Feasibility Study

US 17 Improvements

New Hanover, Pender, and Onslow Counties

Division 3
FS-0803B

Feasibility Studies Unit
Program Development Branch
N.C. Department of Transportation

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1. INTRODUCTION

The purpose of this project is to prepare a feasibility study and conceptual designs for the US 17 corridor between the I-140 /US 17 Bypass interchange in Kirkland and the NC 50 (Ocean Road) intersection in Holly Ridge, North Carolina. The study evaluates three different alternative roadway improvements to the US 17 corridor, with and without the proposed Hampstead Bypass (TIP No. R-3300) in place. This report is intended to provide a high level examination of the US 17 facility and address its long-range needs.

1.1 BACKGROUND

US 17 is an important connection between Jacksonville to the north and Wilmington to the south. This road is heavily travelled by locals, commuters between Wilmington and Jacksonville and tourists travelling to North Carolina beaches.

The proposed Hampstead Bypass is currently being studied and is in the National Environmental Policy Act (NEPA) planning phase with the preparation of an Environmental Impact Statement (EIS). The bypass study alternative that connects with US 17 in the area of this corridor study is the EH-RCW alternative; this alignment is being used in relationship with the conceptual designs developed for this study since it is expected to be the recommended alternative based on studies completed to date. This alternative has a connection to US 17 near Williams Store Road (SR 1568) and ties to the existing US 17 just north of Leeward Lane. This study also examined an Improve Existing alternative which included upgrading the existing US 17 corridor to a freeway with access to side roads via interchanges; however, that alternative was dropped from in depth study due to potential impacts. A Recommended Alternative has not been chosen at this time. The Hampstead Bypass is expected to significantly alter the existing traffic on US 17 and that impact is considered in this study.

Additionally, a corridor study focusing on the Hampstead area has recently been completed which provided short-term recommendations for a portion of the US 17 corridor. That study focused on safety concerns and access considerations if medians were implemented through the area.

The purpose of this feasibility study is to evaluate the different long-term alternatives for the US 17 corridor from I-140/US 17 Bypass to NC 50 in Holly Ridge, NC, approximately 18.6 miles. The three alternatives include widening US 17 to six lanes with a median, with one alternative changing US 17 to a freeway from the end of the Hampstead Bypass to half a mile north of the Pender/Onslow County line.

1.2 STUDY AREA

The scope of the study area for this project includes US 17 from the I-140/US 17 Bypass and US 17 Business interchange in New Hanover County to NC 50 intersection in Holly Ridge, which is in Onslow County. The following are the major intersections included in the study area, as shown in Figure 1-1:

- US 17 and SR 1571 (Scotts Hill Loop Road)
- US 17 and SR 1572 (Sidbury Road)
- US 17 and SR 1571 (Scotts Hill Loop Road)
- US 17 and SR 1582 (Washington Acres Road)
- US 17 and SR 1618 (Hughes Road)
- US 17 and SR 1673 (Deerfield Drive)
- US 17 and NC 210/Dan Owen Drive
- US 17 and SR 1570 (Peanut Road/Factory Road)
- US 17 and SR 1593 (Jenkins Road)/SR 1565 (Country Club Drive)
- US 17 and SR 1675 (Long Leaf Drive)
- US 17 and SR 1563 (Sloop Point Loop Road)
- US 17 and SR 1561 (Sloop Point Road)/SR 1726 (Old Whitfield Road)
- US 17 and NC 210
- US 17 and SR 1533 (Shepards Road)
- US 17 and NC 50 (Ocean Road)

1.3 PROJECT ALTERNATIVES

This study analyzed various base year and future year scenarios. These scenarios present traffic projections for multiple base year and future conditions, as described below.

- *Base Year (2008) – No-Build:* This scenario represents existing conditions. The traffic volumes used in this scenario are from the NCDOT forecasts dated November 17, 2008 and the existing lane configurations and traffic control observed in the field were incorporated. The field observations for these conditions reflect spring 2011 conditions, which were slightly changed from 2008 conditions. Any geometric changes made after 2008 were accounted for and any required volume adjustments for rerouting associated with these changes were made accordingly.
- *Base Year (2008) – No-Build with TIP Projects:* This scenario represents existing conditions with base year volume forecasts with proposed TIP projects in place, including the Hampstead Bypass (NCDOT TIP #R-3300) and the Military Cutoff Road Extension (NCDOT TIP #U-4751).
- *Design Year (2035) – No-Build:* This scenario projects the traffic conditions along the study corridor with forecasted volumes along the roadway and the existing (2011) geometric and traffic control conditions. The only geometric difference is the implementation of a superstreet configuration at the US 17 and SR 1561 (Sloop Point Road)/SR 1726 (Old Whitfield Road) intersection. This superstreet is planned by NCDOT and is currently under construction.

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Figure 1-1
Project Study Area

- *Design Year (2035) – No-Build with TIP Projects:* This scenario projects the traffic conditions along the study corridor with forecasted volumes, existing roadway conditions with proposed TIP projects in place, including the Hampstead Bypass and the Military Cutoff Road Extension. One additional geometric difference is the implementation of a superstreet configuration at the US 17 and SR 1561 (Sloop Point Road)/SR 1726 (Old Whitfield Road) intersection. This superstreet is planned by NCDOT and is currently under construction.
- *Design Year (2035) – Build Alternative 1:* This scenario projects the traffic conditions along the study corridor with design year forecasted volumes along the roadway without the Hampstead Bypass or Military Cutoff Road Extension in place. Specific geometric improvements included in this alternative include widening US 17 with one lane in each direction, upgrading to include a median where there is not one presently. Additionally, any intersection specific improvements required to accommodate future volumes to and from side streets were assumed. These improvements include additional turn lanes, superstreet configurations and intersection signalization.
- *Design Year (2035) – Build Alternative 2:* This scenario projects the traffic conditions along the study corridor with design year forecasted volumes along the roadway with the Hampstead Bypass or Military Cutoff Road Extension in place. Because the Hampstead Bypass would cause a shift in traffic volumes, the specific intersection improvements, such as additional turn lanes, are altered to accommodate the projected traffic demand.
- *Design Year (2035) – Build Alternative 3:* This scenario includes upgrading the existing geometry to a freeway facility from the Hampstead Bypass north to NC 50 (Ocean Road). Four new interchanges as well as service roads are proposed along this section to provide access to the surrounding properties and street network. The volumes utilized in this scenario account for the completion of the Hampstead Bypass and the Military Cutoff Road Extension.

It should be noted that the Build Alternatives examined as part of this study compliment those studied in the Hampstead Bypass (STIP Project No. U-4751 and R-3300) environmental document, but do not replicate the same scenarios. In the Hampstead Bypass study, the Improve Existing alternative proposed upgrading US 17 to a freeway facility from Wilmington to Sloop Point Road. This alternative was eventually dropped from further study due to the potential impacts of the freeway typical section. This feasibility study proposes the addition of a third travel lane in each direction along the study segment under all Build Alternatives, producing a narrower cross section than a freeway and lessening potential impacts. In Build Alternative 3, a freeway cross-section is proposed north of Sloop Point Loop Road (i.e. starting near where the Hampstead Bypass Improve Existing Alternative ended its freeway analysis).

2. EXISTING CONDITIONS

2.1 EXISTING ROADWAY AND TRAFFIC CONDITIONS

Existing Roadway

The section of US 17 being evaluated in this study begins as a four-lane divided section with a 46-foot depressed median in Kirkland. The median begins south of the study area where I-140/US 17 Bypass ties to US 17 Business. The median continues for approximately 3.4 miles to the north with left only access at Scott's Hill Loop Road (SR 1571) (both locations) and Sidbury Road with a signalized U-turn location north of the northern Scott's Hill Loop Road. There are seven full access median openings between Scott's Hill Loop Road (SR 1571) and Washington Acres Road. At this point, US 17 transitions to a five-lane section with a center left turn lane. Signals are present at the intersections of US 17 with NC 210/Dan Owen Drive, Hoover Road, Country Club Drive/Jenkins Road and Topsail Elementary School/Vista Lane. The typical section transitions back to a four-lane divided section just north of Lodge Road with a 46-foot depressed median. Signals are present at the intersections with Sloop Point Loop Road and NC 210 with 11 median openings between the signals. There are seven more full access median openings before US 17 transitions back to a five-lane section approximately one mile south of NC 50/Ocean Road. The remainder of the study area is a five-lane typical section.

The posted speed limit along US 17 varies between 45 miles per hour (mph) and 55 mph. From the south, the speed limit is posted at 55 mph along the median divided segment as well as along the five-lane segment to Deerfield Drive. The speed limit decreases to 45 mph through the remainder of that five-lane section through Hampstead, transitioning back to 55 mph when the roadway returns to a four-lane divided cross section near Sloop Point Loop Road. Once the roadway transitions again to a five-lane section near US 50 (Ocean Road), the speed limit drops again to 45 mph through the Holly Ridge community.

There are numerous side streets and driveways that access US 17 along the entire length. There is little inter-connectivity between driveways of individual businesses resulting in several locations where driveways are immediately adjacent to one another.

The existing traffic control for the intersections along US 17 includes stop controlled side street approaches, traffic signals and superstreet configurations. Along US 17, there are generally exclusive right-turn lanes present at the study area intersections to allow turning traffic to exit the through traffic stream before turning off US 17.

Existing Traffic

The traffic volumes utilized in the traffic capacity analysis were taken from the NCDOT provided forecasts for the project. The base year for these forecasts was 2008; thus the existing conditions are based on the 2008 volume conditions.

The 2008 daily volumes vary along the corridor; along the southern end of the corridor, the daily volumes average 34,000 vehicles per day (vpd) between Scotts Hill Loop Road and NC 210/Dan Owen Drive, 34,900 vpd between NC 210/Dan Owen Drive and Jenkins Road/Country Club Drive; 27,600 vpd between Jenkins Road/Country Club Drive and Old Whitfield Road/Sloop Point Road; 22,700 between Old Whitfield Road/Sloop Point Road and NC 210; and 15,000 vpd between NC 210 and NC 50/Ocean Boulevard.

Figure 2-1 illustrates the existing lane configurations, traffic control and median type along the study corridor.

