.
- No costs are shown for other alternatives, particularly those for various upgrades of U.S. 74. This appears to violate NEPA regulations that require comparable evaluation of viable alternatives.
- No data is provided on the relative cost-effectiveness of the alternatives. Most EISs show costs, benefits and cost-effectiveness, using such measures as benefit-cost ratios, for various alternatives, not just for the recommended alternative.
- The DSFEIS contains no summary table that compares the impacts, costs, benefits, and other features of the viable alternatives.

9. External traffic forecasts for U.S. 74 and other roads is not discussed.

70

In modeling terminology, "external traffic" is that traffic which leaves, enters or goes through the study area. The issue of how to forecast external traffic is particularly severe for proposed projects on the edges of regions, such as the proposed Monroe Connector/Bypass, which ends at the far eastern edge of the MRM coverage area. Specifically, the traffic on U.S. 74 just east of the proposed project terminus is treated as "external" traffic, and therefore is not forecast directly using the MRM. Instead, external traffic is forecast separately using a variety of methods such as trend-lining, statewide modeling, or inter-regional modeling. It is then typically added to the internal (within the Model) forecast of trip ends, or is added to trip OD matrices, or is added directly to network volumes as a "pre-load." In each case, the separate treatment of external traffic is in addition to that of within-region traffic modeling. In some cases, such as on U.S. 74 just east of the project, external traffic could be as much as 30-40% of traffic volume. This includes truck traffic, which is often a significant portion of smaller-region external traffic.

In the case of the proposed Bypass, our review of recent traffic count history at the far eastern edge of the region (Union-Anson County line) shows that the *external traffic has actually been declining* in recent years.

[107] DSFEIS at 3-10.

U.S. 74 Average Daily Traffic at the Union-Anson County Line

Count Location	2000	2005	2010	2012	12-year Percent Change per year
Anson-Union Line	15000	15000	14000	13000	-1.1

70

Source: NCDOT Traffic Count Maps, *available at* www.NCDOT.gov.

Neither the DSFEIS nor the earlier documentation we looked at contains references to external traffic, leaving the reader completely in the dark as to how it was forecast, whether the current count history was considered or the 2009-12 Recession was accounted for. However, given the huge changes in recent US economic activity, it is likely that any forecasts of external traffic prepared before the Recession would now have to be substantially revised.

10. Considerable uncertainty exists in traffic modeling.

Traffic modeling and forecasting is a craft, not an art or a science. The process is fraught with uncertainty throughout because each step in the process involves the use of critical and generally not-verifiable assumptions concerning the nature of growth or traffic. Uncertainties in the myriad assumptions that must be made in virtually all of its steps have the effect of making "output" uncertainties substantial.

71

The DSFEIS supporting documents recognize this uncertainty, but only for land use inputs, noting that errors in population and land use forecasts can be very high. "*For county level projections of 25 years, the typical mean algebraic percentage errors are about 30 percent while for census tracts (which are typically larger than TAZs) errors are typically 45 percent for the same period. Thus, <u>despite the best efforts of researchers and forecasters, the error rates for long-range projections are still quite high and thus any projection or estimate of induced and cumulative effects must be considered the best estimate within a wide range of error</u>. The accuracy of projected growth under any future scenario could be affected by many variables. These include individual owner or developer actions, the timing of or changes in utility provision, changes in local or state regulations on land use and, most importantly, changes in national or regional economic conditions. While the potential for error is high, the techniques used by the MPO are the best available and provide the best available data for projecting population and employment conditions in the future.*"[108] Such "input" errors and also errors in model calibration are also carried forward into traffic forecasts. However, just because the techniques of land use forecasting are the "best available" does not mean that their results can be trusted for decision-making.

[108] Quantitative ICE Analysis, at 78 (underlining added).

71 In addition to large errors in inputs, and errors in calibration (discussed above) recent studies have found wide variations in the accuracy of modeled traffic forecasts, and the errors can be either an "under" or an "over" forecast. A study of 20-year traffic forecasts for Minnesota found that freeway traffic was *under*-forecast by about 5%, while forecasts for other roads were *over*-forecast by 14-29%.[109] On the other hand, a US national review of toll road forecasts found that for 15 US toll roads, the actual traffic averaged 35% *under* the predicted traffic.[110] In England, the Department for Transport found that 90% of major road traffic forecasts were within 43% of actual traffic — a very wide spread for policy making.[111] In another study of 104 toll roads worldwide, Bain found that after correcting for "optimism bias" the average 20-year-out actual traffic was about 20% *under* the predicted traffic.[112] Also worldwide, Flyvbjerg and colleagues found in a review of 258 road and transit projects that the actual road traffic averaged about 17% *under* the forecast traffic, but actual costs were 250% *over* the forecast cost, with toll roads in particular having larger errors.[113] *In short, the limited reviews so far have found that the average error in 20-year forecasts of road traffic range from ±20% upwards to ±30-40%, with most actual traffic coming in substantially under the forecast traffic.* The errors are also substantially higher for toll roads, leading some observers to suggest that "optimism bias" may be substantially inherent in forecasts prepared on behalf of project advocates. This author (Hartgen) has recently reviewed the topic and has found that the overall accuracy of traffic forecasts is likely to be so large that he recommends considerable caution in their use and less reliance on traffic forecasts for transportation decision-making.[114]

72 The DSFEIS partially recognizes this uncertainty (at least in inputs) and employs sensitivity tests to evaluate the range of its results. However, the range of variation in the assumptions (for instance assumption concerning population forecasts, a 20% difference for value-of-time, a 30% difference in economic growth, the use of electronic toll collection, and 5% difference in fuel prices) do not seem to be extreme enough given recent history.

The recent experiences of South Carolina's Southern Connector, in bankruptcy, the New York court case regarding toll-road forecasts in Detroit and Alabama, and North Carolina's Triangle Expressway — built 6-lanes wide but carrying just 20,000 ADT

[109] David Levinson and Parvithra Parthasarathi, *Post-construction evaluation of traffic forecast accuracy.* TRANSPORT POLICY, (Elsevier), 2010.
[110] National Cooperative Highway Research Program, *Estimating toll road demand and revenue,* SYNTHESIS 364, Transportation Research Board (2006), *available at* www.trb.org.
[111] Department for Transport (United Kingdom), TRANSPORTATION ANALYSIS GUIDANCE: TREATMENT OF UNCERTAINTY IN MODEL FORECASTING (2013), *available at* www.dft.gov.uk/webtag/index/php.
[112] R Bain, *On the reasonableness of traffic forecasts,* TRAFFIC ENGINEERING AND CONTROL (2011) *available at* www.tecmagazine.com.
[113] B Flyvbjerg et. al., MEGAPROJECTS AND RISK; AN ANATOMY OF AMBITION, Cambridge University Press (2003).
[114] D. Hartgen, *Hubris or humility? Accuracy issues for the next 50 years of travel demand modeling,* Transportation 40:6 (November 2013), *available at* www.springer.com/11116.

72 near I-40 and 4,000-6,000 ADT elsewhere — all encourage extreme caution in the use of traffic and revenue forecasts for decision-making, particularly for proposed toll roads where project risk is shifted to distant investors, or if fiscal failure occurs, to the People of North Carolina.

Qualifications of the Reviewer
November 2012

David T. Hartgen
Emeritus Professor of Transportation Studies, UNC Charlotte
President, The Hartgen Group Inc.

QUALIFICATIONS

- Senior manager with 45 years experience in state and federal government, academia and consulting.
- Hands-on consulting, management and policy in transportation issues.
- National reputation for high-quality, objective analysis of transportation issues.
- Extensive expertise in a wide range of complex transportation issues.

EXPERTISE

Economic Development

Beltways and economic development	Land pricing and road access
Traffic impacts of site development	Commercial development along Interstates
Business views of transportation	Economic sector and industry targeting
Truck traffic and routing	Regional economic performance
Regional productivity and competitiveness	Regional distribution systems
Congestion and highway capacity	Evaluation of road proposals

Transportation Funding

Comparative performance of highway systems	Legislation and road performance
Condition of state and municipal road systems	Bridge condition and performance
Needs and funding options for road systems	International performance

Airports and Ports

Impacts of commercial airports	Characteristics of air travelers
General aviation airport impacts	Port competitiveness

Transit

Light rail transit evaluation	Transit system comparative assessment
Transit system performance	Transit route location assessment
Visions, trends and costs	Transit rider characteristics

Sprawl, Growth, and Travel

Sprawl and road investment	Travel patterns in numerous cities
Travel demand modeling	Travel behavior, carpooling, transit use
Forecasts of travel and congestion	Regional demographic forecasts

Environment, Energy and Organizational Change

Environmental impacts	Air quality and greenhouse gas analysis
Transportation energy and pricing	Electric vehicles and natural gas fuels
Organizational change and planning	Information technology

EXPERIENCE

January 2007-Present: President, The Hartgen Group, Charlotte, NC. Consultancy in transportation performance, congestion, financing, transit operations, accessibility and regional productivity, greenhouse gas assessment, funding options. Extensive national, state and local studies. www.hartgengroup.net.

January 1989–December 2006: Professor of Transportation Studies, UNC Charlotte. Professor, Department of Geography and Earth Sciences; Adjunct Professor, Civil Engineering, 1989-2000; Associate, Urban Institute, 1989-2000.

- **Academic**: Graduate courses in Transportation Policy, Analysis Methods, Impacts, GIS, Public Transportation, Transportation Planning, and Management and Finance. Numerous research studies and student theses.
- **Leadership**: Organized, initiated and directed Interdisciplinary Transportation Studies Center, 1991-March 2000. Research, workshops, conferences, reports. Extensive nationwide media contact.
- **Research**: Traffic forecasts, road system performance, highway impacts, site evaluation, economic impacts, school locations, transportation system performance, household travel, trade, air quality, passenger security, electric and natural gas vehicles, airport impacts, transit performance, motor sports impacts, highway system condition and needs, sprawl and road investments.

August 1987 - December 1988. Principal Transportation Analyst, New York State Department of Transportation, Albany, NY, 12232

- Information technology plan for the New York State Department of Transportation.
- Testimony on emergency evacuation plans for the Shoreham Nuclear Power Station on Long Island.

February 1981 - July 1987. Director, Transportation Statistics and Analysis, **New York State Department of Transportation**, Albany, NY 12232.

- **Leadership**: Directed 60-person office responsible for data collection, systems planning and forecasting. Revitalized an extensive highway and traffic data system into information system. Designed and implemented new methods of rapidly assessing highway condition, cut data delivery time by 90% and improved accuracy and reliability.
- **Research**: Principal investigator on 6 federal studies of traffic, forecasts, and energy. Implemented demonstrations of employer and community-based ridesharing. Updated NYS household trip generation rates. Transit fare sensitivity, financing, and project benefit-costs. Integrated corporate database. Infrastructure needs assessment model to forecast repair needs. Canal information system.
- **Academic**: Adjunct Professor, SUNY-Albany, Department of Geography, 1984-1988. Student intern program with local universities. Guest lectures at numerous universities in US and Europe.

May 1984 - March 1985. Policy Analyst, Federal Highway Administration, Washington, DC 20590.

- Evaluated highway information needs for FHWA and the States. Recommended improvements to FHWA planning-related data systems.
- Reviewed pavement initiatives studies, long-term monitoring of pavements. Developed bridge and highway condition deterioration models.

July 1967-- February 1981. Transportation Analyst, New York State Department of Transportation, Albany NY 12232.

- Designed and developed transportation plans, traffic models, and planning methods. Directed staff of 10-15 analysts. 68 papers and reports.
- Adjunct Professor, Union College, 1976-79; Syracuse University, 1974.

PROFESSIONAL

- Board of Directors, Cabarrus County Chamber of Commerce; Charlotte Transit Advisory Committee, Cabarrus County Planning and Zoning Board.
- Active in national organizations. Transportation Research Board. US Co-Editor, *Transportation* (Springer Academic Publications). Professional Engineer, Maine (retired). Scholar, John Locke Foundation. Adjunct Scholar, Reason Foundation.

EDUCATION

- Ph.D., Civil Engineering, Northwestern University, 1973
- M.S., Civil Engineering, Northwestern University, 1967
- B.S., Civil Engineering, Duke University, 1966

RECOGNITION

- Walter P. Murphy Fellowship, Northwestern University, 1966-67
- Profiled in *Transportation Research News*, National Academy of Sciences, November 1978
- Profiled in the *Charlotte Observer*, November 1991
- Outstanding paper, Transportation Research Board, National Academy of Sciences, 1993
- Profiled in the *Charlotte Business Journal*, March 29, 1993
- Op-ed profile, *Charlotte Observer, December* 1, 1997
- Scholar, John Locke Foundation, 1999
- Scholar, Reason Foundation, 2005
- Member Emeritus, Transportation Research Board Committee on Travel Behavior, 2002

PUBLICATIONS

355 publications and reports on a wide range of transportation issues. Selected recent:

- Comparative Performance of State Highways, 20th Report. In press, Reason Foundation, 2012.
- Review of Wake County (NC) Transit Plan, John Locke Foundation, May 2012.
- Are Highways Crumbling? ALEC Conference, May 2012. In press, Reason Foundation, 2012.

- Employers' Views of Traffic Congestion. In press, Transportation Research Board, 2012.
- Wisconsin State Highway System Needs and Resources. Wisconsin Policy Research Inst., May 2011.
- Greenhouse Gases and Transportation Policies. Reason Foundation, Sept. 2011.
- Comparative Performance of State Highway Systems, 19th Report. Reason Foundation, Sept. 2010
- Distributing Transportation Funds. Testimony, Joint Oversight Comm., NC Gen Assembly, Apr 2010
- How Traffic Congestion Affects Regional Economic Performance. Reason Foundation, Oct 2009.
- North Carolina Transportation Issues. Presentation at the John Locke Foundation, Feb. 23, 2009.
- Comparative Transportation Performance of Canadian Provinces. Fraser Inst., Vancouver BC, 2008.
- Mega-region Growth and Transportation Readiness. Urban Land Institute, 2008.
- Assessment of Charlotte's Light Rail Line. John Locke Foundation, 2008.
- Economic Impacts of Highways in South Carolina. Report to SCDOT, 2007.
- National Study of Highway Congestion. Reason Foundation, 2006.
- Performance of North Carolina Transit Systems. John Locke Foundation, Spring 2006.
- Cost-Effectiveness of North Carolina Highway Projects. John Locke Foundation, Spring 2005.
- Highways and Sprawl in North Carolina. John Locke Foundation, September 2003.
- Highways and Sprawl in Ohio. Buckeye Institute, January 2003.
- Guidelines for Highway Needs Studies. Eno Foundation, Transportation Quarterly, Spring 2003.
- Performance: A Point-counterpoint Exchange. Eno Foundation, Transportation Quarterly, 2002.
- The Charlotte Region: A Distribution Powerhouse. Ventures Business Magazine, March 2001.
- North Carolina Highway Performance, Needs and Funding. John Locke Foundation, October 2000.
- New York State Highway Needs. Associated General Contractors of NY, 1999.
- Arkansas State Highway Needs. Governor's Citizens Highway Council, June 1998.

CONTACT:

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APPENDIX E-5

Appold Letter (May 29, 1013)

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29 May 2013

Jamal Alavi, PE, CPM
Transportation Planning Branch
1554 Mail Service Center
Raleigh, NC 27699-1554

Dear Jamal Alavi,

Thank you for forwarding a copy of Frank Holleman and Kym Hunter's November 30, 2012 letter to Jennifer Harris to me. That letter detailed the Southern Environmental Law Center's concerns about the proposed Monroe Connector/Bypass.

I have had three involvements which touched directly or indirectly on the Monroe Connector/Bypass: 1) as an "auditor" of an earlier round of socio-economic estimates which were used by Wilbur Smith Associates (now CDM Smith) in support of a revenue study for the Connector/Bypass, 2) as someone who had conducted a recent round of "top-down" socio-economic projections for the region, and 3) as a participant in the "Seven Portals" study conducted under the auspices of the State Logistics Task Force, albeit for a different region of the state. My second involvement is mentioned at several points in the letter.

At no point have I been asked to assess the need for or financial viability of the Monroe Connector/Bypass.

Let me first confirm that, at least on first reading, all mentions of my work in Holleman-Hunter letter appear to be accurate but there are several points at which I'm afraid misinterpretations have arisen.

First, the socio-economic projections cited in the study are neither build nor no-build scenarios. The projections are not affected by specific infrastructure investment decisions.

As stated in the Holleman-Hunter letter, my directions were to "assume that there is sufficient infrastructure in place to keep up with expanding population [p. 19]." However, that does not necessarily imply assuming "projects like the Monroe Connector/Bypass [p. 19]." There are several reasons for this. 1) The Metrolina Region has a generally well-developed road network. Virtually all places are already accessible. 2) The districts projected are quite large compared to the generally accepted spatial impacts of highway construction. There is considerable room for intra-district redistribution should any specific infrastructure impact population or employment distribution. 3) Most importantly, although journey-to-work is ahnost certainly a factor in residential location decisions, such decisions are not very sensitive to even large variations in commuting time. In fact, there is a very productive urban research tradition

building on the Tiebout hypothesis which ignores travel times and focuses on the relationship between amenities and local taxes.

The Holleman-Hunter letter claimed that "the model equated distance to travel times" and used "proximity distances as a proxy for travel time [p.19]." This is simply not so. The district-level projections do not utilize travel times. I do not know the employee place of work nor do I know where residents shop or attend school. I do estimate and project the approximate locations of "traffic generators" but, in general, we also know that much contemporary driving is due to the various types of "cross-commutes" – employees driving right past the facilities of their own employers to arrive at different facilities, shoppers driving past one supermarket to buy at another one, and so on. Some estimates have held excess commuting accountable for quite large proportions of contemporary driving.

Ideally, the projections might build on a non-recursive land use-transportation model. However, such models have proven themselves to be extremely difficult to implement in practice. As suggested above, these may over-weight transportation concerns compared to real-world decision-making.

Instead, I believe most regions approach the utility maximization problem by projecting the location decisions of households and establishments first. I followed that approach. That is, the projection process asks: "Where might households choose to live?" and "Where might organizations choose to locate?" There are several types of households and several types of organizations, each with their own sets of needs and budget constraints.

The best available information for that purpose may be the historical pattern of behavior in the Metrolina region and elsewhere.

The task of the transportation planner is then to model the travel patterns which result from those loosely linked household and establishment location decisions and support the provision of the infrastructure and services which support welfare maximization.

Although the traditional monocentric model performs relatively well in describing urban structure, research has confirmed that important behavioral assumptions are not closely met. Therefore, the Holleman-Hunter claim about equating distance, proximity, and travel time misinterprets what is done in theory and in practice.

Second, as Holleman and Hunter suggest, the projection process was indeed collaborative – although somewhat less so than I had originally hoped. Several interim projections were presented before the final projections were generated. (I believe the Holleman-Hunter relies on one of the interim versions as the final version had not yet been submitted at the time of their letter.) The preliminary presentations were important in obtaining "buy-in" for the region-wide projections which were one basis for the county and district projections. It may sometimes be true that planners can be under pressure to push for high growth projections as implied in the Holleman-Hunter letter and the adoption of any projections requires broad political "buy-in." However, the planners involved in the process are also highly skilled professionals who have a great deal of detailed knowledge about growth patterns and preferences. The top-down and bottom-up procedures ideally would be performed in tandem to maximize the information incorporated in the projections.

The major differences between the earlier and later district-level projections were due to greater data availability. As the Holleman-Hunter letter suggests, local planners did raise concerns. I reacted to planner comments in two ways. 1) Because the adjustments were small, I did modify my "methodology to ensure that most counties grow at at least their long-term relationship to the regional growth rate [p. 20]." These adjustments affected mainly the outlying ring of counties. 2) Several local planners made plausible cases that the initial projections did not fit historical development trends. In most cases, these adjustments entailed intra-county reallocations for which the historical data are not as strong or as long as for counties.

A third type of adjustment could emerge from the bottom-up process. It is possible that limited land availability could render some of the projections implausible but I have received no feedback to that effect.

It may be that "the ultimate top-down numbers are reviewed and modified by local planners based on their assumptions about what growth they hope to see in the future [p. 19]," but I have no knowledge of any such adjustments. It may be that there is a "perceived failure to incorporate the growth that planners anticipate may result from local infrastructure projects [p. 20]" but population and employment growth is not nearly as responsive to infrastructure provision as some like to believe. In the end, the planning process generally acknowledges and reacts to, but is not steered by, such claims.

Third, just to be clear, the major reason for differences between my (later) projections and Thomas Hammer's (earlier) projections is differences in the available data. These differences generally, but not universally, work in favor of the more recent set of projections. Not only do we now have an extra decade of recent experience, we also have additional historical population data which has been adjusted to 2010 Census tracts. These allow for a stronger calibration period than was available a decade ago. On the other hand, the latest full decade has been tumultuous for the nation and the region. The decade began and ended with recessions, the latter being the largest disruption since the 1930s with a significant bubble in between. The subsequent path to recovery has been anything but robust. Although all population and employment projections need wide confidence intervals, there is greater than usual uncertainty about the pace of short-term growth and it may not be clear for several years which of the growth patterns of the first decade of the century are indicators of trends and which will turn out to be episodic.

There are two aspects which do not necessarily touch on my projections where I feel that the Holleman-Hunter letter may be mis- or over-interpreting the available evidence.

First, they cite the projections for Legacy Park and interpret them as "build" projections. I believe that to be an over-interpretation. Typically, such projections are "at buildout." Such projections may be useful in planning discussions but many proposed developments never approach buildout and quite a few don't attract any users/tenants at all. In general, property-based development of all sorts has an extremely poor record of generating growth.

There are several contingencies which must be addressed before even initial tenants can be attracted to Legacy Park. The envisioned anchor tenant has expressed interest but not yet made a commitment. Its location is distant from the main traffic flows. Even if the Monroe

Connector/Bypass were built as a non-toll road, it is not clear that Legacy Park would develop as a logistics node. The impact of tolled access on development prospects is even less clear.

The Holleman-Hunter letter makes several additional similar references to the potential acceleration of employment growth with the completion of road improvements, particularly in rural areas. Improved access sometimes does contribute to employment growth but, again, access is only one of a constellation of relevant factors. The last several decades have not been kind to rural North Carolina and, unfortunately, the North Carolina experience with impact of highways on rural employment growth has been uneven, at best.

Second, I feel that Holleman and Hunter may be misinterpreting the literature on "induced traffic" and the stimulating Duranton-Turner article, in particular. That article is a recent addition to a long and informative academic discussion.

In terms of economic theory, supply and demand should equilibrate. Any increase in supply should, in theory, result in greater demand. Up to a point, this general thesis holds for roads and driving also. What the increase in driving implies, given certain key constraints, is an increase in utility (social welfare). That is, when the supply (of roads) increases making travel less costly, people drive more up to the point that the (joy of) needs met by travel are again balanced by the disutility (pain) of travel and paying for the roads. Accordingly, there may be extra trips to visits friends and family. There may be extra trips to work or for civic engagement. These are arguably not only personal but also social "goods" and that planners ought to be facilitating them.

The Duranton-Turner article finds that, on average, a 10 percent increase in Interstate lane miles results in a 10.3 percent increase in Interstate vehicle miles travelled. (Actually, the authors use kilometers.)

They attribute from 9 to 39 percent of the increase to changes in household driving behavior with their best estimate finding that a 10 percent increase in Interstate lane miles results in a 1 percent increase above baseline expectations in driving on all roads. Thus, the behavioral impact is real but small.

Duranton and Turner further attribute from 19 to 29 percent of the increase in traffic to truck traffic. They attribute 5 to 21 percent of the increase to migration (perhaps 2 percent greater migration above baseline expectations over 20 years as a result of a 10 percent increase in Interstate miles) and 0 to 10 percent of the increase to diversion (changes in routes or timing). Other researchers have attributed a significant portion of the induced driving to shifts in the timing of trips.

There is a potential hole in the Duranton-Turner model in that their statistical "instruments" essentially tap regional central places. Regional central places, especially large metropolitan areas, have, on average, grown more rapidly than other places over recent decades. The primary explanation for the disproportionate growth of such places is the changing skill needs of the U.S. economy and the ability of large central places to support labor markets for high-skill personnel. Therefore, their estimate of the impact of highways on migration may be biased.

The demand-supply linkage may not be straightforward. I believe the consensus belief is that the increase in truck miles has occurred in response to the reorganization of the logistics

sector and relatively inexpensive fuel to favor fewer, larger distribution centers and that this has occurred despite increasing congestion on Interstate highways. As we know, Rocky Mount is home to at least two distribution centers which serve the entire eastern third of the U.S. and the former Dell plant in Forsyth County served a similar territory.

Further, the Duranton-Turner article explicitly rejects public transportation as a means of reducing miles driven and it rejects "sprawl" as a contributor to induced driving. These conclusions run counter to several popular claims about highways and transit but, over the last decade, planners and researchers have begun to reconsider the common wisdom about the linkages between transportation and land use. Induced traffic is a complex phenomenon but it does not mean "build it and they will come."

All human behaviors have externalities, possibly leading to a divergence between individual and social costs. In the case of driving, these external effects can have significant implications. The first is in the seeming inevitability of rush hour congestion. A second is an adverse environmental impact. It may be that the best way to address both challenges is to tax the "bads" to induce different behaviors. In that regard, as a tolled facility, the Monroe Connector/Bypass may incorporate the policy favored by economists (including Duranton and Turner).

There are several caveats to the application of the Duranton-Turner article to the Monroe Connector/Bypass. First, the article examines metropolitan area-wide relationships, not the impact of specific projects. Given the discussions in the literature, I'm not sure the research can be directly used to support individual project decision-making. Second, the use of tolls effectively nullifies the induced driving argument. In the toll road case, the pain of paying substitutes for the pain of being stuck in traffic. The basic theoretical argument behind induced driving resulting from a decrease in the cost of travel does not apply. In any event, there is too little experience with toll roads to test the induced driving argument. I believe the research on optimal tolls does suggest that tolls are an effective means of reducing congestion, however. Third, despite their extensive and very careful work, Duranton and Turner place very large confidence intervals around their parameter estimates. This confirms the findings of Flyvbjerg and others. Traffic projections, like all other projections, are subject to a large degree of uncertainty. Under such conditions, the confidence intervals for any build and no-build projections would likely overlap by a large margin with the implication that build and no-build scenarios could be indistinguishable from each other.

Thank you.

Sincerely,

Stephen J. Appold

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APPENDIX E-6

MUMPO letter to Kym Hunter (April 16, 2013)

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mecklenburg-union
MUMPO
metropolitan planning organization

600 East Fourth Street
Charlotte, NC 28202
704-336-2205
www.mumpo.org

April 16, 2013

Kym Hunter, Staff Attorney
Southern Environmental Law Center
601 W. Rosemary St., Suite 220
Chapel Hill, NC 27516-2356

RE: 2008 Ozone Conformity Determination

Dear Ms. Hunter:

We appreciate your interest and submittal of comments on the 2008 ozone conformity determination. You asked for clarification regarding the legality of using the Metrolina Regional Model (MRM) to simulate a future without the road for NEPA analysis, and then using the same model to simulate a future with the road in another analysis for the conformity determination. It appears that there may be some confusion about the MRM and its relationship with the Land Use Model that provides socioeconomic information for use in the travel demand model.