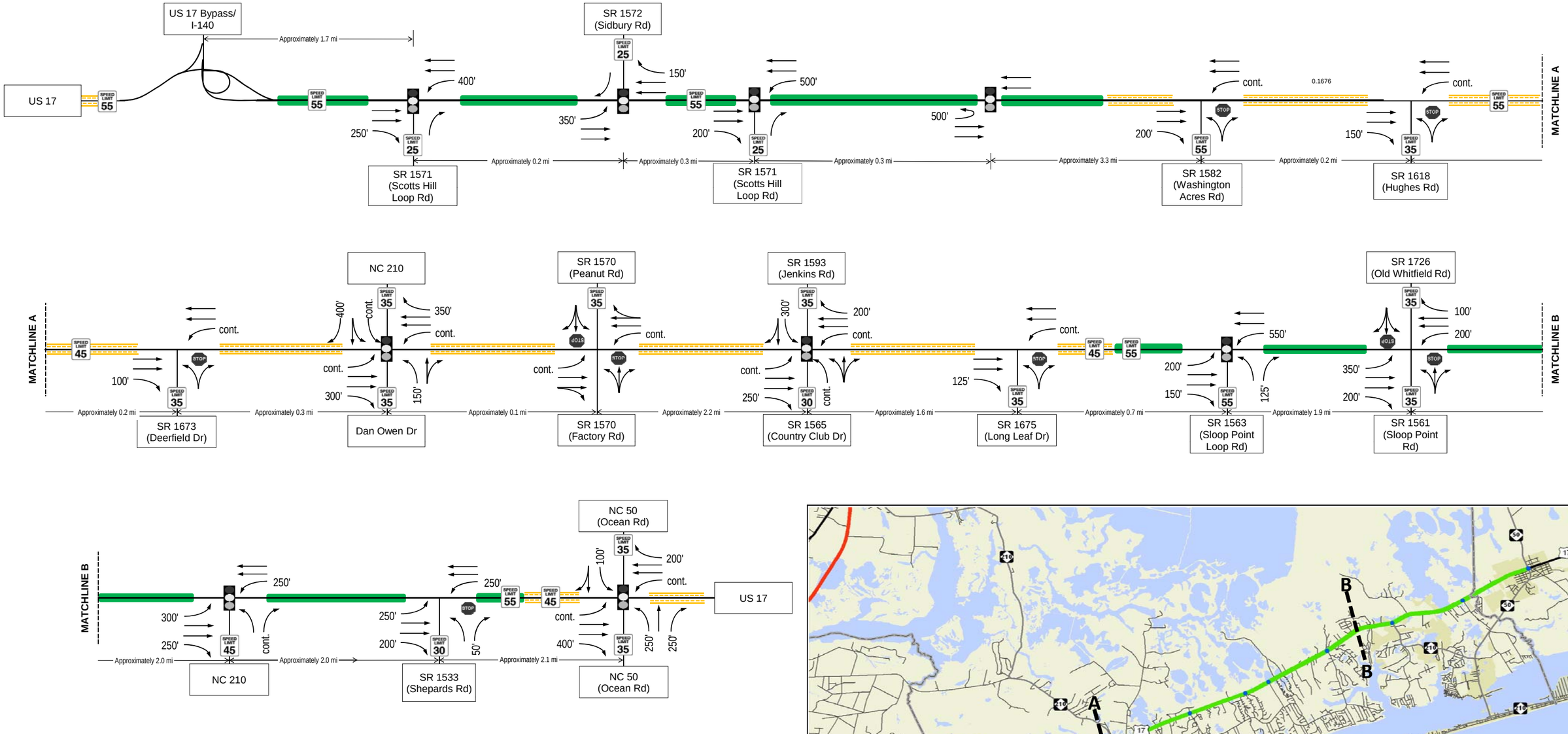

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Figure 2-1
Base Year (2008) - Lane Configurations
and Traffic Control

2.2 ENVIRONMENTAL SCREENING

An environmental screening was completed for the project study area. This screening indicated areas of potential environmental concern, including items such as: wetland areas, historic resources, hazardous material sites, community services, and many others. The data was obtained through various GIS sources, including:

- National Parks Service (NPS)
- National Resource Conservation Service (NRCS)
- NC DENR Division of Water Quality (DWQ)
- NC DENR Division of Coastal Management (DCM)
- NC DOT GIS Unit
- NC Flood Mapping Program (NCFMP)
- NC One Map Geospatial Portal
- NC Wildlife Resources Commission (WRC) – Natural Heritage Program (NHP)
- New Hanover County GIS
- Onslow County GIS
- Pender County GIS

More detailed information was also obtained from the NCDOT team working on the Hampstead Bypass and Military Cutoff Road Extension TIP projects.

Streams, Wetlands, and Flood Plains

The area surrounding US 17 in the study area is at a low elevation, and based on Coastal Area Management Act (CAMA) surveys, there are large areas of wetlands along the length of the project, many that are directly adjacent to the existing roadway. Based on the 1997 USGS Quad maps, there are nine blue line stream crossings. Field observations resulted in the location of four major crossings that had reinforced concrete box culverts (RCBC), as listed below.

- 8'x10' reinforced concrete box culvert (RCBC) with headwall and wingwalls approximately 825 feet north of Scotts Hill Loop Road
- 4'x8' RCBC with headwall approximately 800 feet south of Sloop Point Road
- 6'x8' RCBC with headwall approximately 3,150 feet north of Sloop Point Road
- 6'x9' RCBC with headwall and wing walls reinforced with rip rap and a large dam/weir made of rip rap 30-40 feet downstream, approximately 1,500 feet north of Shepards Road, just north of the Pender/Onslow County line.

No portions of US 17 within the study area are located within the 100-year or 500-year flood plains.

Threatened or Endangered Species

Habitat suitable for the red-cockaded woodpecker is located along the west side of US 17 in the area across from Leeward Lane. None of the proposed alternatives impact this habitat area.

Hazardous Materials

There are four probable underground storage tank (UST) locations along the project corridor. These are located at existing gas stations. There is one hazardous materials disposal site located in Holly Ridge near the US 17 and NC 50/Ocean Boulevard intersection. This location is listed as an inactive superfund site and is not on the priority list for remediation. There are no other known hazardous material sites along the project corridor.

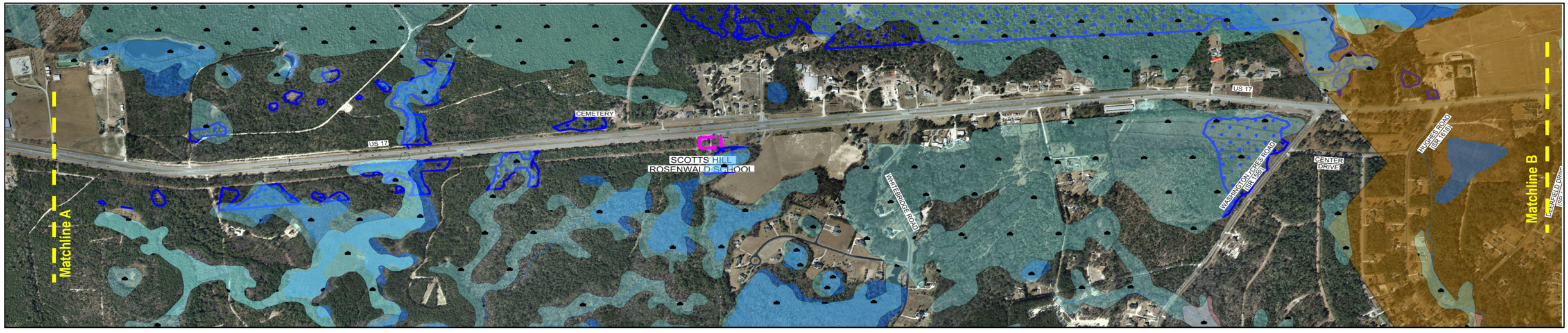
Historic Resources

There is one property in the study area listed on the National Register of Historic Places (NRHP) and three which are listed as eligible for the NRHP. Poplar Grove Plantation is located at the intersection of US 17 and Scott's Hill Loop Road and consists of a 14 acre parcel with a Greek Revival main house and numerous outbuildings. Poplar Grove Plantation was listed in the NRHP in 1979 and began operating as a museum in 1980.

Additionally, there are three historic resources within the study area that have been recommended as eligible for the NRHP. These resources were identified as part of the Historic Architectural Resources Survey Report completed for Military Cutoff Road and Hampstead Bypass projects. These properties include:

- Wesleyan Chapel United Methodist Church; located at the intersection of US 17 and Sidbury Road
- Scotts Hill Rosenwald School; located on US 17 approximately 2,030 feet south of Whitebridge Road
- Topsail Consolidated School; located on US 17 across from Hoover Road

The area with the most concern over impacts to historic resources are the closely spaced intersections of Scotts Hill Loop Road and Sidbury Road, as this is where the Poplar Grove Plantation is located (NRHP property, south of US 17) as well as Wesleyan Chapel United Methodist Church (NRHP eligible, north of US 17). Although design work to this point has only been conceptual, it seems feasible that impacts to these and the other historic resources can be minimized, likely contained to property impacts and avoiding the taking of any structures. There is the possibility of adverse impacts to these resources as the designs are refined; however, they are not of major concern at this point in the planning process. Figure 2-2(a-d) illustrates the environmental features along the study corridor.