First, let me clarify that the MRM is a set of mathematical equations used to replicate and predict travel behavior. Second, the model bases this replication and prediction of travel behavior on the representation of highway and transit to be expected in service in the horizon years covered by the long range transportation plan. Third, the population/employment projections used in the MRM are generated by separate modeling and are officially adopted by the region, as required by the USDOT Conformity Regulations.

Your letter represented that the North Carolina Turnpike Authority (NCTA) used the MRM in its study of the Monroe Connector/Bypass to simulate a "No Build" Scenario. That statement is not correct. The NCTA suggested that results from our land use model best represented a No Build land use scenario for analysis required under the National Environmental Policy Act. The land use model is a separate and independent model from the MRM.

Further, your email transmitting your letter includes a PowerPoint file attachment that you reference as a Michael Baker presentation. You further suggest that this presentation found that under the MRM the Monroe Connector/Bypass reduces travel time to employment in the region by an average of only 18 seconds. It appears to us that the attachment is summarizing results of a sensitivity analysis of the travel time to employment factor in the land use model. It does not appear that the presentation used the MRM in its analysis.

As required by USDOT, the official travel demand model (MRM) was used for the conformity determination for the 2035 LRTP. The network used in the model represented MUMPO's 2035

LRTP. The MUMPO adopted population, household and employment projections were used as input into the MRM and the 2035 LRTP conformity process.

If you have further questions, please contact me at rwcook@charlottenc.gov or 704-336-8643.

Sincerely:

Robert W. Cook, AICP
Secretary, Mecklenburg-Union Metropolitan Planning Organization

cc: Sarah McAulay, MPO Chairwoman
Brad Horvath, MPO Vice-Chairman
Danny Pleasant, TCC Chairman
Eldewins Haynes, CDOT
Eddie Dancausse, FHWA
Loretta Barren, FHWA
Dianna Smith, EPA
Todd Pasley, NCDAQ

APPENDIX E-7

FHWA Conformity Determination for CRTPO 2040 MTP (May 2, 2014)

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U.S. Department of Transportation
Federal Highway Administration

North Carolina Division
310 New Bern Avenue, Suite 410
Raleigh, NC 27601
(919) 856-4346
(919) 747-7030
http://www.fhwa.dot.gov/ncdiv/

May 2, 2014

In Reply Refer To:
HDA-NC

Mr. Anthony J. Tata
Secretary
North Carolina Department of Transportation
1501 Mail Service Center
Raleigh, NC 27699-1501

Dear Secretary Tata:

We reviewed the Metrolina Area Transportation Conformity Determination Report for the:

- Cabarrus Rowan (CR) Metropolitan Planning Organization (MPO), Charlotte Region Transportation Planning Organization (CRTPO) and the Gaston Cleveland Lincoln (GCL) MPO 2040 Metropolitan Transportation Plans (MTPs)
- CRMPO, CRTPO and the GCLMPO FY 2012-2018 Transportation Improvement Programs (TIPs)
- Projects from the FY 2012-2018 State TIP for the county donut area of Union

The CRMPO, the CRTPO and the GCLMPO made conformity determinations on the 2040 MTPs/FY 2012-2018 TIPs and the North Carolina Department of Transportation made a conformity determination on projects from the FY 2012-2018 State TIP on the following dates:

- CRMPO April 23, 2014
- CRTPO on April 16, 2014
- GCLMPO on March 27, 2014
- The NCDOT (for the county donut area of Union) on April 1, 2014

The CRMPO, the CRTPO and the GCLMPO FY 2012-2018 TIPs are direct subsets of the 2040 MTPs.

The Federal Highway Administration and the Federal Transit Administration reviewed these documents. We also coordinated our review with the Environmental Protection Agency (EPA) Region 4 and enclosed their comments to this letter.

Based on our review and the comments provided to us by the EPA, we find that the following conform to the purpose of the State Implementation Plan (or interim emissions tests, in areas where no State Implementation Plan is approved or found adequate by EPA) in accordance with 40 CFR Part 93:

- The CRMPO, the CRTPO and the GCLMPO 2040 MTPs
- The CRMPO, the CRTPO and the GCLMPO FY 2012-2018 TIPs
    - *Including CRMPO TIP amendments for projects W-5516 and U-4910A&B*
- Projects from the FY 2012-2018 State TIP for the county donut area of Union

Sincerely,

For John F. Sullivan, III, P.E.
Division Administrator

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

April 28, 2014

John F. Sullivan, III, P.E.
Division Administrator
North Carolina Division Office
Federal Highway Administration
310 New Bern Avenue, Suite 410
Raleigh, North Carolina 27601

Dear Mr. Sullivan:

Thank you for your letter requesting our review of the transportation conformity determinations for the 2008 8-hour ozone and carbon monoxide (CO) standards for the new 2040 Long Range Transportation Plans (LRTPs) and reaffirmed/amended Fiscal Year (FY) 2012-2018 Transportation Improvement Programs (TIPs) for the Charlotte Regional Transportation Planning Organization (CRTPO); the Gaston-Cleveland Lincoln Metropolitan Planning Organization (GCLMPO); the Cabarrus-Rowan Metropolitan Planning Organization (CRMPO); and the FY 2012-2018 TIP for the donut portion of Union County located in the North Carolina portion of the Charlotte bi-state nonattainment area. As allowed by the Transportation Conformity Rule, the South Carolina portion of this nonattainment area implements transportation conformity independent of the North Carolina portion of this area.

On June 20, 2013, the United States Environmental Protection Agency approved a maintenance plan, known as a "limited maintenance plan," for the Mecklenburg County, North Carolina CO maintenance area. This limited maintenance plan has a 2015 horizon year. Because of the approved limited maintenance plan, the CRTPO no longer has to complete a regional emissions analysis for the CO standard pursuant to 40 Code of Federal Regulations (CFR) 93.109(e). However, all other transportation conformity requirements under 40 CFR 93.109(b) continue to apply. We have completed our review, and recommend a finding of conformity for the 2008 8-hour ozone and CO standards for the new 2040 LRTPs and the reaffirmed/amended FY 2012 -2018 TIPs.

On August 15, 1997, and subsequently on July 1, 2004, the EPA published revisions related to the "Criteria and Procedures for Determining Conformity to State or Federal Implementation Plans of Transportation Plans, Programs, and Projects Funded or Approved Under Title 23 U.S.C. or the Federal Transit Act," or Transportation Conformity Rule (40 CFR Part 93). These revisions outline the criteria that must be met for the 8-hour ozone standard. The EPA has reviewed the conformity determinations related to the 2008 8-hour ozone and CO standards for the new 2040 LRTPs and the reaffirmed/amended FY 2012-2018 TIPs, and has concluded that all of the criteria, including those outlined in the July 1, 2004, conformity rule revision entitled, "Transportation Conformity Rule Amendments: Conformity Amendments for New 8-hour Ozone and PM2.5 National Ambient Air Quality Standards, Response to March 1999, Court Decision and Additional Rule Changes," (69 FR 40004) have been met.

The EPA has considered this conformity determination in light of the current status of the Clean Air Interstate Rule (CAIR). The EPA notes that the District of Columbia (D.C.) Circuit issued a decision on July 11, 2008 vacating CAIR. North Carolina v. EPA, 531 F.3d 896 (D.C. Cir. 2008). On September 24, 2008, the EPA and other parties in the case filed motions for rehearing asking the D.C. Circuit to reconsider its decision in the case. On December 23, 2008, the court granted EPA's motion for rehearing to the extent it agreed to remand CAIR without vacating it. However, the court made no other changes to the July 11, 2008 opinion, remanding the case to the EPA for further rulemaking consistent with this opinion. Therefore, the CAIR rule remained in place, but the EPA was required to promulgate another rule consistent with the court's July 11, 2008 opinion.

On August 8, 2011, (76 FR 48208) the EPA finalized the Cross State Air Pollution Rule (CSAPR) as replacement for the remanded CAIR rule. The final rule was effective on October 7, 2011.

On December 30, 2011, the D.C. Circuit Court stayed the implementation of CSAPR pending its review of the rule. The Court also ruled that the EPA was expected to continue administering the CAIR pending the Court's resolution of the petitions for review of CSAPR.

On August 21, 2012, the D.C. Circuit Court issued its decision on CSAPR. The Court vacated the rule and the associated federal implementation plans. The Court further ruled that the EPA must continue to administer CAIR pending the promulgation of a valid replacement. Therefore, CAIR remains in place. (EME Homer City Generation v. EPA, No. 11-1302 (D.C. Cir))

Thank you again for the opportunity to review the conformity determinations for the 2008 8-hr ozone and CO standards for the new 2040 LRTPs and reaffirmed/amended FY 2012-2018 TIPs for the CRTPO, the GCLMPO, the CRMPO and the FY 2012-2018 TIP for the donut portion of Union County located in the North Carolina portion of the Charlotte bi-state nonattainment area. If you have any questions regarding this letter, please contact Dianna B. Smith of the EPA Region 4 staff at (404) 562-9207.

Sincerely,

Katy R. Lusky
Chief
Air Quality Modeling
and Transportation Section

cc: Eddie Dancausse, FHWA NC
Loretta Barren, FHWA NC
Anne Galamb, NCDNER
Heather Hildebrandt, NCDOT
Keith Melton, FTA Region 4

APPENDIX E-8

FHWA Memos

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U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: **INFORMATION:** Prior Concurrence on Combined Final Supplemental Final Environmental Impact Statement and Record of Decision (FSFEIS/ROD) for the Monroe Connector/Bypass

Date: May 13, 2014

From: Gerald L. Solomon
Director, Office of Project Development and Environmental Review

In Reply Refer To: HEPE-1

To: John F. Sullivan, III
Division Administrator (HDA-NC)
Raleigh, North Carolina

This memorandum is in response to your request for Prior Concurrence dated April 25, 2014, on the combined Final Supplemental Final Environmental Impact Statement and Record of Decision (FSFEIS/ROD) for the Monroe Connector/Bypass Project. You updated the summary attachment to the request Prior Concurrence document in response to a request to double check the forecasts. The attachment was also revised to reflect the conformity determination on the Metropolitan Planning Organization's (MPO's) Metropolitan Transportation Plan (MTP). Staff from the Office of Planning, Environment, and Realty coordinated with Division staff for the review of the issues related to:

- Purpose and Need;
- Alternative Designs;
- Indirect and Cumulative Effects;
- Consideration of CRTPO's 2040 LRTP Socioeconomic Forecasts;
- Use of Different Socioeconomic Data Sets in Traffic Forecasting;
- Traffic Forecasting; and
- Need to Supplement the DSFEIS.

Staff from the Office of Project Development and Environmental Review, in coordination with the Office of Planning, and the Office of Chief Counsel, reviewed the information in the proposed FSFEIS/ROD. We also coordinated extensively with your Division staff.

We are pleased to concur in your approval of the FSFEIS/ROD for the subject project in Charlotte, NC. This concurrence is provided in accordance with procedures specified in 23 CFR 771.125 (c).

We also concur with your determination that the use of a combined FSFEIS/ROD is appropriate for this project.

Thank you for the opportunity to work cooperatively with your staff on this important project.

Memorandum

U.S. Department
of Transportation
Federal Highway
Administration

Subject: Review of Forecasting and Analysis in Support of the Monroe Connector/Bypass Project

Date: May 14, 2014

From: Brian Gardner
Team Leader, Systems Planning & Analysis Team

In Reply Refer to: HEPP-30

To: John F. Sullivan, III
Division Administrator
North Carolina Division

Gerald L. Solomon
Director, Office of Project Development
and Environmental Review

At the request of the Director of the Office of Planning, I have provided ongoing technical assistance to the North Carolina Division on issues related to travel forecasting for the Monroe Connector/Bypass over the past year. I have reviewed the May 5, 2014 Summary of Issues attached to the Prior Concurrence Request along with supporting material from the North Carolina Division and offer the following comments.

Earlier this year the Charlotte Regional Transportation Planning Organization (CRTPO) released a new set of population and employment projections in support of the 2040 Metropolitan Transportation Plan (MTP). After a 30-day public comment period, the CRTPO adopted the 2040 MTP on April 16, 2014, and the Federal Highway Administration (FHWA) issued a conformity determination on the CRTPO 2040 MTP on May 2, 2014. The 2014 projections incorporate new Census Bureau data and reflect the full effects of the recent recession. This forecast suggests 2030 growth will favor areas closer to the core, resulting in slightly faster growth in population and employment within Mecklenburg County and slower growth in Union County, particularly towards the east. Union County is still expected to add 48% more population by 2030. This consolidated growth pattern is anticipated to occur with the addition of the Monroe Connector as the CRTPO planning assumptions for the 2014 projections include the project.

The Michael Baker Engineering, Inc. May 1, 2014 Memorandum (Scudder Wagg and Ken Gilland) to Jennifer Harris, NCDOT compared the 2009 and 2014 projections, with an emphasis on the population forecasts. The methodology focused on household changes, discounting the employment changes, noting:

> *Since the projections show similar results for Mecklenburg County as a whole and since residential development is the main driver of land use change in the study area, the*

comparison of these projections will focus on the differences in the household growth trends by watershed.

The 2014 projections anticipate more residential development within the Crooked Creek watershed and less development in the central and eastern portions of the study area. Crooked Creek is the only area seeing a higher growth rate for the 2014 projections. It's not clear from the May 1, 2014 Memorandum how many additional acres of development would likely occur; as a result the rationale for minimal impacts isn't well established.

My concerns were conveyed to the Division. In response to my comment regarding the sufficiency of the basis for not considering distribution of employment, the Division provided the following clarification:

The Michael Baker Engineering, Inc. March 20, 2014 Memorandum (Scudder Wagg and Ken Gilland) to Jennifer Harris, NCDOT compared the MPO's 2009 socioeconomic projections used in its latest update of the 2035 Metropolitan Transportation Plan (MTP) to the MPO's 2014 socioeconomic projections used in its recently adopted 2040 MTP. It should be noted that Michael Baker Engineering, Inc used the MPO's 2009 projections as 2030 no-build scenario and added induced project growth to those projections to obtain its adjusted 2009 projections of a 2030 build scenario. The memorandum estimates what the differences between the projection might have on the conclusions in the ICE Update in the draft supplemental FEIS.

The memorandum focused primarily on the household projection changes because the largest changes in land use are in residential land use. I concur with Michael Baker's assessment. In addition to being the main driver of land use changes in the study area, the MPO's 2014 projections of households saw a larger shift in the distribution of households within the county. The MPO's 2014 household projections for the Northwest district saw an increase in households while the overall household projections for the other districts and for Union County as a whole were less than the 2009 projections.

The memorandum also showed differences between the MPO's two projections of employment in the year 2030. The MPO's 2014 employment projections for Union County are less than the MPO's 2009 projections for the year 2030. Unlike the household projections, the 2014 projections of employment in 2030 are lower in each district within Union County as well (table 2). The memorandum really did not need to consider the changes in employment projections because the ICE Update for the draft supplemental FEIS estimated very limited change in non-residential land use because of the project.

The Michael Baker Engineering, Inc. ICE Update used the employment projections to a TAZ as an input to estimate commercial and industrial/office/institutional (non-residential) land use. The ICE Update estimated very limited change in non-residential development due to the project. ICE Update table 20 shows 300 acres of change in commercial land use between in the build and no-build in 2030. Compared to the overall project study area (202,000 acres), this change is so small that when expressed as a percentage of land area in the study area it is no change. Similarly, the ICE Update estimated 100 acres of change in industrial/office/institutional land use between the build and no-build in 2030. Again, when

compared to the overall study area, this change is so small that when it expressed as a percentage of land area in the study area it is no change.

The MPO's 2014 employment projections for Union County in 2030 are lower than those used in the ICE Update. The 2014 projections would lower the overall estimate of non-residential land use in the no-build and build scenarios compared to those in the ICE Update. However, such a difference would not significantly alter the estimated change in acreage between the build and no-build scenarios, especially when expressed as a percentage of the total project study area. The 2010 baseline land use scenario shows that non-residential development is 5% of the study area. In the 2030 no-build scenario, the non-residential land use is 7% of the study area. In the 2030 build scenario, the non-residential land use (excluding the highway right-of-way) is 7% of the study area. If we lowered the 2030 build scenario non-residential land use 20% - 25% and then subtracted out the changes in non-residential land use around interchanges, we would likely get similar differences in overall changes in land use. The ICE Update shows that most of the non-residential land use change due to the project is expected around the interchanges. The ICE Update estimated very little change in non-residential land use because of the project. Thus, the reduction in 2030 employment projections would not significantly alter the change and distribution of non-residential land use because of the project.

In response to my comment regarding the adequacy of the rationale for minimal impacts in Crooked Creek, the Division provided the following clarification:

The Michael Baker Engineering, Inc. May 1, 2014 Memorandum concluded that use of the MPO's 2014 projections would likely lead to similar conclusions regarding the indirect and cumulative effects with the exception of the Crooked Creek watershed. In the Crooked Creek watershed slightly higher indirect and cumulative effects are likely due to the increase in expected development in the watershed over the MPO's 2009 household projections for the year 2030. The Crooked Creek watershed might see increased development because it is a watershed affected by the ICE Update accessibility analysis.

*The MPO's 2014 household projections for the year 2030 show a change from the 2010 baseline of 5251 households (table 7). The MPO's 2009 projections for the year 2030 show an increase of 3639 households from the 2010 baseline (table 6). This is roughly an increase in 1600 households between the projections from the 2010 baseline to the 2030 build scenario. Assuming that the household increase was totally related to building the project, which is not likely, then the increase in the impervious surface would roughly be only 1 percent greater than the 2 percent change predicted in the ICE Update. We arrived at that determination by calculating the increase in impervious surface related to the increase in households. The ICE Update showed the area of the Crooked Creek watershed at 38.3 square miles (table 1). If the 1600 households acres of additional development occurred as low density residential (1 to 2 houses per acre, pE1-82), then the resulting increase in impervious surface would be only 1% [(1600 households / 1.5 households per acre*0.2) / (38.3 square miles * 640 acres per square mile)]. The ICE Update page E1-94 shows the percent impervious surface per land use category. The percent impervious surface for low density residential land use is 20%. If the development was medium residential density, the resulting increase in impervious surface would negligible (rounded to 0 percent) [1600/3.5 households per acre *0.25) / (38.3 square miles * 640 acres per*

square mile)]. The analysis used 3.5 households per acre for medium density because the range on page E1-82 for medium density residential land use is greater than 2 but fewer than 5 households per acre. In conclusion, if the 1600 increase in households between the 2009 and 2014 projections was solely related to the project, which is highly unlikely, then the resulting change in impervious surface in Crooked Creek would be negligible to 1 percent increase. This is not significantly new information changing the environmental effects of the project.

Subsequently, I asked the Division if they could double-check the figures to ensure proper basis (build to build) for comparisons between the 2009 and 2014 forecasts. The Division provided the following response:

As requested, I'm clarifying and confirming the data used In Tables 6 and 7 of the M. Baker memorandum titled: "Review of CRTPO Socioeconomic Projections" below:

Table 6 includes 2030 Households (build) forecasts from the 2009 Michael Baker induced growth projections included in the ICE.

Table 7 includes 2030 Households (build) forecasts from the 2014 projections.

Comparing table 6 to table 7 is an appropriate comparison of the 2009 build scenario projections to the 2014 build scenario projections.

The additional clarifications provided by the Division address the concerns I raised regarding the employment projections, Crooked Creek impacts, and the basis for comparison of the 2009 and 2014 projections. The basis for comparing the adjusted 2009 population and employment projections with the 2014 projections is reasonable as the assumptions for both sets of predictions include the presence of the project.

The 2014 population and employment projections that include the presence of the project suggest the central and eastern portions of Union County are generally less attractive for development than anticipated by the 2009 projections. As such, residential development attributable to the Monroe Connector in the vicinity of the eastern terminus would be lower using the 2014 projections.

The 2014 employment projections that include the presence of the Monroe Connector suggest other areas, notably Mecklenburg County, will be more attractive for non-residential development relative to Union County than anticipated by the 2009 projections. As noted in the Quantitative Analysis Update, non-residential development impacts attributable to the project are most likely localized near the interchanges. Based on the higher 2009 projection of non-residential development, 300 acres were attributable to the influence of the Monroe Connector. With less overall growth in non-residential development anticipated for all the Union County districts by the 2014 projections, the non-residential development attributable to the Monroe Connector would be lower using the 2014 projections.

In light of the 2014 projections reflecting concentrated growth closer to the urban core assuming the proposed project opens in 2020, the most likely characteristic of a future No-Build scenario would be a somewhat more dispersed intra-district allocation of non-residential development.

Given the lower levels of employment growth for Union County under the 2014 projections, these differences would not substantially alter the distribution of impermeable surfaces or traffic congestion.

The INRIX speed data provides the basis for the project need. This information documents the current travel speeds in the U.S. 74 corridor. The INRIX data show that the intersection improvements did provide localized relief but did not sufficiently mitigate current congestion in the corridor. Further growth in population and employment in Union County, though reduced and redistributed by the recession, will result in additional demand for travel and subsequently more congestion.

Regarding Dr. Hartgen's report, the Division conducted a review of the report, discussed their approach with me via conference call, and developed a set of detailed responses with a clear summary narrative. I've reviewed the detailed comment/response summary to the Hartgen report and offer the following comments.

The forecasting methodology used is consistent with current accepted practice, specifically relying on existing traffic and development patterns in addition to a refined version of the regional model to estimate future traffic. The response to comment #43 provides a good summary of the project traffic forecasting approach. The approach incorporated

- detailed turning movement counts,
- aggregate link counts,
- local roads not in the regional model,
- historical growth rates, and
- expert judgment.

The project traffic forecasting methodology is documented in the June 2008 MAB report, June 2008 WSA report, May 2014 HNTB summary as cited in the response. The forecasts are also informed by the ICE analysis that determined the induced development effects of the project on would not be significant.

The FHWA calibration standards cited by Dr. Hartgen are provided as guidelines for accepting baseline regional forecasts. It is common for agencies engaged in travel forecasting to establish validation guidelines for their own purposes. Per the May 2006 Metrolina Regional Travel Demand Model Documentation, the regional model was validated for use by the four MPOs using commonly accepted criteria, such as FHWA's Model Validation and reasonableness Checking Manual (1997). As recommended by Dr. Hartgen, the validation included VMT by functional class, screen line volumes, and multiple summaries of link-level prediction vs observation errors (RMSE). As noted in the responses to comments, the regional travel model was but one of several resources used to develop the project traffic forecasts.

The use of INRIX data effectively replaces the traffic simulation approach. This is responsive to the comments and could be considered a best practice approach. The traffic simulation was previously used to establish the base congested condition. The DSFEIS relied on observed INRIX data to evaluate current operating conditions and demonstrate the need for the project. Improving the accuracy of the simulation model is unrelated to the observe speed data used for supporting project need. The accuracy of the regional model and appropriate HCM procedures are addressed in responses to comments #49-50 and #66. Note that HCM 2010 was used in the response to comment #40.

Regarding induced land-use effects, the response to comment #47 provides a good summary of the issues. The response to comment #48 summarizes the project level findings, specifically that the issue of induced growth was explicitly considered. The regional land use forecast is a starting point. The study teams considered the basis for the land use forecast and subsequently evaluated how the project might alter development patterns. They concluded that some modest redistribution of development within the study area was likely (eastern terminus and also around the interchanges) and, based on professional judgment, the magnitude of the redistribution was sufficiently low that the impacts on the traffic forecast would not warrant further refinement to the travel model.

Finally, regarding comments 71-72 on uncertainty in modeling, NCDOT relied on multiple sources, in addition to the travel demand model, to establish the project need and estimate future traffic.

In summary, the Division has completed a thorough analysis of the prevailing travel conditions on U.S. 74 and appropriately considered the socioeconomic forecasts related to the Monroe Bypass Connector, including the finding that use of the 2014 socioeconomic data would not alter the ICE analysis. I concur with their assessments. The documentation and subsequent clarifications provided by the Division have addressed all of my concerns. The Division completed a diligent review of Dr. Hartgen's comments. I concur with their responses.

U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: Prior Concurrence on Combined FSFEIS/ROD–Monroe Connector/Bypass

Date: April 24, 2014

From: John F. Sullivan, III
Division Administrator
Raleigh, North Carolina

In Reply Refer To:
HDA-NC

To: Gerald L. Solomon
Director, Office of Project Development & Environmental Review (HEPE-1)

As you are aware, the North Carolina Division has been working with the North Carolina Department of Transportation (NCDOT) on a Supplemental Final Environmental Impact Statement (SFEIS) for the Monroe Connector Bypass. The Draft SFEIS published on November 8, 2013, indicated the Division and State were contemplating a combined Final SFEIS and Record of Decision (ROD) in accordance with Section 1319(b) of MAP-21, the Moving Ahead for Progress in the 21st Century Act (P.L. 112-141). Three public hearings for the project were subsequently conducted on December 9, 10, and 11, 2013. Two were conducted in the town hall-style format in which the State presented an overview of the project and members of the public could express comments into an open microphone, and the third was conducted in an open-house style fashion, in which information was on display with members of NCDOT and its consultants to answer project questions posed by interested members of the public. The public comment period ended on January 6, 2014. Numerous comments were received, including extensive comments submitted by the Southern Environmental Law Center, which reiterated arguments they had previously presented that the project's NEPA analysis was flawed because of an impermissibly narrow statement of need and purpose, flawed traffic modeling, and flawed indirect and cumulative effects analysis and that there were irregularities with the project's fiscal constraints.

The State and the Division have reviewed and responded to these comments as well as those submitted by other members of the public and cooperating Federal agencies. We have also included Systems Planning and Analysis Team and the Office of Program Development and Environmental Review in this review process. We determined that none of the issues presented rise to the level of significant new information bearing on the proposed action or its environmental impacts. Nor have we proposed any substantial changes to the project that are relevant to environmental or safety concerns. Therefore, we think a combined Final SFEIS/ROD is appropriate.

We would, however, appreciate the independent review and analysis of the Office of Planning and Environment and Realty. The memorandum presents our reasoning for determining a

combined Final SFEIS/ROD is appropriate as stated in the draft ROD. We have also attached a summary of key project issues commenters have asserted are burdened with either flawed analysis or new unanalyzed information or circumstances.

Combined Final Supplemental Final EIS and Record of Decision

The FHWA is using the Draft SFEIS, together with public and agency input and comments received on that document, as the basis for a combined Final SFEIS/ROD, which will be the final document prepared under the National Environmental Policy Act (NEPA) process. The intention to prepare a combined Final SFEIS/ROD was stated on the signature page of the Draft SFEIS, as well as in Section P.2 of that document. Section 1319(b) of MAP-21 directs the lead agency, to the maximum extent practicable, to expeditiously develop a single document that consists of a Final EIS and ROD, unless the following conditions exist:

1. The Final EIS makes substantial changes to the proposed action that are relevant to environmental or safety concerns; or
2. There are significant new circumstances or information relevant to environmental concerns and that bear on the proposed action or the impacts of the proposed action.