SCALE
0' 1000' 2000'

LEGEND

- SCHOOLS
- POINT SOURCE POLLUTION
- AIRPORT
- FIRESTATION
- LIBRARY
- WATER BODIES
- WETLANDS (NWI)
- GAMELANDS
- NATURAL AREAS
- NATURAL HERITAGE
- WETLANDS DELINEATED FOR U-4751 & R-3300
- HAZARDOUS SUBSTANCE DISPOSAL SITE
- MUNICIPAL BOUNDARY
- FLOODWAY
- 100-YR FLOODPLAIN
- 500-YR FLOODPLAIN
- STREAM
- HISTORIC (NRHP)
- ELIGIBLE NRHP HISTORIC
- COUNTY BOUNDARY

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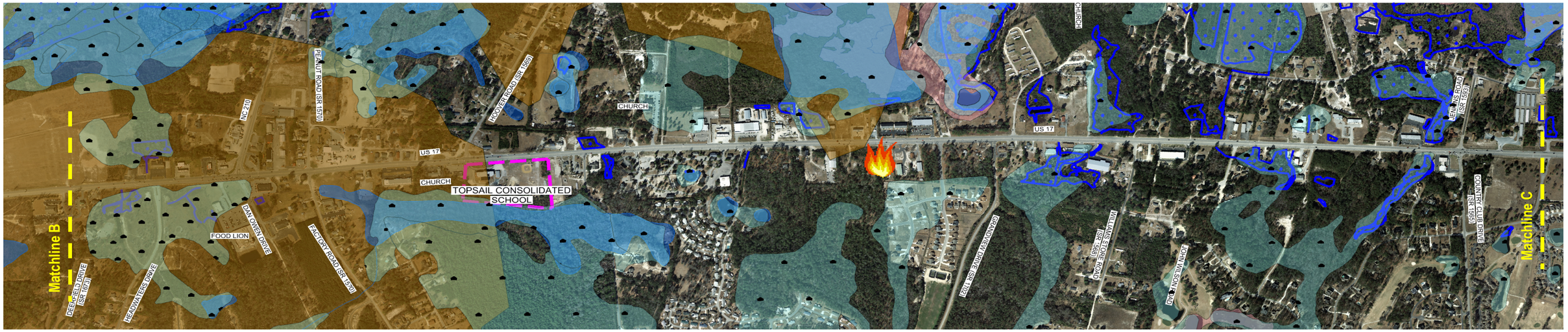
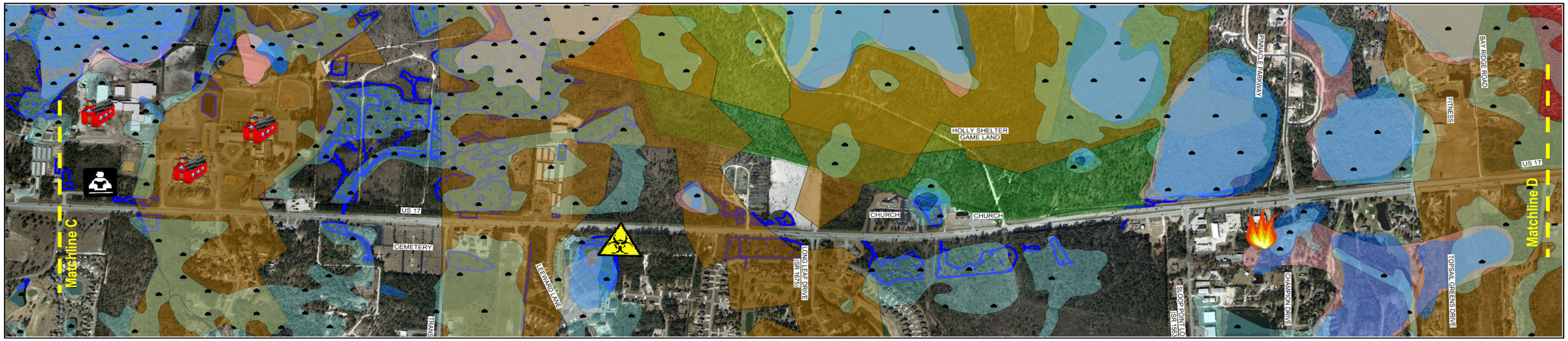
Figure 2-2a
Environmental Screening Map





SCALE
0' 1000' 2000'

LEGEND

SCHOOLS	LIBRARY	NATURAL AREAS	MUNICIPAL BOUNDARY	STREAM
POINT SOURCE POLLUTION	WATER BODIES	NATURAL HERITAGE	FLOODWAY	HISTORIC (NRHP)
AIRPORT	WETLANDS (NWI)	WETLANDS DELINEATED FOR U-4751 & R-3300	100-YR FLOODPLAIN	ELIGIBLE NRHP HISTORIC
FIRESTATION	GAMELANDS	HAZARDOUS SUBSTANCE DISPOSAL SITE	500-YR FLOODPLAIN	COUNTY BOUNDARY

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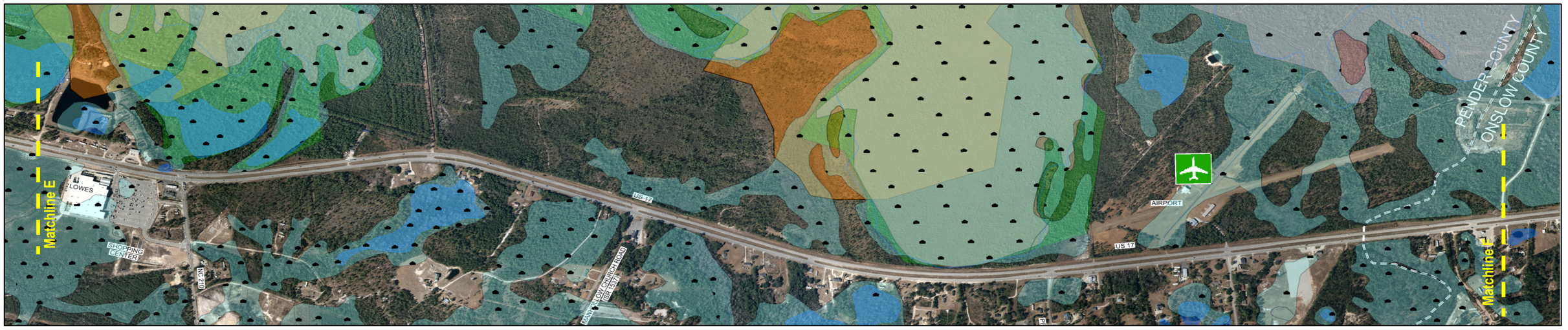
Figure 2-2b
Environmental Screening Map



SCALE
0' 1000' 2000'

LEGEND

SCHOOLS	LIBRARY	NATURAL AREAS	MUNICIPAL BOUNDARY	STREAM
POINT SOURCE POLLUTION	WATER BODIES	NATURAL HERITAGE	FLOODWAY	HISTORIC (NRHP)
AIRPORT	WETLANDS (NWI)	WETLANDS DELINEATED FOR U-4751 & R-3300	100-YR FLOODPLAIN	ELIGIBLE NRHP HISTORIC
FIRESTATION	GAMELANDS	HAZARDOUS SUBSTANCE DISPOSAL SITE	500-YR FLOODPLAIN	COUNTY BOUNDARY

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Figure 2-2c
Environmental Screening Map

SCALE
0' 1000' 2000'

LEGEND

SCHOOLS	LIBRARY	NATURAL AREAS	MUNICIPAL BOUNDARY	STREAM
POINT SOURCE POLLUTION	WATER BODIES	NATURAL HERITAGE	FLOODWAY	HISTORIC (NRHP)
AIRPORT	WETLANDS (NWI)	WETLANDS DELINEATED FOR U-4751 & R-3300	100-YR FLOODPLAIN	ELIGIBLE NRHP HISTORIC
FIRESTATION	GAMELANDS	HAZARDOUS SUBSTANCE DISPOSAL SITE	500-YR FLOODPLAIN	COUNTY BOUNDARY

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Figure 2-2d
Environmental Screening Map

2.3 ACCIDENT ANALYSIS

The accident analysis was derived from the most recent three years of available crash data obtained from NCDOT. The data covered the period from January 1, 2008 to December 31, 2010 and includes crashes that were reported along US 17 from SR 1455 (Porters Neck Road) near Wilmington to SR 1538 (Morris Landing Road) in Holly Ridge, an approximately 19 mile stretch. The corridor was divided into four segments based on existing facility type, as shown in Figure 2-3. Table 2-1 details the total number of accidents, by type reported for each section along the corridor.

Figure 2-3 Crash Analysis Segments

Table 2-1
Accident Summary, By Type (January 2008 – December 2010)

Segment along US 17 Corridor		Length in miles	Angle	Head On	Object	Other	Over turn	Ran Off Road	Rear End	Side Swipe	Turns	Peds	Animal	TOTAL
FROM	TO													
SR 1455 (Porters Neck Road)	Pearson Lane	4.67	1	1	29	6	10	3	72	13	11	1	19	**166**
Pearson Lane	Old Lodge Road	5.83	13	4	19	4	1	1	150	35	84	1	33	**345**
Old Lodge Road	Drag Strip	7.13	7	1	23	5	4	4	30	9	16	0	40	**139**
Drag Strip	NC 50	1.22	1	0	1	0	0	2	4	3	7	0	5	**23**
CORRIDOR-WIDE TOTAL		**18.85**	**22**	**6**	**72**	**15**	**15**	**10**	**256**	**60**	**118**	**2**	**97**	**673**

As shown in the summary table, the main collision type along the US 17 corridor was rear-end crashes, with turning and animal collisions also having higher frequencies than other crash types. Rear-end collisions generally indicate overall congestion issues, as these type of collisions occur mainly in areas where there is frequent "stop and go" traffic or at traffic signals where vehicles may stop suddenly to avoid running a red light. Turning collisions often indicate the need for more controlled access to side streets, thereby localizing the turning movements, making them more predictable to on-coming traffic.

The intersection of NC 210 and US 17 (near Hampstead) had the highest overall number of collisions with 31 total crashes reported. The most common collision type was turning collisions, accounting for 45% of crashes at this intersection. The other most common crash types at this location were rear-end (35%) and angle (13%) collisions. The US 17 and SR 1570 (Factory Road/Peanut Road) intersection had the second highest number of collisions, 30, with the most common type being rear-ends followed by turning accidents. Another location that had significant number of collisions, 25, is the intersection of US 17 and SR 1565 (Country Club Road)/SR 1593 (Jenkins Road) with the most common type being rear-end, accounting for approximately 60% of the total collisions at that location.

Table 2-2 compares the crash rates for US 17 to similar corridors statewide. The NCDOT provides calculated rates for facility types, based on data collected statewide. For the purpose of comparison, the US 17 corridor within the study area was split into four analysis segments based on characteristics of the roadway. The first segment extends from Porters Neck Road (SR 1455) to Pearson Lane and is classified as a rural US route with four lanes, divided and partial access control. The second segment extends from Pearson Lane to Lodge Road and is classified as a rural US route with four lanes, undivided and a continuous left-turn lane. The third segment extends from Lodge Road to Drag Strip and is classified as a rural four-lane divided US route with no access control. Finally, the fourth segment extends from Drag Strip to NC 50 and is classified as a rural US route with four lanes, undivided and a continuous left-turn lane. During the three years studied, there were a total of four fatalities along these sections of US 17.

As shown in the table, the total crash rate for US 17 are generally lower than or approximately equal to the statewide average for similar facilities from Old Lodge Road to NC 50. The segment from Porters Neck to Pearson Lane has slightly higher crash rates than similar facilities in all reported fields; additionally, the segment from Pearson Lane to Old Lodge Road, which includes the Hampstead area, has a higher overall and fatal crash rate than similar facilities. Of specific concern along this segment are three fatal crashes occurring during the analysis period.

Some spot improvements are necessary at specific locations to improve safety along the corridor. For example, the predominant collision type at the NC 210 and US 17 intersection were turning collisions. This could be due to the high traffic volumes and can be improved by providing more controlled access to side-streets through the implementation of a median and by constructing additional turn lanes. Another critical location is the paired left-over intersection just east of the I-140/US 17 Bypass interchange. Rear-end collisions are predominant at this location. This could be because of vehicles suddenly slowing down from high speeds of 55 mph to stop at a traffic signal. Additional signage alerting drivers to the presence of traffic signals could curb this trend.

Any of the proposed alternatives would result in a median divided facility along the entire length of the study area. A recent corridor study completed for US 17 and NC 210 in the Hampstead area focused on safety issues along the US 17 corridor in that area. As stated in that study, the implementation of median divided facilities, rather than facilities with center-turn lanes, results in safer overall operations, specifically when comparing overall and fatal crash rates. Specifically, the installation of a median can be expected to reduce the overall crash rate by approximately 15% and has been shown to reduce the number of fatal crashes by approximately 65% (*FHWA Desktop Reference for Crash Reduction Factors, FHWA 2007*).

Table 2-2
Fatality Crash Rate* Comparison

Roadways	Total Crash Rate	Fatal Crash Rate	Non-Fatal Injury Crash Rate	Night Crash Rate	Wet Crash Rate
US 17 (Porters Neck to Pearson Lane)	108.83	0.66	29.50	30.81	23.6
Statewide Rural United States Routes (4-lane divided, partial access control)	83.74	0.63	28.07	28.57	16.74

**All crash rates per 100 Million Vehicle Miles Traveled*

Roadways	Total Crash Rate	Fatal Crash Rate	Non-Fatal Injury Crash Rate	Night Crash Rate	Wet Crash Rate
US 17 (Pearson Lane to Old Lodge Road)	171.95	1.5	51.84	34.39	24.42
Statewide Rural United States Routes (4+lanes, cont. left-turn lane)	155.47	1.46	58.80	41.22	27.79

**All crash rates per 100 Million Vehicle Miles Traveled*

Roadways	Total Crash Rate	Fatal Crash Rate	Non-Fatal Injury Crash Rate	Night Crash Rate	Wet Crash Rate
US 17 (Old Lodge Road to Drag Strip)	101.07	0.00	31.26	42.17	11.63
Statewide Rural United States Routes (4-lane divided, no access control)	111.44	1.10	39.62	32.70	19.85

**All crash rates per 100 Million Vehicle Miles Traveled*

Roadways	Total Crash Rate	Fatal Crash Rate	Non-Fatal Injury Crash Rate	Night Crash Rate	Wet Crash Rate
US 17 (Drag Strip to NC 50)	132.32	0.00	17.26	23.01	17.26
Statewide Rural United States Routes (4+lanes, cont. left-turn lane)	160.79	1.39	60.74	40.70	26.63

**All crash rates per 100 Million Vehicle Miles Traveled*

3. LAND USE

3.1 EXISTING LAND USE

The existing land use along US 17 within the study corridor is a mix of commercial, residential, institutional and open space. Generally, along the corridor parcels fronting US 17 are primarily commercial in nature with cross streets providing access to residential side streets and neighborhoods. There are also schools along US 17 in this area, including Topsail High School and Topsail Middle School along with multiple churches. In the areas with less development, it is not uncommon for residences to have a driveway directly accessing US 17.

3.2 FUTURE LAND USE

The majority of the study corridor is located within Pender County. Based on the Comprehensive Land Use Plan for the County, dated June 2010, the US 17 corridor is planned to be developed with mixed uses, with pockets of conservation lands. The plan for continued mixed use development, including commercial and residential projects indicates that traffic volumes in the area can be expected to increase through time as the development of existing open space occurs.

4. TRAFFIC FORECASTS

The traffic forecast for this project was completed by NCDOT Transportation Planning Branch in 2008. Previously completed forecasts for other projects within the area were reviewed during the development of this forecast. The forecast provided volumes for the following scenarios:

- 2008 Base Year No-Build
- 2008 Base Year Build (Build R-3300 & U-4751)
- 2035 Future Year (Without R-3300 and U-4751)
- 2035 Future Year Build

The future year forecasts were based on the 2009-2015 State TIP. Since the forecasts were completed, NCDOT has altered the strategic plan for transportation decision-making and now follows the "Policy to Projects" process, which outlines projects that will be undertaken in the decade from 2011-2020. The STIP is part of this process and lists projects included in the Work Program and the Program & Resource Plan. The Hampstead Bypass (R-3300) is included in the current STIP and is to be funded by the Highway Trust Fund. Right-of-Way and Utility costs are funded for the 2017 fiscal year; however, construction is currently unfunded and is shown as occurring beyond the 2020 fiscal year. Also, the Military Cutoff Road Extension (U-4751) is included and is also to be funded by the Highway Trust Fund. Right-of-Way, Utility, and Mitigation costs are funded and are to be complete by the 2016 fiscal year. Construction is funded and is planned to occur from 2017-2019.

The project area is located within the Wilmington Metropolitan Planning Organization (MPO) and the Cape Fear Rural Planning Organization (RPO) but is located outside of the area covered by the Wilmington Regional Model. Thus, traffic growth rates were obtained from historical trends and specific information on planned developments were considered during the forecast development. Turning movement counts and electronic hourly counts were also used in the development of the forecast. The traffic forecasts for this project can be found in the appendix.

The developed forecasts were used to derive the AM and PM peak hour turning movement volumes using the NCDOT Intersection Analysis Utility (IAU) tool.

The forecast developed for use in this project account for a base year of 2008 and a design year of 2035. Some geometric changes occurred along the study corridor between 2008 and 2011; thus, some volumes were manually shifted to account for these geometric changes. Specifically, the Scotts Hill Loop Road, Sidbury Road, and Scotts Hill Loop Road intersection volumes were altered to account for the superstreet configuration that is in place currently. Additionally, the future year forecasts were manipulated to account for the Sloop Point Road/Old Whitfield Road superstreet configuration that is currently under construction. Lastly, intersection volumes in the vicinity of the proposed northern terminus of the Hampstead Bypass were adjusted to reflect that project's EH-RCW alternative. This specifically included a new intersection east of SR 1565 (Country Club Drive), a reduction of through volume at this intersection, removal of the SR 1675 (Long Leaf Drive) connection with US 17 and adjustment to the volumes at SR 1563 (Sloop Point Loop Road).

5. TRAFFIC CAPACITY ANALYSIS

A capacity analysis was performed for each of the alternatives including intersection operations. Intersection capacity analyses were conducted for the AM and PM peak hours. Levels of service range from A through F, based on the average control delay experienced by vehicles traveling through the intersection during the peak hour. Control delay represents the portion of total delay attributed to traffic control devices (e.g., signals or stop signs). Table 5-1 provides a general description of various levels of service categories and delay ranges for intersection levels of service.

Table 5-1
Level of Service Descriptions for Intersections

Level of Service	Description	Signalized Intersection	Unsignalized Intersection
A	Little or no delay	<= 10 sec.	<= 10 sec.
B	Short traffic delay	10-20 sec.	10-15 sec.
C	Average traffic delay	20-35 sec.	15-25 sec.
D	Long traffic delay	35-55 sec.	25-35 sec.
E	Very long traffic delay	55-80 sec.	35-50 sec.
F	Unacceptable delay	> 80 sec.	> 50 sec.

Intersection capacity analysis was completed using the *Synchro, version 7* software package. Signal timings were optimized within this software. The following intersections within the study area were analyzed for AM and PM peak hour operations:

- US 17 and SR 1571 (Scotts Hill Loop Road)
- US 17 and SR 1572 (Sidbury Road)
- US 17 and SR 1571 (Scotts Hill Loop Road)
- US 17 and SR 1582 (Washington Acres Road)
- US 17 and SR 1618 (Hughes Road)
- US 17 and SR 1673 (Deerfield Drive)
- US 17 and NC 210/Dan Owen Drive
- US 17 and SR 1570 (Peanut Road/Factory Road)
- US 17 and SR 1593 (Jenkins Road)/SR 1565 (Country Club Drive)
- US 17 and SR 1675 (Long Leaf Drive)
- US 17 and SR 1563 (Sloop Point Loop Road)
- US 17 and SR 1561 (Sloop Point Road)/SR 1726 (Old Whitfield Road)
- US 17 and NC 210
- US 17 and SR 1533 (Shepards Road)
- US 17 and NC 50 (Ocean Road)

Note that forecasted volumes were not available for the signalized SR 1569 (Hoover Road) or Topsail School Driveway/Vista Lane intersections with US 17 and therefore those intersections were not incorporated into the capacity analysis. The functional designs, however, maintain full access at these intersections in the design year.

5.1 BASE YEAR (2008) – NO-BUILD

This scenario represents existing conditions. The traffic volumes used in this scenario are from the NCDOT forecasts dated November 17, 2008 and the existing lane configurations and traffic control observed in the field were incorporated. The field observations for these conditions reflect spring 2011 conditions, which were slightly changed from 2008 conditions. Any geometric changes made after 2008 were accounted for and any required volume adjustments for rerouting associated with these changes were made accordingly. Figure 5-1 summarizes the volumes used in this analysis.

Based on the results of the intersection capacity analysis, most signalized intersections operate acceptably under the Base Year (2008) No-Build conditions. The US 17 and NC 210/Dan Owen Drive intersection, however, operates at a LOS F during both peak hours. Most of the stop controlled cross street approaches also operate at LOS F during the peak hours due to a combination of high turning volumes from the side streets conflicting with high through volume along US 17. Table 5-2 summarizes the LOS results for this scenario.