The proposed project does not meet either of the conditions listed above. The Final SFEIS/ROD does not make any changes to the proposed action as presented in the Draft SFEIS and there are no significant new circumstances or information that would change the proposed action or its impacts as presented in the Draft SFEIS.

According to FHWA's *Interim Guidance on MAP-21 Section 1319 Accelerated Decisionmaking in Environmental Reviews* (January 2013), the following questions should be considered in deciding whether the use of a combined Final EIS/ROD is practicable for a particular project. Notes are included after each question to show how each was considered for the current project. The guidance uses the term "FEIS", which also applies to a Final SFEIS.

1. Are there any coordination activities that are more effectively completed after the Final EIS is available? For example, if there is a need to develop a more detailed mitigation plan, or if a joint lead or cooperating agency requests separate FEIS and ROD documents in order to accommodate its decisionmaking requirements, then FHWA may determine that a separate Final EIS and ROD provides a more effective and efficient decisionmaking process.
   - Agency and public coordination has been ongoing throughout the project development process. There are no outstanding coordination concerns and no agencies have requested separate Final SFEIS and ROD documents to accommodate their decisionmaking requirements.
2. Are there any unresolved interagency disagreements over issues that need identification in the Final EIS under 23 CFR 771.125(a)(2)?
   - There are no unresolved interagency disagreements with regard to the project. Appendix A-1 of the Final SFEIS includes all comment letters received from environmental resource and regulatory agencies on the Draft SFEIS. In addition, Appendix B-1 of the Final SFEIS includes a December 16, 2013 letter from the USFWS concurring with the Biological Conclusions for protected species under Section 7 of the Endangered Species Act.

3. Is there a substantial degree of controversy? FHWA may decide not to combine a Final EIS and ROD in these situations if the agencies believe that issuing the Final EIS as a separate document could help to resolve the controversy. For example, the opportunity to review additional comments submitted after the Final EIS may assist FHWA to develop additional mitigation commitments that could be included in the ROD to address the controversy.

   - All interested agencies have reviewed and provided comments on the Draft SFEIS. Based on these comments, there are no interagency issues or disagreements. The USFWS issued their concurrence under Section 7 of the Endangered Species Act on December 16, 2013. As far as public opposition to the project, there is a certain level of controversy as evidenced by comments received from the Southern Environmental Law Center and other local groups. However, per the terms of the interim guidance on MAP-21, it does not appear that issuing a separate Final SFEIS and ROD would help resolve this controversy in the eyes of the special interest groups who are opposed to the project. We have fully examined and explored the substantive issues raised by these groups, consulting with subject matter specialists in the process. In light of this analysis, we are confident there is no significant new information or circumstances pending that warrant further study and analysis. We think the comments and criticisms of the worthiness of the project as a whole are a matter beyond the purview of our NEPA review. Local MPOs are empowered with the authority to prioritize project development. Our role is to ensure that that any projects submitted for Federal-aid funding comply with NEPA requirements. Throughout the life of this project, we have studied a number of alternatives, including a no-build alternative whose validity was re-assessed in the course of this SEIS process, and selected the preferred alternative over the no-build alternative, because the preferred alternative meets the project need and purpose while the no-build alternative does not. We have also determined that the comments and criticisms of the MPO's travel demand modeling and the project traffic forecasting amount to differences of opinion. For the reasons discussed in the technical memorandum addressing Dr. Hartgen's report and elsewhere we are satisfied the MPO's travel demand modeling and the project forecasting used in our analysis is reasonable and valid. NCDOT has thoroughly reviewed and considered all comments on this project and has responded accordingly. Finally, we note that even though a separate Final SFEIS is not being circulated, NCDOT received two sets of additional comments from the SELC and those comments were considered and are being addressed in the ROD.

4. Does the Draft EIS identify the preferred alternative from among the comparatively evaluated reasonable alternatives? If the Draft EIS does not identify the preferred alternative, then FHWA should provide agencies and the public with an opportunity after issuance of the Final EIS for an informed assessment related to impacted resources and environmental concerns of the preferred alternative. Whenever possible, FHWA should work with project applicants and appropriate participating agencies to identify the preferred alternative prior to issuing the Draft EIS.

   - The Draft SFEIS identifies the Preferred Alternative, which is the same as the Preferred Alternative presented in the *Final EIS* (May 2010). Agencies and the public have had ample opportunity to make an informed assessment related to

impacted resources and environmental concerns of the Preferred Alternative.

5. Are there compliance issues with substantive requirements that must be resolved before issuance of the ROD, or that FHWA wants to resolve before signing the ROD, but that do not merit deferring issuance of the Final EIS? Section 1319 does not alter the compliance timing requirements under substantive environmental laws. If FHWA determines there are reasonable assurances of compliance so that FHWA can issue the Final EIS pursuant to 23 CFR 771.125(a)(1) and 771.133, and the agency believes there are important benefits to the overall decisionmaking process if the Final EIS is issued before such compliance matters are fully resolved, then FHWA may decide that it should not combine the Final EIS and ROD. In such cases, FHWA can publish the Final EIS using the reasonable assurances provisions in sections 771.125(a) and 771.133, and can update compliance status in the ROD. For example, if FHWA cannot sign the ROD until conforming amendments are made to planning documents due to the need for a new Clean Air Act conformity determination, it may be beneficial for purposes of both transparency and the overall project timeline to issue the Final EIS separately. This provides the agencies and the public access to the Final EIS information while the amendments are being made to the planning documents.

   - Agency comments have not identified, nor are NCDOT and FHWA aware of, any compliance issues with substantive requirements that must be resolved prior to issuance of the ROD.

Based on the information presented in the discussion above, we have determined that the use of a combined Final SFEIS/ROD process for this project is practicable.

SUMMARY OF ISSUES

Purpose and Need

Commenters suggested that the purpose and need is overly narrow and written in a way that in precludes meaningful consideration of a full range of alternatives. The Southern Environmental Law Center (SELC) hired Dr. David Hartgen to review the Draft Supplemental Final Environmental Impact Statement (DSFEIS). According to his resume, Hartgen is a professor emeritus of transportation studies at the University of North Carolina, Charlotte and president of the Hartgen Group. His resume indicates among other accomplishments, 45 years of experience in government, academia and consulting and lists areas of expertise that include travel demand modeling, forecasts of travel and congestion and regional demographic forecasts. He is also the author of Highways and Sprawl in North Carolina, a report FHWA previously cited for the proposition that road construction does not inevitably lead to development. Dr. Hartgen suggests in his report that the purpose and need for the project appears to have been written narrowly. He interprets the DSFEIS purpose and need of the project being as a high-speed long-distance facility. He then suggests that congestion on US 74 is caused by local traffic rather than long-distance travel. Next, he assumes that long-distance traffic is low. He concludes that proposed bypass is unlikely to reduce congestion on US 74.

We don't agree with Dr. Hartgen's interpretation and assessment of the project purpose and need. The purpose of the project is to improve mobility and capacity within the project study area by providing a facility for U.S. 74 corridor from near I-485 in Mecklenburg County to between the towns of Wingate and Marshville in Union County that allows for high-speed regional travel consistent with the designations of the North Carolina Strategic Highway Corridor program while maintaining access to properties along existing US 74. The *Draft EIS* doesn't describe long-distance travel as part of the problem on US 74 and it is not included as part of the project purpose. Regional travel is used within the context of travel within the Charlotte Region Transportation Planning Organization (formerly Mecklenburg-Union Metropolitan Planning Organization (MUMPO)). Exhibits 1-1 and 1-4 and Tables 1-1 and 1-2 of the DSFEIS show congestion during work day peak hours is a major part of the transportation problem. Congestion during work commute peak hours is not generally associated with long-distance travel.

The project is needed today because the existing US 74 is congested during peak hours of work days. The DSFEIS used INRIX travel data to show congestion during typical work days in Exhibits 1-1 through 1-4. Our summary of INRIX data replaces the traffic simulation computers (Sim Traffic) predictions of travel speeds during rush hour used in the *Draft EIS*. The DSFEIS summary of INRIX data shows that current travel demand for the facility exceeds its US 74's capacity. While the DSFEIS focused on peak hour congestion, the following charts and tables highlight travel speeds throughout the day on US 74 between I-485 and US 601/Pageland Highway. These charts and tables show average travel speeds (Tuesday through Thursday) for the entire year of 2013 by hour of the day. Because traffic volumes on Mondays and Fridays tend to be volatile and can be extraordinarily high or low, data from Mondays and Fridays were excluded from the analysis. Data from Tuesdays, Wednesdays, and Thursdays was used to represent average weekday traffic conditions.

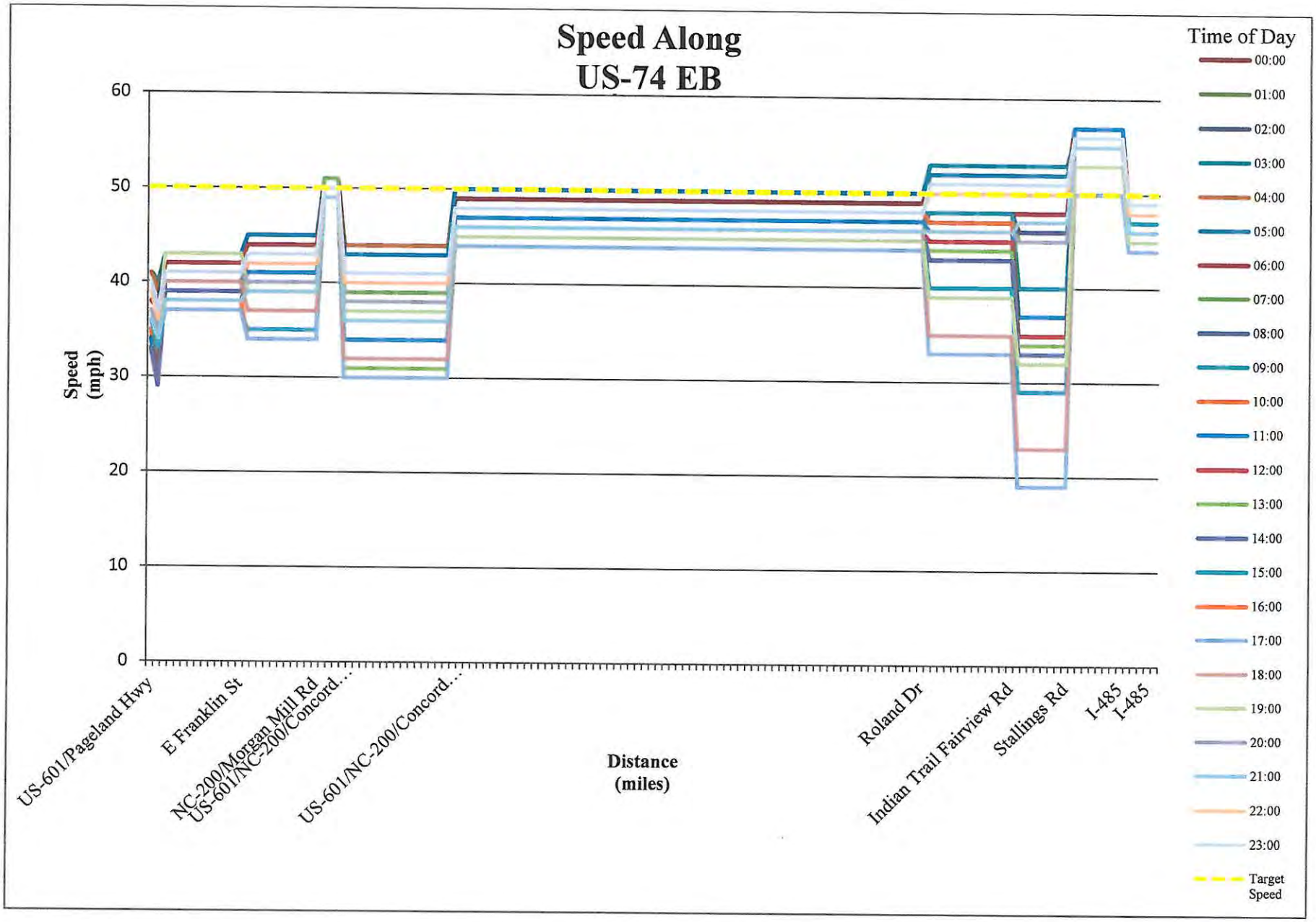
US74 is a four-lane to six-lane arterial roadway with numerous driveway access points, turning movements and intersections. Speed limits along the corridor vary because of municipal boundaries and geometric constraints, such as intersections and driveway access points. There are 27 signalized intersections along US 74 in the project study area. In the DSFEIS, we recognized that NCDOT made numerous operational improvements to several intersections along the project study area. Commenters on the *Draft EIS* and *Final EIS* suggested that we did not adequately consider Transportation Demand Management (TDM) and Transportation System Management (TSM) improvements in those documents. Commenters specifically referenced operational improvements included in a 2007 Stantec Consultants US 74 Corridor study (Stantec's study). The DSFEIS shows that NCDOT has implemented most of the Stantec's study improvements since the *DEIS/FEIS/ Record of Decision (ROD)*. Our summary of the INRIX 2013 average travel speeds during a typical work clearly reinforce that those TSM improvements don't meet the project purpose and need.

Superstreet Design Intersections

Commenters suggested that we did not adequately consider implementing "Superstreets" along US 74. Commenter's specifically referenced Stantec's study. The SELC hired O'Connell & Lawrence, Inc. (OCL) to review the project and Stantec's study in 2013. OCL suggested that we did not adequately evaluate implementation of "Superstreets" at intersections recommended in the US 74 Corridor Study. Dr. Hartgen also suggested that we did not adequately evaluate a superstreet design in his report of his review of the DSFEIS. He also suggested in his review of the DSFEIS that NCDOT noted average peak travel speeds well above the projections in the US 74 Corridor Study, as high as 45 mph after improvements to intersections along US 74. Neither OCL nor Dr. Hartgen provided engineering analysis to support their views.