5.2 BASE YEAR (2008) – NO-BUILD WITH TIP PROJECTS

This scenario represents existing conditions with base year volume forecasts with proposed TIP projects in place, including the Hampstead Bypass (NCDOT TIP #R-3300) and the Military Cutoff Road Extension (NCDOT TIP #U-4751). Figure 5-2 summarizes the volumes used in this analysis.

Based on the results of the intersection capacity analysis, traffic operations under these conditions are similar to the Base Year (2008) No-Build results. In general, operations improve slightly, with some reduction in delay observed due to the implementation of the TIP projects. These reductions, however, do not result in any significant improvement at locations with failing operations (i.e. improvement from failing to acceptable operations). Table 5-3 summarizes the LOS results for this scenario.

5.3 DESIGN YEAR (2035) – NO-BUILD

This scenario projects the traffic conditions along the study corridor with forecasted volumes along the roadway and the existing (2011) geometric and traffic control conditions. The only geometric difference is the implementation of a superstreet configuration at the US 17 and SR 1561 (Sloop Point Road)/SR 1726 (Old Whitfield Road) intersection. This superstreet is planned by NCDOT and is currently under construction. Figure 5-3 summarizes the volumes used in this analysis.

Results of the intersection capacity analysis indicate that the study intersections are expected to experience significant degradation in the future as traffic volumes increase. With no changes to the existing roadway geometrics and traffic control, it is projected that all intersections, signalized and unsignalized, will operate at LOS F with lengthy delays and considerable queuing throughout the study corridor. Table 5-4 summarizes the LOS results for this scenario.

5.4 DESIGN YEAR (2035) – NO-BUILD WITH TIP PROJECTS

This scenario projects the traffic conditions along the study corridor with forecasted volumes, existing roadway conditions with proposed TIP projects in place, including the Hampstead Bypass and the Military Cutoff Road Extension. One additional geometric difference is the implementation of a superstreet configuration at the US 17 and SR 1561 (Sloop Point Road)/SR 1726 (Old Whitfield Road) intersection. This superstreet is planned by NCDOT and is currently under construction. Figure 5-4 summarizes the volumes used in this analysis.

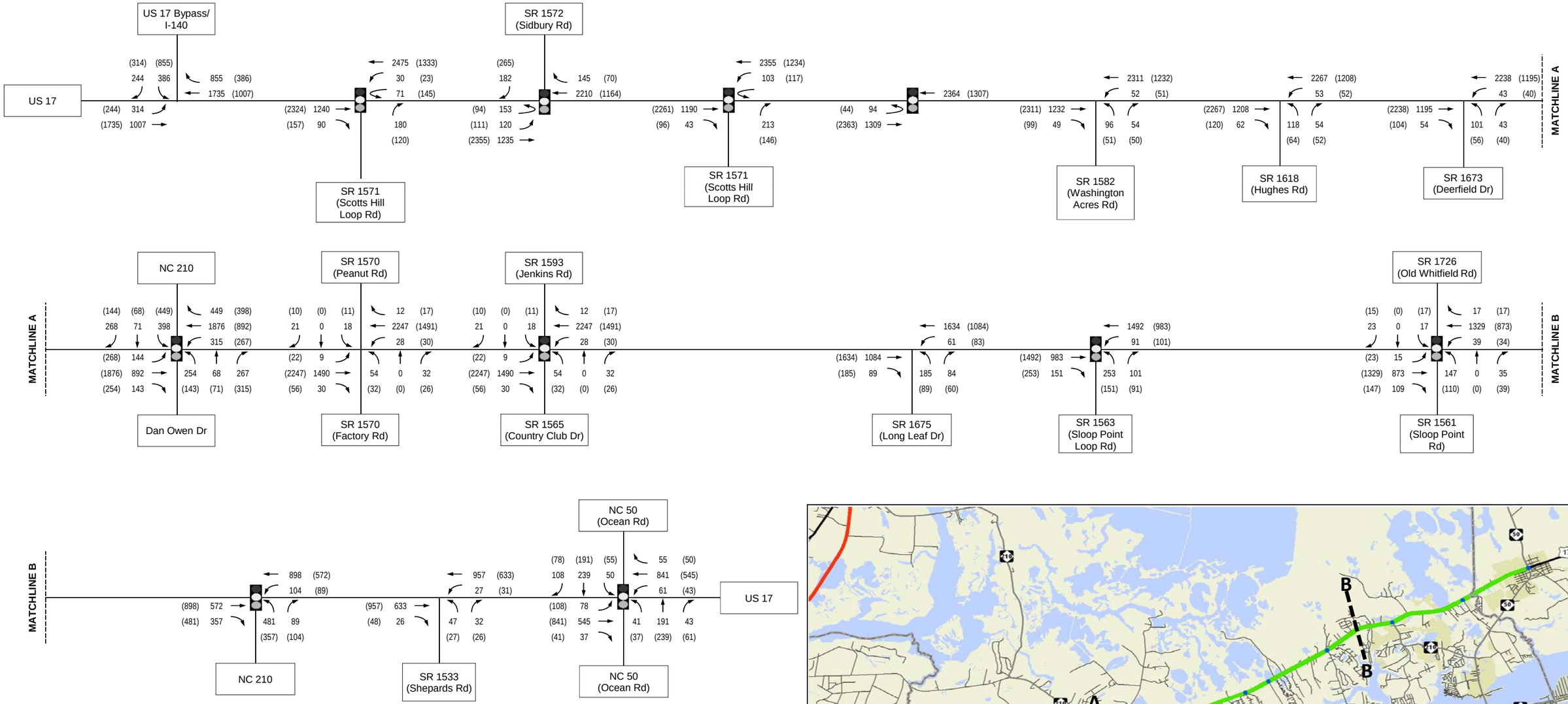

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Figure 5-1
Base Year (2008) No-Build without TIP Projects - AM and PM Peak Hour Volumes

Based on the results of the intersection capacity analysis, traffic operations under these conditions are similar to the Design Year (2035) No-Build results in that nearly all intersections report failing operations during both peak hours. The only exceptions are that during the AM peak hour, both of the Scotts Hill Loop Road intersections are projected to operate acceptably. Table 5-5 summarizes the LOS results for this scenario.

Table 5-2
Base Year (2008) No-Build Without TIP Projects - LOS Summary

ID	Intersection	Existing Traffic Control	Base Year (2008) No-Build without TIP Projects	
			AM	PM
1	US 17 & SR 1571 (Scotts Hill Loop Road)	Superstreet Signal	B (NB-C) 11.5 sec	C (SB-F) 25.8 sec
2	US 17 & SR 1572 (Sidbury Road)	Superstreet Signal	C (NB-F) 30.8 sec	A (NB-C) 9.8 sec
3	US 17 & SR 1571 (Scotts Hill Loop Road)	Superstreet Signal	A (NB-C) 8.8 sec	B (NB-F) 16.1 sec
4	US 17 & SR 1582 (Washington Acres Road)	Stop Controlled	**(NB-F)**	**(NB-F)**
5	US 17 & SR 1618 (Hughes Road)	Stop Controlled	**(NB-F)**	**(NB-F)**
6	US 17 & SR 1673 (Deerfield Drive)	Stop Controlled	**(NB-F)**	**(NB-F)**
7	US 17 & NC 210/Dan Owen Drive	Conventional Signal	**F (SB-F) 113.6 sec**	**F (NB-F) 147.4 sec**
8	US 17 & SR 1570 (Factory Road/Peanut Road)	Stop Controlled	**(SB-F)**	**(NB-F)**
9	US 17 & SR 1593 (Jenkins Road)/ SR 1565 (Country Club Drive)	Conventional Signal	B (NB-F) 19.0 sec	C (NB-E) 22.9 sec
10	US 17 & SR 1675 (Long Leaf Drive)	Stop Controlled	**(NB-F)**	**(NB-F)**
11	US 17 & SR 1563 (Sloop Point Loop Road)	Conventional Signal	B (NB-C) 16.6 sec	B (NB-D) 14.4 sec
12	US 17 & SR 1726 (Old Whitfield Road)/SR 1561 (Sloop Point Road)	Conventional Signal	**(NB-F)**	**(NB-F)**
13	US 17 & NC 210	Conventional Signal	B (NB-C) 15.2 sec	B (NB-C) 15.0 sec
14	US 17 & SR 1533 (Shepards Road)	Stop Controlled	(NB-D)	(NB-D)
15	US 17 & NC 50/Ocean Road	Conventional Signal	C (SB-D) 21.9 sec	C (SB-D) 20.5 sec

LEGEND: X (XX-X) – Overall LOS (Lowest Operating Approach and LOS), signalized intersection
XX.X sec – overall delay in seconds, signalized intersection
(XX-X) –Lowest Operating Approach and LOS, unsignalized intersection
Bold indicates LOS E/F conditions