We don't agree with the comments suggesting that we did not adequately evaluate a superstreet alternative. The DSFEIS summarized results from analysis contained in the Appendices IV and VII of Stantec's study. Stantec's study Appendix IV presented estimated travel speed and time results for the 12.5-mile segment of US 74 from its intersection with US 601 South to Stallings Road. This considered all recommended long-term improvements, including superstreet intersections for this segment of road. Analysis in Appendix IV (Table 5.3) shows that US 74 eastbound speeds through this segment would be 32 mph in the morning peak and Appendix IV (Table 5.4) 31 mph in the afternoon peak. Travel speeds in the westbound direction through the segment were shown as 34 mph in the morning peak and 31 mph in the afternoon peak.

Stantec's Study Appendix VII presented estimated travel speed and time results of those superstreet intersections for the 2.7-mile segment of US 74 from Stallings Road to Faith Church Road. Appendix VII (Table 6.3) showed travel speed estimates of 39 mph in the eastbound direction and 41 mph in the westbound during the 2015 morning peak hour. Appendix VII (Table 6.4) also showed travel speed estimates of 39 mph in the eastbound direction and 47 mph in the westbound direction during the afternoon peak hour. These predicted speeds do not meet the purpose and need of the project.


Speed Along
US-74 EB
Speed (mph)
60
50
40
30
20
10
0
US-601/Pageland Hwy
E Franklin St
NC-200/Morgan Mill Rd
US-601/NC-200/Concord...
US-601/NC-200/Concord...
Roland Dr
Indian Trail Fairview Rd
Stallings Rd
I-485
I-485
Distance (miles)
Time of Day
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
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18:00
19:00
20:00
21:00
22:00
23:00
Target Speed

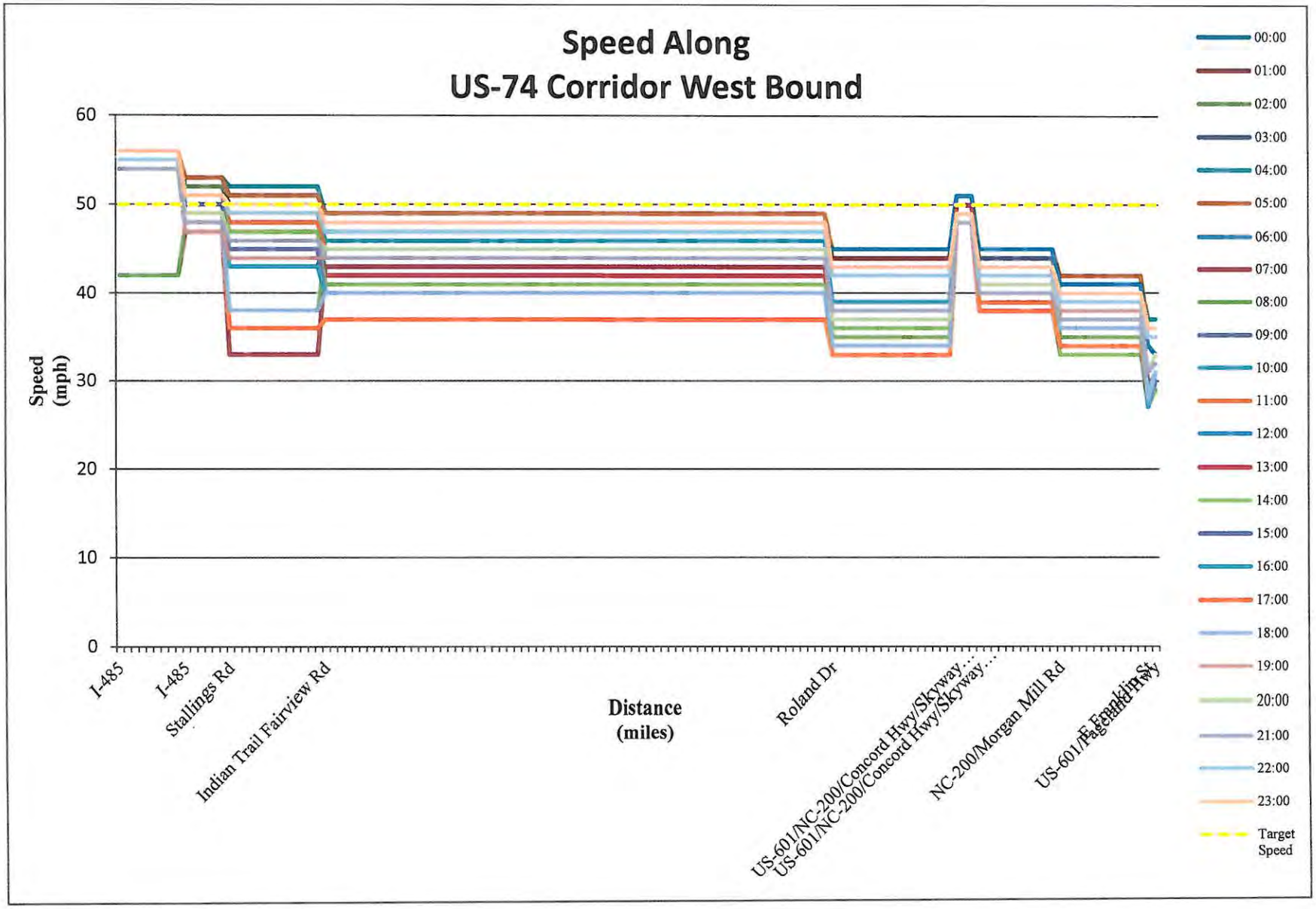

Speed Along
US-74 Corridor West Bound
Speed (mph)
60
50
40
30
20
10
0
I-485
I-485
Stallings Rd
Indian Trail Fairview Rd
Distance (miles)
Roland Dr
US-601/NC-200/Concord Hwy/Skyway…
US-601/NC-200/Concord Hwy/Skyway…
NC-200/Morgan Mill Rd
US-601/Fagland Hwy
E Franklin St
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
Target Speed

Table 5 - US 74 Corridor INRIX Average Speed Data

2013, Tuesday - Thursday

Average Speed for US 74 from I-485 to US 601 Pageland Hwy
Eastbound US 74 Corridor Average Speed

TMC CODE	LENGTH (MILES)	SEGMENT NAME	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
125P05822	0.02	US-601/Pageland Hwy	41	41	41	41	41	39	38	36	36	34	35	34	33	33	33	36	36	36	37	36	37	36	39	40
125+05822	0.12	US-601/Pageland Hwy	39	39	39	40	39	38	37	36	35	32	31	30	30	29	29	33	34	34	35	35	35	34	36	37
125+07487	1.21	E Franklin St	42	43	42	43	43	43	42	39	38	40	40	40	39	39	39	37	38	37	40	43	41	38	41	41
125+07486	1.11	NC-200/Morgan Mill Rd	43	44	44	44	45	45	44	41	40	42	42	41	39	40	40	35	34	34	37	39	40	39	42	43
125P05821	0.35	US-601/NC-200/Concord Hwy/Skyway Dr	51	50	50	51	51	51	51	51	50	50	50	50	49	49	50	50	49	49	50	49	50	49	50	50
125+05821	1.58	US-601/NC-200/Concord Hwy/Skyway Dr	43	43	44	44	44	43	41	39	37	38	38	34	32	31	32	30	30	30	32	37	38	36	40	41
125+05820	6.86	Roland Dr	49	50	50	50	50	50	48	46	47	48	48	47	46	45	46	46	45	44	46	45	46	46	48	48
125+05819	1.27	Indian Trail Fairview Rd	52	52	52	53	52	52	48	48	48	48	47	46	45	44	43	40	36	33	35	39	46	46	50	51
125+05818	0.75	Stallings Rd	52	52	52	53	52	52	48	45	46	40	37	37	35	34	33	29	23	19	23	32	45	47	50	51
125P05817	0.76	I-485	56	56	56	56	57	56	57	56	57	57	57	57	56	56	56	56	53	50	53	53	55	55	56	56
125+05817	0.44	I-485	49	49	49	49	49	48	48	48	48	48	48	47	46	46	46	47	46	44	46	45	46	46	48	49
	14.47		48	49	49	49	49	49	47	45	45	46	45	44	43	42	43	42	40	39	41	43	45	44	47	47

Average Speed for US 74 from US 601 Pageland Hwy to I-485
Westbound US 74 Corridor Average Speed

TMC CODE	LENGTH (MILES)	SEGMENT NAME	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
125N05817	0.91	I-485	56	55	55	56	56	56	54	42	42	55	56	56	55	55	56	55	55	54	54	54	54	54	55	56
125-05817	0.61	I-485	52	52	52	53	53	53	49	47	48	50	51	51	50	50	50	50	49	47	47	47	49	48	51	51
125-05818	1.26	Stallings Rd	50	50	51	52	52	51	43	33	36	47	49	48	47	47	47	45	43	36	36	44	46	46	49	50
125-05819	6.86	Indian Trail Fairview Rd	48	49	49	49	49	49	46	43	45	46	46	45	42	42	41	40	40	37	40	44	45	44	47	48
125-05820	1.66	Roland Dr	44	44	45	45	45	45	45	37	35	38	39	37	36	36	36	33	34	33	34	37	37	38	42	43
125N05821	0.30	US-601/NC-200/Concord Hwy/Skyway Dr	49	49	49	49	50	50	51	50	49	49	49	49	48	49	49	49	49	48	49	49	49	48	49	49
125-05821	1.07	US-601/NC-200/Concord Hwy/Skyway Dr	44	44	44	44	45	45	45	43	42	40	40	39	38	38	38	38	38	38	41	42	41	40	42	43
125-07486	1.22	NC-200/Morgan Mill Rd	40	41	41	41	41	42	41	37	35	34	34	34	33	33	33	34	34	34	36	38	37	37	39	40
125-07487	0.11	E Franklin St	36	36	37	36	37	36	34	30	28	29	29	28	27	27	27	27	27	28	28	31	31	31	35	36
125N05822	0.01	US-601/Pageland Hwy	36	36	37	36	37	36	33	30	29	31	31	30	29	29	29	30	31	31	31	33	33	32	35	36
	14.02		47	48	48	48	48	48	46	41	42	44	45	44	42	42	41	40	40	38	40	43	44	43	46	47

Dr. Hartgen suggests that the Superstreet intersection predicted speeds we showed from the Stantec - US 74 Corridor Study in the DSFEIS are too low because the DSFEIS Tables 1-2 and 1-3 show INRIX average travel speeds much higher than those predicted speeds from the study. We don't believe such a comparison is appropriate. Dr. Hartgen appears to compare the DSFEIS estimated travel speeds for 2015, through a 12.5 mile segment of US 74; to INRIX average travel speeds collected in 2011, 2012 and August 2013, shown for an 8.2-mile segment of the corridor (I-485 to Fowler Secrest Rd). Therefore, we don't agree with his conclusions regarding our evaluation of the Superstreet alternative.

The SELC's January 6, 2014 comments on the DSFEIS (attachment 23 to their comment letter) offered the NCDOT Congestion Management Section's (NCDOT-CMS) November 5, 2012 operational analysis of superstreet designs on US 74. A point SELC raised in its comments is the NCDOT-CMS evaluated the superstreet designs with 2007 traffic because the NCDOT-CMS recognized that traffic had been stable on US 74 in the past years. However, the referenced NCDOT-CMS memorandum contains analysis showing that superstreet intersections through this segment of US 74 would not meet purpose and need of the project under current traffic conditions.

The NCDOT-CMS analyzed implementation of Superstreet designs through an approximately 3-mile segment of US 74. The analysis evaluated superstreet designs at US 74 intersections with Stallings Road, Indian Trail-Fairview Rd, Unionville-Indian Trail Road, Faith Church Road, and Sardis Church Road (roughly 3 mile segment). The NCDOT-CMS compared the superstreet intersections with existing intersections with traditional improvements. The NCDOT-CMS analysis shows that superstreet implementation will allow more vehicles through the intersection in peak hour and will reduce queuing. However, the analysis notes that superstreet intersections will not eliminate queuing at intersections and U-turns; and, thus will not eliminate congestion. The analysis does show that implementation of Superstreet intersections through this segment of US 74 (roughly 3 miles) would likely raise the worst speeds in peak hour 4-7 mph. However, this analysis using 2007 traffic (existing) shows that superstreet intersections through this segment would not meet the purpose and need of the project under current conditions. Any future growth in traffic would worsen conditions beyond those predicted in this analysis. The following table summarizes predicted travel speeds during peak hour along this road segment.

US 74 from Stallings Road to Sardis Church-Stallings/Indian Trail
NCDOT Congestion Management Section

	AM Peak Hour		PM Peak Hour	
	Traditional	Superstreet	Traditional	Superstreet
Eastbound speed (mph)	36	35	22	27
Westbound speed (mph)	21	25	27	34

How would this compare to the INRIX average travel speeds for typical work days in 2013 (page 5)? One can't make a direct comparison between the NCDOT-CMS's analysis predicted speeds and the average speeds reported through the INRIX data because the length of the segment in the analysis does not match the TMC segment lengths for the INRIX data (page5). However, assuming superstreet designs would improve travel speeds during peak hour 4 to 7 mph over

existing intersections, such improvements would not raise speeds through the corresponding TMCs to meet purpose and need of the project (for example, the average INRIX eastbound travel speeds during 2013 afternoon peak hour are 19 mph through the 0.75-mile Stallings Rd TMC and 33 mph through the 1.27-mile Indian Trail Fairview Rd TMC. In the westbound direction, average INRIX travel speeds are 36 mph through the 1.26-mile Stallings Rd TMC and 37 mph through in the 6.86 mile Indian Trail Fairview Rd TMC during afternoon peak hour). In summary, we have performed sufficient evaluations to show that implementation of superstreet intersections in the corridor would not meet the purpose and need of the project. No commenters have provided analysis to the contrary.

The SELC suggested there were other alternatives that we did not consider such as short bypasses around their suggested "hot-spots" along US 74. The SELC offered figures attached to their January comment letter showing mini-bypasses to the north around specific hot-spots along their figures. In the Draft EIS and Alternatives Screening Report, we considered corridors that utilized existing roadways including Old Monroe Road/Old Charlotte Highway and Secrest Shortcut Road (SR 1501. The SELC's figures also included a Monroe Rd. Loop that ties into US 74 prior to the proposed superstreet intersections which have been shown not to meet purpose and need under current traffic conditions.

Indirect and Cumulative Effects

The DSFEIS included an Indirect and Cumulative Effects Quantitative Analysis Update (ICE Update) as part of the re-evaluation of effects because of the project (DSFEIS Appendix E). Similar to the prior ICE analysis, the ICE Update considered changes in land use and its effect on water quality as a significant issue for the scope of the study. We estimated land use changes and effects based on watershed boundaries because of resource agency concern of water quality and the Carolina Heelsplitter.

We used MUMPO's (now CRTPO) socioeconomic projections and its models to allocate population, households and employment to traffic analysis zones (TAZ) as part of analysis in the Indirect and Cumulative Effects Update (Appendix E). We had Mr. Smith use his population project and employment allocation model to recalculate TAZ population and household allocations without the project. We found that MUMPO's socioeconomic projections and its models to allocate growth to TAZ would not alter land use in watersheds in the project study. However, our conclusions in the qualitative ICE (DEIS) and research into local expectations of growth associated with the project suggest that it is unlikely that there would be no difference in land use with construction of the project. Therefore, the ICE Update included an induced growth analysis to account for the potential environmental impacts associated with these potential land use changes. We found differences in land use between the 2030 Build and 2030 No-Build scenarios are small relative to the overall level of growth in development expected between the Baseline and No-Build. Total additional developed land associated with the Build is approximately 3,200 acres, less than two percent of all land in the study area. Approximately 1,100 acres of this difference, however, is directly attributable to the footprint of the roadway. Therefore, the indirect land use impacts attributable to growth-induced by the project are approximately 2,100 acres. Locations of our forecasted land use changes due to the project are shown by watershed in the following figure.

Commenters did not like those results and offered critique of Mr. Smith's model for population projections and employment allocation within Union County. Commenter's found it hard to believe Mr. Smith's model would not forecast change in land use close to the project. Dr. Hartgen noted that Michael Baker's ICE Update analysis did consider that the project travel time benefits in its induced growth analysis. He noted that the impacts were modest, but he neither agreed nor disagreed with conclusions of the report. The SELC questioned why the analysis did not redistribute growth within the study area. However, the ICE Update addressed this point by stating that our analysis was conservative in adding growth to a baseline scenario to estimate attraction of growth to the area. If we had gone through a redistribution calculation, the induced impact to critical watersheds and significant issues would have indicated lesser impacts because of the project. No commenters offered other data or models to use in our analysis.

Commenters, including Dr. Hartgen, questioned the validity of using the Charlotte regional socioeconomic forecasts developed by Dr. Hammer for the Mecklenburg-Union Metropolitan Planning Organization (MUMPO). Dr. Hammer developed regional socioeconomic forecasts and county allocations for the MUMPO 2030 and 2035 Metropolitan Transportation Plans (MTP). They also questioned his allocation process of the regional forecasts to counties and suggested that his forecast were probably significantly overstated. We compared Dr. Hammer's socioeconomic forecasts for the year 2030 developed in 2003 to the Charlotte Regional Transportation Planning Organization's (CRTPO)'s socioeconomic forecasts in the 2040 MTP for the year 2030. After the 2010 census and expanded urbanized boundaries, MUMPO became CRTPO in 2013. Dr. Hammer forecasted a most-likely population for Union County of 312,147 in 2030. The lower range of his county population forecast was 268,543 and the upper range 338,309. The CRTPO 2040 MTP year 2030 population forecast is 297,028. The difference between the 2030 population is 15,119 or 4.8%. This is not a significantly large difference.

Dr. Hammer forecasted the most likely number of households in 2030 would be 110,733. The CRTPO 2040 MTP year 2030 households forecast is 100,335 or 9% less than Dr. Hammer's

most likely forecast. The CRTPO 2040 MTP year 2030 employment forecast (103,282) is 20% lower than Dr. Hammer's most likely employment forecast for that year (128,494). In summary, Dr. Hammer's forecasts for Union County are not significantly overstated compared to forecasts being used for Union County in the CRTPO's 2040 MTP.

However, the socioeconomic forecasts within Union County are distributed differently in the 2035 MTP socioeconomic forecasts and the socioeconomic forecasts in the CRTPO's 2040 MTP. The socioeconomic forecasts for Union County in the CRTPO's 2040 MTP show more population and households in the Northwest District of the county in 2030 and less population and households in the Central, South and East Districts than forecasts developed by Dr. Hammer.

Consideration of CRTPO's 2040 LRTP Socioeconomic Forecasts

Commenters on DSFEIS suggest our analysis of the project is outdated because CRTPO adopted its MTP on April 16. They suggest that we completely revisit our studies. The SELC's April 8 letter suggests that we supplement the supplemental FEIS. When we published the DSFEIS, CRTPO MTP and its socioeconomic data had not been made available to the public for review. Subsequently, the CRTPO held a 30-day public comment period for its draft 2040 Metropolitan Transportation Plan & draft Air Quality Conformity Determination Report on Tuesday, February 18, 2014. The comment period closed on Wednesday, March 19, 2014. In addition, four meetings, in an open house format, were held to receive the public's input on the draft documents. The CRTPO has since adopted the 2040 Metropolitan Transportation Plan on April 16, 2014. FHWA and FTA issued a conformity determination for the CPTPO's 2040 Metropolitan Plan on May 2, 2014.

We evaluated how the new socioeconomic projections and the model would change growth forecasts in the study area and how such forecast would alter our analysis of indirect and cumulative effects due to the project. While the project is clearly in the model, we would not likely see significantly different growth patterns due to the project (delta between the no-build and build scenarios). Similar to its previous land use allocation model, this model does not calculate changes in growth due to travel time improvements resulting from projects. Instead, this model relies upon planner's judgment as one of the main inputs to allocate growth. So we would reverse the process we used to forecast additional growth with MUMPO's projections and models to deduct or subtract induced growth from CRTPO's 2014 projections of future growth.

The NCDOT's consultant, Michael Baker Engineering, Inc. compared and contrasted the MPO's 2009 socioeconomic future projections with the MPO's 2014 socioeconomic future projections. The MPO's 2009 socioeconomic future projections were based on projections developed by Dr. Hammer in 2003. The MPO used adjusted their 2009 projections near the upper range of Dr. Hammer's 2030 projections for Union County. The MPO's 2014 socioeconomic future projections were developed by Dr. Appold. He followed a methodology similar to Dr. Hammer's methodology for developing the overall socioeconomic projections. However, Dr. Appold's projections considered an additional census reference year (2010) that was not available when Dr. Hammer conducted his projections.

The MPO's 2014 projections developed by Dr. Appold forecast slower growth in Union County than the current MPO's 2009 future socioeconomic projections. In essence, the MPO 2014

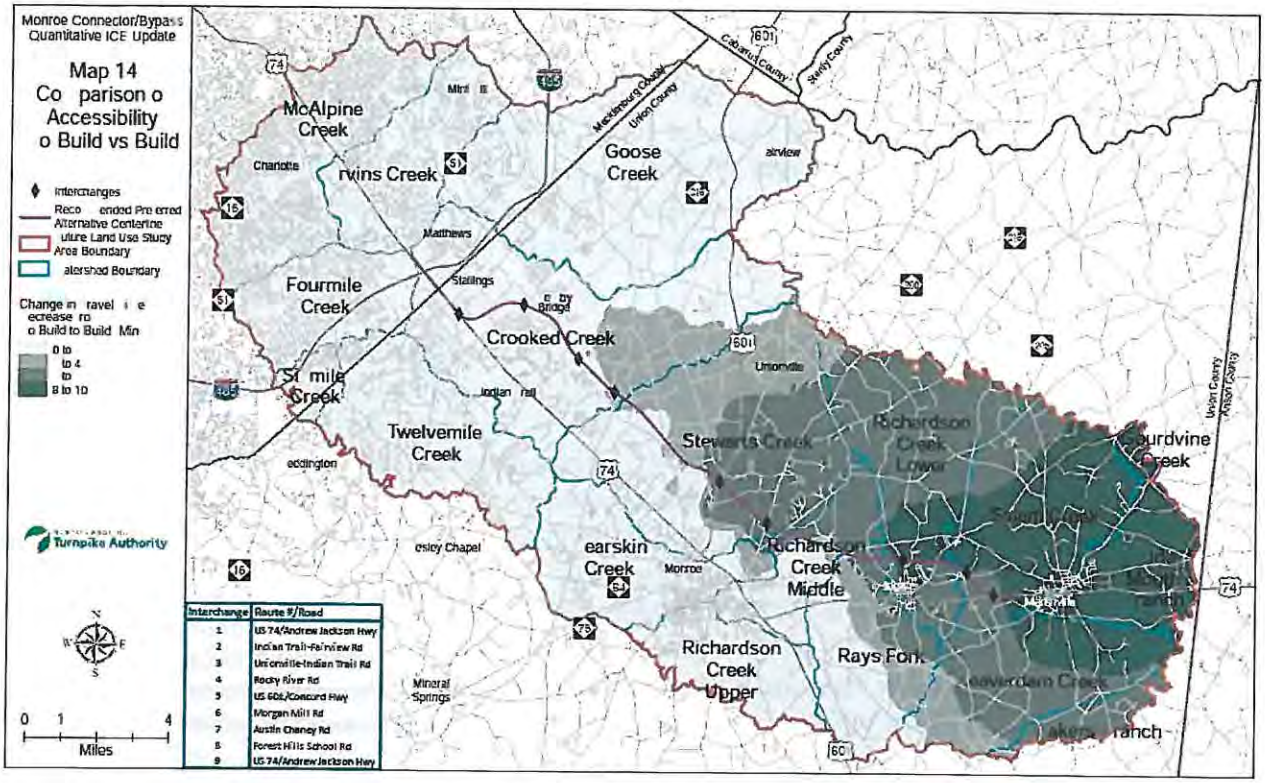
projections show total Union County households and employment anticipated by the current 2009 projections for the year 2030, occurring a little more than a decade later (2040).

The MPO's 2014 projections also shift more growth in Union County towards Mecklenburg County than the current 2009 projections. Dr. Appold explained that the 2010 Census showed that the density to distance gradient did not flatten out as expected with traditional urban growth models. He mentioned that density to distance gradient for 2000-2010 had actually steepened from the prior time period. Thus, the projections reallocated more growth to the western part of the county (towards Charlotte).

The ICE Update evaluated the difference in the socioeconomic projections on a watershed basis. Michael Baker aggregated the MPO's 2014 TAZ household forecasts for the year 2030 to the watershed level within the project study area to compare against the build scenario in the ICE Update. Michael Bakers' analysis showed using the MPO's 2014 projections would reduce total households in the project study area by 11 percent in the year 2030. Michael Baker breakdown of the MPO's 2014 projections by individual watersheds would show fewer households in the 2030 build year in eleven of the 18 watersheds in the project study area. The analysis showed that the following 7 watersheds in the project study area would see more households in the 2030 build scenario.

- Crooked Creek
- Fourmile Creek
- Ivins Creek
- McAlpine Creek
- Sixmile Creek
- Twelvemile Creek

Michael Baker determined that ICE Update conclusions about the increase in households and development due to the project would not change for Fourmile Creek, Ivins Creek, McAlpine Creek, Sixmile Creek and Twelvemile Creek because these watersheds are south of the existing U.S. 74 or west of I-485 (see accessibility map). The project would not improve accessibility or mobility in those areas. Michael Baker's analysis suggests that one watershed, out of the 18; Crooked Creek may see more induced growth than we estimated in the ICE Update as the MPO's 2014 projections forecast more household in 2030 build scenario than the ICE Update. However, Michael Baker concluded that the increases in households in Crooked Creek due to the project would not be significantly higher because of the minimal travel time improvements for that watershed as shown in the map below.



In summary, Michael Baker determined that it would be highly unlikely that use of the MPO's 2014 socio economic projections would alter the analysis of the indirect and cumulative effects on sensitive natural resources. Overall, the use of the MPO's 2014 socioeconomic projections would lower (lessen) our overall estimate of indirect and cumulative effects presented in the DSFEIS and its ICE Update. Therefore, the MPO's 2014 socioeconomic projections would not result in new information or circumstances relevant to environmental concerns, which would cause a significant impacts not evaluated in the EIS.

<u>Use of Different Socioeconomic Data Sets in Traffic Forecasting</u>

Commenters suggested that we should have used two different socioeconomic data sets with the Metrolina Regional Travel Demand Model (MRM) to develop our no-build and build traffic forecasts. The MRM is MUMPO's regional travel demand model that MUMPO uses to forecasts future travel on a limited set of roads in the regional network for transportation planning purposes. Regional travel demand models are calibrated at a regional level, using corridor vehicle-mile traveled as a measure. Traffic forecasting is a separate process that performs more rigorous analysis at a specific project level looking at travel on specific roads and breaking traffic into through traffic and turning movements. A traffic forecast is not necessarily performed using a travel demand model such as the MRM. Instead a traffic forecaster uses the raw output out of a travel demand model as part of the investigation in development of a traffic forecast as described in MAB's traffic forecast.