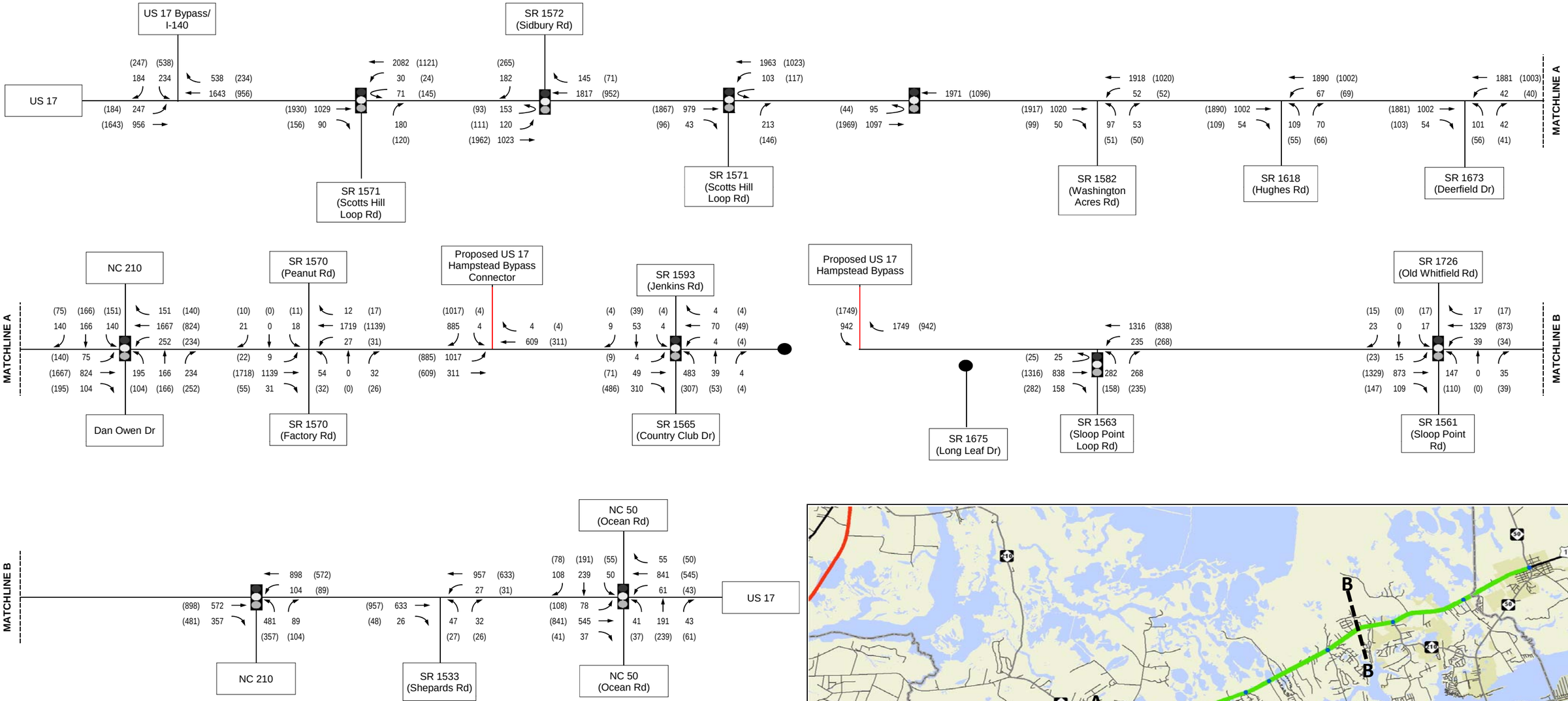

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Figure 5-2
Base Year (2008) No-Build with TIP Projects - AM and PM Peak Hour Volumes

Table 5-3
Base Year (2008) No-Build with TIP Projects - LOS Summary

ID	Intersection	Existing Traffic Control	Base Year (2008) No-Build with TIP Projects	
			AM	PM
1	US 17 & SR 1571 (Scotts Hill Loop Road)	Superstreet Signal	B (NB-C) 10.6 sec	B (SB-D) 16.4 sec
2	US 17 & SR 1572 (Sidbury Road)	Superstreet Signal	B (NB-D) 19.2 sec	A (NB-B) 8.6 sec
3	US 17 & SR 1571 (Scotts Hill Loop Road)	Superstreet Signal	A (NB-C) 9.1 sec	B (NB-E) 11.1 sec
4	US 17 & SR 1582 (Washington Acres Road)	Stop Controlled	**(NB-F)**	**(NB-F)**
5	US 17 & SR 1618 (Hughes Road)	Stop Controlled	**(NB-F)**	**(NB-F)**
6	US 17 & SR 1673 (Deerfield Drive)	Stop Controlled	**(NB-E)**	**(NB-F)**
7	US 17 & NC 210/Dan Owen Drive	Conventional Signal	**F (SB-F) 83.5 sec**	**F (NB-F) 112.5 sec**
8	US 17 & SR 1570 (Factory Road/Peanut Road)	Stop Controlled	**(SB-F)**	**(NB-E)**
9	US 17 & SR 1593 (Jenkins Road)/ SR 1565 (Country Club Drive)	Conventional Signal	C (SB-E) 34.3 sec	C (SB-E) 31.0 sec
10	US 17 & SR 1675 (Long Leaf Drive)	Stop Controlled	**(NB-F)**	**(NB-F)**
11	US 17 & SR 1563 (Sloop Point Loop Road)	Conventional Signal	B (NB-C) 16.6 sec	B (NB-D) 14.4 sec
12	US 17 & SR 1726 (Old Whitfield Road)/SR 1561 (Sloop Point Road)	Conventional Signal	**(NB-F)**	**(NB-F)**
13	US 17 & NC 210	Conventional Signal	B (NB-C) 15.2 sec	B (NB-C) 15.0 sec
14	US 17 & SR 1533 (Shepards Road)	Stop Controlled	(NB-D)	(NB-D)
15	US 17 & NC 50/Ocean Road	Conventional Signal	C (SB-D) 21.8 sec	C (SB-D) 20.5 sec

LEGEND: X (XX-X) – Overall LOS (Lowest Operating Approach and LOS), signalized intersection
XX.X sec – overall delay in seconds, signalized intersection
(XX-X) –Lowest Operating Approach and LOS, unsignalized intersection
Bold indicates LOS E/F conditions

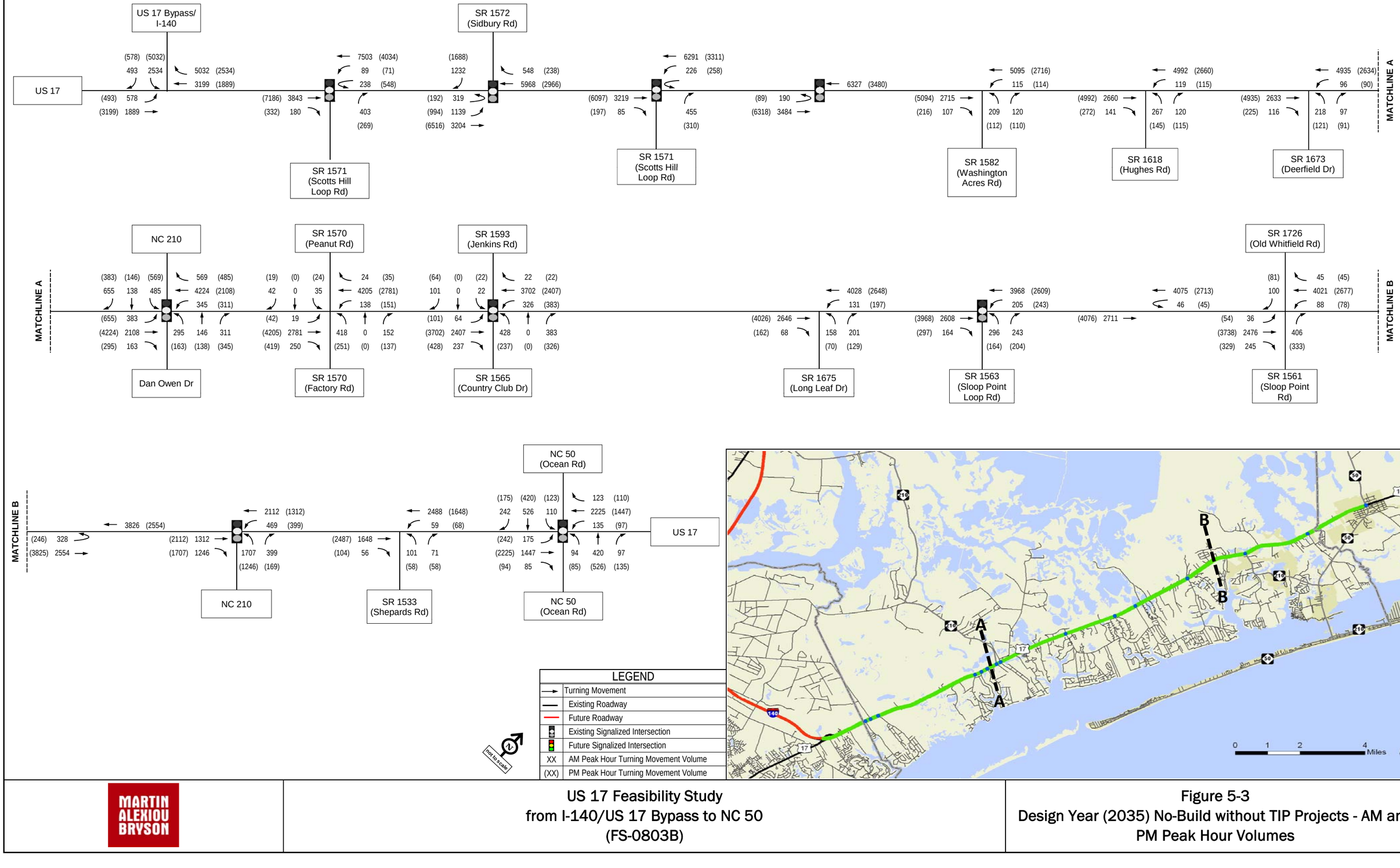

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Figure 5-3
Design Year (2035) No-Build without TIP Projects - AM and PM Peak Hour Volumes

Table 5-4
Design Year (2035) No-Build Without TIP Projects - LOS Summary

ID	Intersection	Existing Traffic Control	Design Year (2035) No-Build without TIP Projects	
			AM	PM
1	US 17 & SR 1571 (Scotts Hill Loop Road)	Superstreet Signal	**F (EB-F) 304.5 sec**	**F (EB-F) 990.8 sec**
2	US 17 & SR 1572 (Sidbury Road)	Superstreet Signal	**F (WB-F) 993.6 sec**	**F (SB-F) 506.0 sec**
3	US 17 & SR 1571 (Scotts Hill Loop Road)	Superstreet Signal	**F (EB-F) 220.7 sec**	**F (EB-F) 666.7 sec**
4	US 17 & SR 1582 (Washington Acres Road)	Stop Controlled	**(NB-F)**	**(NB-F)**
5	US 17 & SR 1618 (Hughes Road)	Stop Controlled	**(NB-F)**	**(NB-F)**
6	US 17 & SR 1673 (Deerfield Drive)	Stop Controlled	**(NB-F)**	**(NB-F)**
7	US 17 & NC 210/Dan Owen Drive	Conventional Signal	**F (WB-F) 567.0 sec**	**F (EB-F) 600.1 sec**
8	US 17 & SR 1570 (Factory Road/Peanut Road)	Stop Controlled	**(SB-F)**	**(SB-F)**
9	US 17 & SR 1593 (Jenkins Road)/ SR 1565 (Country Club Drive)	Conventional Signal	**F (WB-F) 350.5 sec**	**F (EB-F) 342.4 sec**
10	US 17 & SR 1675 (Long Leaf Drive)	Stop Controlled	**(NB-F)**	**(NB-F)**
11	US 17 & SR 1563 (Sloop Point Loop Road)	Conventional Signal	**F (EB-F) 238.0 sec**	**F (EB-F) 227.7 sec**
12	US 17 & WB U-Turns	Unsignalized Superstreet	**(WB-F)**	**(WB-F)**
	US 17 WB & SR 1726 (Old Whitfield Road)		**(SB-F)**	**(SB-F)**
	US 17 EB & SR 1561 (Sloop Point Road)		**(NB-F)**	**(NB-F)**
	US 17 & EB U-Turns		**(EB-F)**	**(EB-F)**
13	US 17 & NC 210	Conventional Signal	**F (NB-F) 248.3 sec**	**F (EB-F) 246.4 sec**
14	US 17 & SR 1533 (Shepards Road)	Stop Controlled	**(NB-F)**	**(NB-F)**
15	US 17 & NC 50/Ocean Road	Conventional Signal	**F (SB-F) 213.8 sec**	**F (SB-F) 176.9 sec**