We addressed how changes in the socioeconomic data between a no-build scenario and a build scenario determined by our ICE Update would affect traffic forecasts in Question 3 in Section 2.5 of the DSFEIS. We used the MRM 11v1.1 to evaluate the difference in the model's predicted vehicle miles traveled along the US 74 corridor for a no-build scenario versus a build

scenario (socio economic data set including induced growth determine in ICE Update) to determine if different socioeconomic data sets would require a new set of traffic forecasts. This analysis showed that the difference between the no-build and build MRM outputs for vehicle miles traveled along US 74, 20+ years into the future, was only 4%. The difference for the Monroe Connector/Bypass was 5% and 3% for Union County total travel. These small differences in raw model output, from two different socioeconomic data sets indicate there is no need to re-calculate a build and no-build traffic forecast based on separate socioeconomic data.

Traffic Forecasting

Commenters suggested in a report entitled, Review of Traffic Forecasting: Monroe Connector/Bypass Draft Supplemental Final EIS, November 2013, that the traffic forecasts for the project need to be redone for several reasons. Rather than reproducing or paraphrasing those comments we are attaching the report itself and a technical memorandum prepared by NCDOT's consultant, which responds in detail to the points raised in the report. We would appreciate your office's review of the technical report and your opinion on whether it adequately addresses the technical traffic modeling issues raised in the report or whether there are any issues raised by the report which warrant further consideration or additional analysis. At key points throughout development of the SEIS, including development of the technical memorandum responding to the report referred to here, we have worked with Brian Gardner, Team Leader of the Systems Planning and Analysis Team within your office. Mr. Gardner may be in the best position to comment upon the final version of the technical memorandum.

Need to Supplement the DSFEIS

The SELC letter of April 8, 2014 to Ms. Harris of the NCDOT states "Significant new information has arisen since our previous comment letter, prompting new concerns that NCDOT should address before reaching a decision under the National Environmental Policy ("NEPA")." The SELC suggested that the NCDOT must issue a supplement to its recent DSFEIS because of the following issues:

- NCDOT did not use the most accurate available model in validating its traffic forecasts;
- Northern long-eared bat and Savannah Lilliput
- The Town of Stallings opposes the project

We have evaluated the SELC concerns in its April 8, 2014 letter to Ms. Harris and determined that we do not need to supplement the draft supplemental final environmental impact statement.

An EIS shall be supplemented whenever the Administration determines that (23 CFR§771.130):

1. Changes to the proposed action would result in significant environmental impacts that were not evaluated in the EIS; or
2. New information or circumstances relevant to environmental concerns and bearing on the proposed action or it impacts would result in significant impacts not evaluated in the EIS.

"NCDOT did not use the most accurate available model in validating its traffic forecasts"

The SELC April 8 letter states "Newly available information has brought to light the fact that NCDOT knowingly used an outdated traffic model to validate its traffic forecasts in its recent DSFEIS for the Monroe Connector/Bypass." The SELC goes on to further state

"MRM has been updated, such that MRM version 11v1.1 was outdated when used in NCDOT's validation process. The Charlotte Department of Transportation, the official custodian of the MRM, in cooperation with other transportation planning organizations in the region, has long been in the process of developing a more accurate version of the MRM, version 14v1.0, calibrated with fresh data. In particular, the MRM's trip generation model was adjusted based on a 2012 household travel survey of 4,231 households (supplemented by a 2003 workplace survey of 185 establishments), and a 2012 non-freeway external survey. These results were used to calibrate, update, and refine the MRM such that MRM14v1.0 is a more accurate reflection of traffic conditions expected in the Metrolina region than previous models." (Footnotes omitted)

The SELC's January 6, 2014 letter commenting on the DSFEIS suggested that the current socio-economic data is not accurate and outdated because Dr. Appold had developed socioeconomic forecasts for use in the MRM and the CRTPO 2040 MTP. We showed in earlier discussion that the CRTPO 2040 MTP socioeconomic data does not result in new information or circumstances relevant to environmental concerns, which would result in significant impacts not evaluated in the EIS. Therefore, we would not need to supplement the DSFEIS.

Does the CRTPO 2040 MTP socioeconomic data set and its revised travel demand model present new information or circumstances relevant to the purpose and need of the proposed actions? No, unlike the DEIS/FEIS/ROD where we estimated average travel times and speeds in the morning and evening peaks hour for both directions of travel along US 74 using a computer simulation model (SimTraffic), we used real-time travel information from INRIX to depict the performance of U.S. 74 in the supplemental document.

Analysis for the DEIS/FEIS/ROD was dependent on existing traffic counts and traffic forecasts to show that the need of the project. The DSFEIS, to the contrary, uses real-time travel information from INRIX to depict the performance of U.S. 74. Figures 1-1 through 1-4 graphically depicted averaged operating speeds along U.S.74 during August 2013. Our analysis and presentation of INRIX showed that U.S. 74 is congested today, despite the operational improvements made since the ROD in 2010. The real-time travel information from INRIX is not dependent on traffic counts or forecasts to calculate speed, so the traffic forecasts are no longer critical inputs to demonstrate the need of the project. Therefore, the MPO's 2014 socioeconomic projections and the MRM 14v1 would not change the need of the project.

Does the CRTPO 2040 MTP socioeconomic data set and its revised travel demand model present new information or circumstances relevant to the alternatives analysis for the proposed action? No, most of the alternatives were ruled out using traffic forecasts based on the MUMPO's 2030 MTP. We worked with the City of Charlotte and HNTB to calculate differences between future vehicle miles traveled on US 74 in a no-build scenario. In our analysis, we did not reduce CRTPO's socioeconomic forecasts for induced growth because earlier works showed the socioeconomic data had a small effect on the US74 corridor VMT (4%). So, the results for the 2030 No-build scenario using the MRM 14 exclude the project from the road network, but include the project in the socioeconomic data. However, using 96% of the corridor VMT using CRTPO's 2040 updated model and socioeconomic forecasts would suggest that the difference between a no-build scenario (project not included in road network and socioeconomic forecasts

would suggest that the differences between the two no-build scenarios would be 8% [(876,001-(0.96*842,066))/876,001]. Again, this would be a small difference in raw model output predicted by the MPO's models.

US 74 Corridor Vehicle Miles Traveled Comparison

Year	2030	2030
Scenario	No-Build	No-Build
Model Version	MRM 05	MRM 14
SE Data	2005	2014
Info	MRM output	MRM output
Corridor VMT	876,001	842,066

TSM alternative - The DSFEIS reconsidered the effect of TMS measures along the US 74 corridor, which the DEIS and FEIS screened out as not being able to meet purpose and need. Section 2-4 described and Table 2-2 inventories those TSM improvements implemented along U.S. 74 in the project study area. INRIX data confirms that the U.S. 74 corridor with implemented TSM measures does not meet purpose and need of the project. The CRPTO's 2014 socioeconomic projections and the MRM 14 v1 traffic outputs would not change that conclusion.

Superstreet alternative – Commenters suggested that the NCDOT give further consideration of the Superstreet alternative contained in the Stantec's study. NCDOT has considered those improvements and plans to implement them. While NCDOT has plans to implement those superstreet facilities at the U.S. 74 intersections with Indian Trail Road-Fairview Road, Unionville-Indian Trail Road, Faith Church Road, and Sardis Church Road; analysis shows that those improvements will not meet the purpose and need of the project regardless of our future traffic forecasts. We previously discussed in this document that Stantec's Study (Appendices IV and VII) shows that implementation of those improvements will not upgrade corridor speeds to 50 mph to meet purpose and need. Stantec used existing traffic volumes and assumed 3 percent annual growth rate to forecast 2015 traffic. The NCDOT Congestion Management Section conducted an analysis of planned superstreet improvements for a five intersection segment of US 74 near Indian Trail (Reese, November 5, 2012). This 2012 analysis demonstrates that the planned superstreet (roughly 3 miles of the 20-mile corridor) may only provide travel speeds in this vicinity in the range of 25-35 mph. As noted by the SELC in its January 6, 2014 comment letter on the SDFEIS, the NCDOT Congestion Management Section used 2007 traffic volumes because it noted that traffic volumes remained steady for the previous ten years.

Since the NCDOT's analysis shows that the implementation of the Superstreet using existing traffic information (25-35 mph) is below 50 mph, we can conclude that Superstreet intersection improvements along U.S. 74 will not meet purpose and need of the project. Use of the CRPTO's 2014 socioeconomic projections and the MRM 14 v1 traffic outputs would not represent new information or circumstances relevant to environmental concerns and bearing on the alternative analysis of the proposed action.

Cost Estimate

The cost estimate for the Preferred Alternative were originally presented in Section 2.3.4 of the Final EIS and assumed a construction contract award date of December 2010 and a project opening in December 2014. The estimated project cost presented in the Final EIS was $802.0M with a 70 percent confidence level (70 percent probability the cost will be less than or equal to this cost). Updated cost estimates for the Preferred Alternative were provided in Section 3.3.4 of the DSFEIS based on a notice to proceed date of October 2014 and a project opening in October 2018. The estimated project cost presented in the DSFEIS was $898.0M with a 70 percent confidence level.

Following publication of the Draft Supplemental Final EIS, comments were received during the public comment period noting an increase in the Monroe Connector/Bypass project. The FHWA HQ – Office of Innovative Program Delivery – Project Delivery Team, NCDOT, and their consultants reviewed the project cost estimate to ensure that the assumptions utilized in updating it for inclusion in the DSFEIS were correct. The group found was that the cost update for the DSFEIS included incorrect environmental mitigation costs, did not reflect the awarded construction contract value, and inappropriately inflated costs that were already expended. The estimated environmental mitigation costs ($11.3M to $11.9M) presented in Table 3-3 of the DSFEIS was incorrect. Estimated mitigation costs were calculated based on a 2:1 ratio for the intermittent streams, but did not include costs for mitigation of impacts to perennial streams. The correct mitigation cost of $17M reflects mitigation for perennial streams at a 2:1 ratio. The estimated cost estimate for the Preferred Alternative presented in Section 3.3.4 of the DSFEIS ($898.0M) was also based on simply inflating the cost estimates presented in Section 2.3.4 of the Final EIS ($802.0M) to reflect a delay in the project opening date from December 2014 to October 2018. This caused the inappropriately inflation of costs previously incurred. In addition, the cost estimate also needed to be revised to reflect the actual design-build price proposal. The cost estimate was updated. The FHWA HQ – Office of Innovative Program Delivery – Project Delivery Team participated in the revision of the project cost estimate. They agreed that updated cost estimate is valid and based on reasonable assumptions. The updated total project cost is estimated to be $838.0M with a 70 percent confidence level (70 percent probability the cost will be less than or equal to this cost).

The State Transportation Improvement Plan (STIP) currently shows a total project cost of $759,100,000 for state project number R-3329 and $29,655,000 for state project number R-2559 for a combined total Monroe Connector/Bypass project cost of $788,755,000. The programmed amount in STIP ($789M) is approximately 6% less than the updated estimate of total project cost ($838M). Due to the estimated cost increase, the NCDOT has indicated to FHWA that funds will be identified in the STIP to cover estimated increases in the project cost. In addition, based on the NCDOT's most recent cost estimate and their STIP Amendment and Modification Guidelines (approved by the FHWA), a STIP amendment is not required.

Northern long-eared bat and Savannah Lilliput

In a letter dated April 8, 2013, the SELC asserted that NCDOT failed to study the project's potential impacts upon the Northern long-eared bat and the Savannah liliput against the recommendations of the U.S. Fish & Wildlife Service (USFWS). The issue is not new and the

characterization of the agencies failing to heed the advice of the USFWS is not correct. In an email commenting on a draft version of the Biological Assessment for the project, USFWS brought the Savannah Lilliput and the Northern long-eared bat to the attention of NCDOT and FHWA. USFWS indicated that the Northern log-eared bat has been proposed for listing as an endangered species, occurs in a county adjoining the project study area and has a range that extends to one of the counties in the project study area. The agency also advised NCDOT and FHWA that the Savannah Lilliput is a species currently petitioned for federal listing. USFWS noted a listing decision is expected to occur in the next couple of years and suggested that extra protective measures be provided at the crossing of South Fork Crooked Creek where the mussel occurs, and on on December 16, 2013, USFWS issued its concurrence with the BA. In a section of their memo titled Other Rare Species, these points were reiterated. To date neither species has been listed, and NCDOT has committed to coordinating with USFWS to monitor the status of the potential listing of the Savannah Lilliput (Toxolasmapullus) throughout construction. Consequently, we think we have completed all necessary analysis under the Endangered Species Act (ESA) and that there is no new information warranting a supplemental EIS. When and if the either species is listed, we will take the appropriate additional actions.

The Town of Stallings opposes the project

In the same letter SELC also noted that the Town of Stallings, which had previously supported the project, now opposes the project. We note their position and acknowledge they have changed position because of their understanding that the project will not sufficiently relieve congestion on the existing U.S. 74. Notwithstanding the town's opposition to the project, the metropolitan planning organization has not removed the project from its transportation planning documents and future plans. The letter indicates the Stallings concerns are rooted at least in part in the same concerns about project forecasting articulated in the O'Connell and Lawrence study and the Hartgen Group's review of the Draft SEIS. FHWA and NCDOT reviewed and responded to the O'Connell and Lawrence study prior to issuing the DSEIS. FHWA and NCDOT have reviewed the Hartgen Group's comments and is responding to them in the Final SEIS. Consequently, we do not think the news of Stallings' changed position rises to the level of significant new information warranting a SEIS.