LEGEND: X (XX-X) – Overall LOS (Lowest Operating Approach and LOS), signalized intersection
XX.X sec – overall delay in seconds, signalized intersection
(XX-X) –Lowest Operating Approach and LOS, unsignalized intersection
Bold indicates LOS E/F conditions

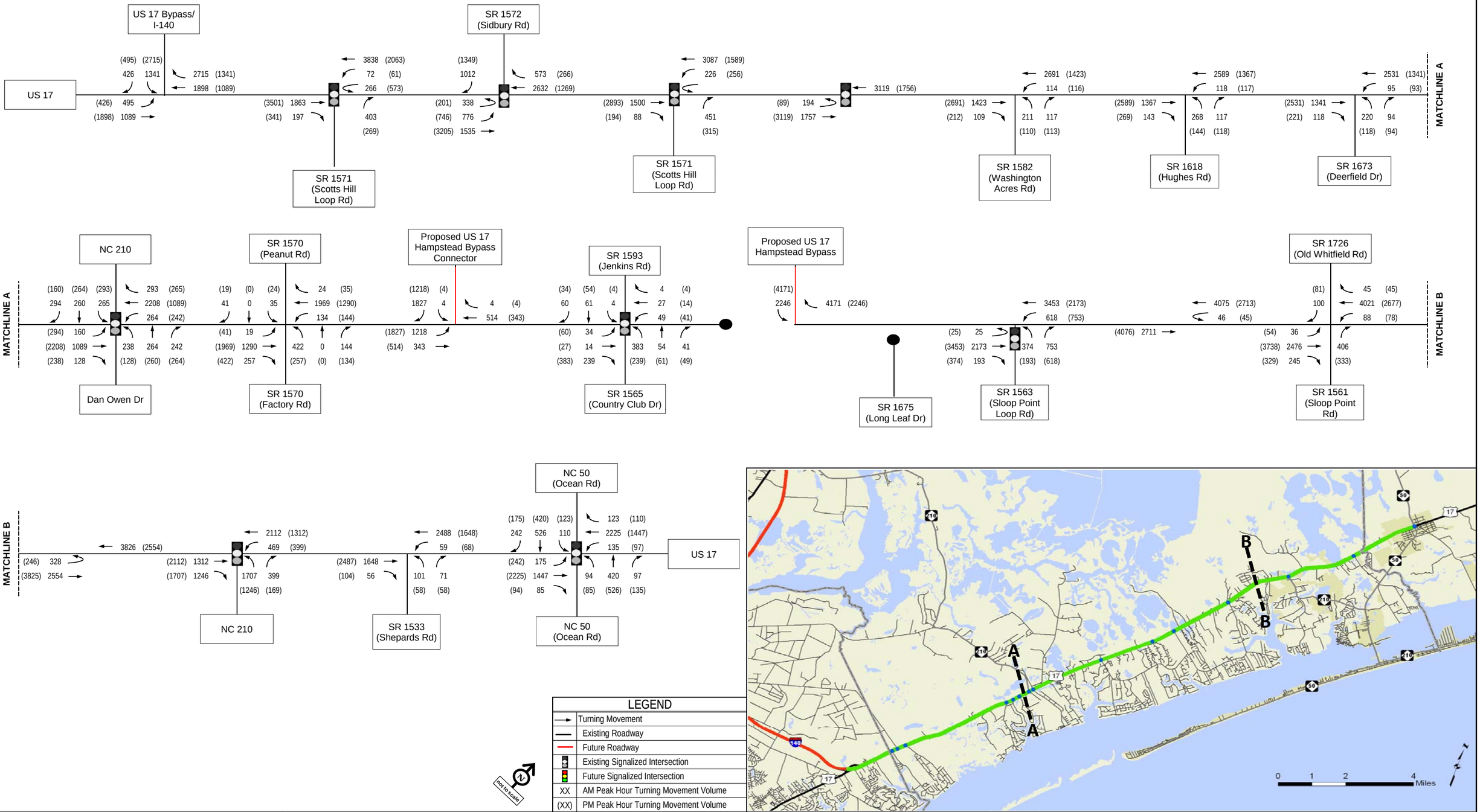

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Figure 5-4
Design Year (2035) No-Build with TIP Projects - AM and PM Peak Hour Volumes

Table 5-5
Design Year (2035) No-Build with TIP Projects - LOS Summary

ID	Intersection	Existing Traffic Control	Design Year (2035) No-Build with TIP Projects	
			AM	PM
1	US 17 & SR 1571 (Scotts Hill Loop Road)	Superstreet Signal	D (NB-E) 35.4 sec	**F (EB-F) 289.6 sec**
2	US 17 & SR 1572 (Sidbury Road)	Superstreet Signal	**F (SB-F) 294.5 sec**	**F (SB-F) 173.8 sec**
3	US 17 & SR 1571 (Scotts Hill Loop Road)	Superstreet Signal	C (NB-D) 25.8 sec	**F (NB-F) 115.3 sec**
4	US 17 & SR 1582 (Washington Acres Road)	Stop Controlled	**(NB-F)**	**(NB-F)**
5	US 17 & SR 1618 (Hughes Road)	Stop Controlled	**(NB-F)**	**(NB-F)**
6	US 17 & SR 1673 (Deerfield Drive)	Stop Controlled	**(NB-F)**	**(NB-F)**
7	US 17 & NC 210/Dan Owen Drive	Conventional Signal	**F (WB-F) 212.0 sec**	**F (EB-F) 240.1 sec**
8	US 17 & SR 1570 (Factory Road/Peanut Road)	Stop Controlled	**(NB-F)**	**(NB-F)**
9	US 17 & SR 1593 (Jenkins Road)/ SR 1565 (Country Club Drive)	Conventional Signal	D (SB-E) 45.1 sec	C (SB-E) 32.1 sec
10	US 17 & SR 1675 (Long Leaf Drive)	Stop Controlled	N/A	N/A
11	US 17 & SR 1563 (Sloop Point Loop Road)	Conventional Signal	**F (WB-F) 233.4 sec**	**F (EB-F) 291.7 sec**
12	US 17 & WB U-Turns	Unsignalized Superstreet	**(WB-F)**	**(WB-F)**
	US 17 WB & SR 1726 (Old Whitfield Road)		**(SB-F)**	**(SB-F)**
	US 17 EB & SR 1561 (Sloop Point Road)		**(NB-F)**	**(NB-F)**
	US 17 & EB U-Turns		**(EB-F)**	**(EB-F)**
13	US 17 & NC 210	Conventional Signal	**F (NB-F) 247.7 sec**	**F (EB-F) 246.6 sec**
14	US 17 & SR 1533 (Shepards Road)	Stop Controlled	**(NB-F)**	**(NB-F)**
15	US 17 & NC 50/Ocean Road	Conventional Signal	**F (WB-F) 213.0 sec**	**F (SB-F) 177.3 sec**

LEGEND: X (XX-X) – Overall LOS (Lowest Operating Approach and LOS), signalized intersection
XX.X sec – overall delay in seconds, signalized intersection
(XX-X) –Lowest Operating Approach and LOS, unsignalized intersection
Bold indicates LOS E/F conditions

6. BUILD ALTERNATIVES

This report examines three specific build alternatives. A capacity analysis for all Build Alternatives was completed using *Synchro, version 7* software package. Signal timings were optimized within this software. The Build Alternatives represent unique future conditions that can be compared and used in the decision making process. A description of each alternative is below:

Build Alternative 1

This alternative includes the volumes forecasted for the Design Year (2035) No-Build scenario, meaning that it does not account for the Hampstead Bypass or Military Cutoff Road Extension projects. This alternative evaluates the option of widening US 17 to add one additional through lane in each direction and upgrade to include a median where there is not one present. At places where the existing cross-section is a five-lane section with curb and gutter, the proposed section is analyzed as a six-lane section with a 23-foot raised median with mountable curb. Individual study area intersections were improved as needed by adding turn lanes with adequate storage bays, traffic signals, or superstreet intersections to improve them to an acceptable LOS. Widening of the intersecting side streets was often necessary in order to provide receiving lanes for the multiple turning lanes from US 17. Because of the high volume of traffic projected, only the intersections of US 17 at NC 210 (east of Hampstead) and US 17 at Shepards Road are proposed to be full access. All other intersections will be upgraded to superstreet configurations to accommodate the combination of high through volume and turning movements. Additionally, turn bays range from single to triple left turns to accommodate these high volumes. Bulbs to accommodate U-turns are incorporated at the intersections and at median breaks specifically for U-turns. All side roads, with the exception of NC 210 and Shepards Road, will be right-in/right-out only along US 17.

Build Alternative 2

This alternative includes the volumes forecasted for the Design Year (2035) No-Build with TIP Projects scenario, meaning that it accounts for the Hampstead Bypass or Military Cutoff Road Extension projects. Alternative 2 considers similar geometrical changes to the corridor included in Alternative 1 but assumes the Hampstead Bypass is in place. In this alternative, a considerable amount of through traffic on US 17 is assumed to use the Hampstead Bypass thus reducing the overall through traffic on US 17 between Grandview Drive (SR 1702), where there is a connection to the Bypass, and just north of Leeward Lane where the northern terminus of the Bypass ties back to the existing US 17 facility. Given the lower projected volumes, the intersection improvements beyond the additional through lane in each direction considered between the I-140/US 17 Bypass interchange and SR 1570 (Peanut Road/Factory Road) are more conventional than those in Alternative 1. Additionally, no improvements were recommended between the Hampstead Bypass Connector intersection and the point where the Bypass ties back into US 17, east of Hampstead. This section will remain four lanes with a center left turn lane. North of the Hampstead Bypass, recommended improvements are similar to those in Alternative 1, with superstreet configurations in place at most of the study area intersections to accommodate the high volumes.

Build Alternative 3

This alternative utilizes the same volumes used in the Build Alternative 2 analysis. Alternative 3 also includes the same improvements as Alternative 2 through the connection of the Hampstead Bypass with the existing US 17. North of the Hampstead Bypass, however, US 17 is evaluated as a freeway section. The freeway is proposed to be a six-lane freeway with a 46-foot median from the Hampstead Bypass to NC 210. At that point, the cross section is proposed to drop to a four-lane

freeway through the remainder of the freeway facility. As a freeway, this stretch of US 17 would be converted to a full control-of-access facility with the only access being at interchanges. Because of this, service roads will be required to allow homes and business which currently have driveways directly on US 17 to have access to the interchanges. These proposed service roads are two lane facilities that run parallel to US 17 and tie to the Y-line roads which will have interchanges with US 17. The recommended interchanges are as follows:

- Sloop Point Loop Road (SR 1563) – standard diamond interchange
- Sloop Point Road (SR 1561) – standard diamond interchange
- NC 210 – diverging diamond interchange
- Shepards Road (SR 1533) – partial clover interchange

Additionally, service roads would continue approximately 5,000 feet north of Shepards Road to the end of the control-of-access. At the end of the freeway section the road would transition to a six lane section with curb and gutter and a raised median with mountable curb. This typical section would continue through the superstreet configuration proposed at the NC 50 (Ocean Road) intersection.

6.1 DESIGN CRITERIA

Conceptual designs were prepared for each build alternative, showing right-of-way estimations for each alterative along with proposed laneage and capacity improvements at each study intersection. These designs are included in the appendix.

The criteria used in these conceptual designs are based on standards found in the *Geometric Design of Highways and Streets Manual* (AASHTO, 2004) as well as the *Roadway Design Manual* (NCDOT, 2002). The design criteria establish minimum values for various design parameters based on proposed characteristics of the facility, such as speed limit, median width, shoulder width, minimum and maximum grades and cross slope. Table 6-1 summarizes the design criteria used for each alternative. The conceptual designs can be found in the appendix.

6.2 TYPICAL SECTIONS

The typical sections along the study corridor vary somewhat along its length and between alternatives. There are four variations of typical sections present in the Build Alternatives as described below and shown in Figure 6-1.

Typical Section No.1

Typical Section No. 1 includes three 12-foot travel lanes in each direction and four-foot left-side and 12-foot right-side paved shoulders. The median in this typical section varies with the existing median widths, but is generally 46-foot. This typical section is present in all Build Alternatives along segments that currently have shoulder sections, rather than curb and gutter treatment.

Typical Section No.2

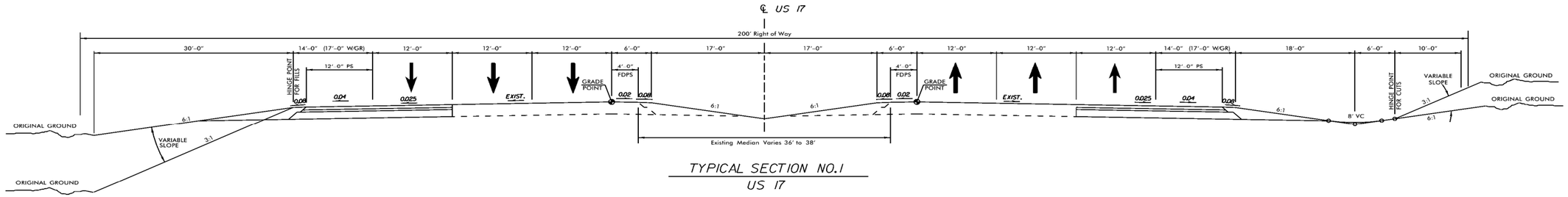
Typical Section No. 2 includes three 12-foot travel lanes in each direction and curb and gutter treatment. The median in this typical section is a 23-foot raised median. This typical section is present in all Build Alternatives along segments that currently have five lanes with curb and gutter treatment.

Table 6-1
Design Criteria

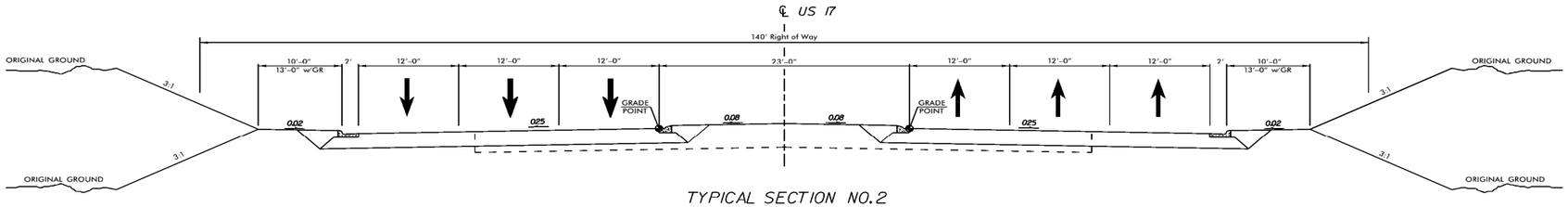
	Typical Section No. 1	Typical Section No. 2	Typical Section No. 3 & No. 4
ROUTE	**US 17**	**US 17**	**US 17**
LINE	**L**	**L**	**L**
Present In Alternatives:	**1/2/3**	**1/2/3**	**3**
Classification	Arterial	Arterial	Freeway
Terrain Type	Level	Level	Level
Design Speed (mph)	60 mph	60 mph	60 mph
Posted Speed (mph)	55 mph	55 mph	55 mph
Prop. ROW Width (ft)	200'	140'	200'
Control of Access	N	N	Y
Typical Section Type	shoulder	C&G	shoulder
Lane Width (ft)	12'	12'	12'
Sidewalks (Y/N)	N	N	N
Bicycle Lanes (Y/N)	N	N	N
Median Width (ft)	46'	23'	46'
Median Protection (GR or Barrier)	N	N	N
Shoulder Width (total)	12'	-	12'
Median (ft)	10'	-	10'
Outside w/out GR (ft)	10'	-	10'
Outside w/ GR (ft)	13'	-	13'
Paved Shoulder			
Outside Total/FDPS (ft)	10'	-	10'
Median Total/FDPS (ft)	4'	-	10'
Grade			
Maximum	5	5	5
Minimum	0.3	0.3	0.3
K Value			
Sag	136	136	136
Crest	151	151	151
Horiz. Align.			
Spiral (Y/N)	Y	Y	Y
Cross Slopes			
Pavement	0.02	0.02	0.02
Paved Shoulder	0.04	0.04	0.04
Turf Shoulder	0.08	0.08	0.08
Median Ditch	6:1	6:1	6:1
Clear Zone (ft)	30'	30'	30'

Typical Section No. 3 and No. 4

Typical Section No. 3 and No. 4 are freeway cross-sections. Typical Section No. 3 includes two 12-foot travel lanes in each direction, while Typical Section No. 4 includes three 12-foot travel lanes in each direction. Additionally, these typicals both provide four-foot left-side and 12-foot right-side paved shoulders. The median in this typical section is generally 46-foot. This typical section is present in Build Alternative 3 between the Hampstead Bypass and just before NC 50.



TYPICAL SECTION NO.1
US 17



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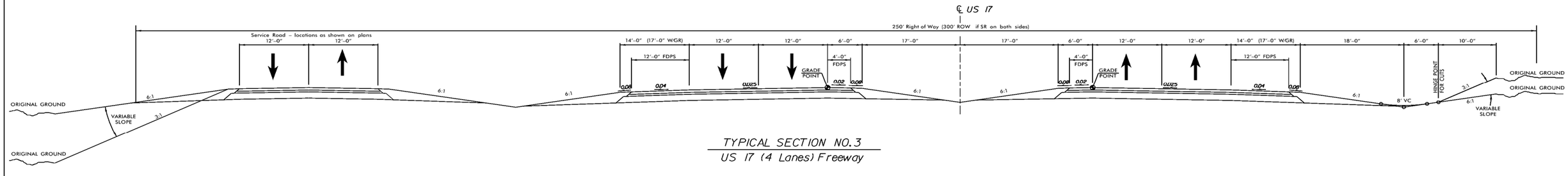
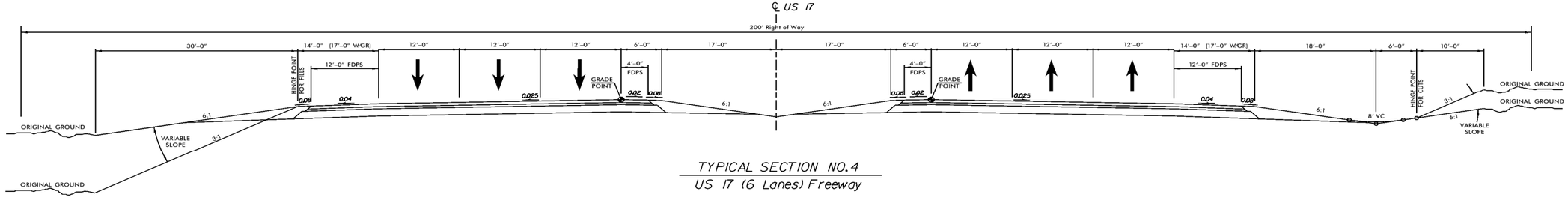
US 17



TYPICAL SECTION NO.3
US 17 (4 Lanes) Freeway



TYPICAL SECTION NO.4
US 17 (6 Lanes) Freeway

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Figure 6-1
Typical Sections

Bicycle and Pedestrian Considerations

The current typical sections do not provide provisions for pedestrians or bicycle users. A portion of US 17 is currently a designated bike route (NCDOT Bicycle Route 3, Ports of Call); however, there are no special provisions in place for this route. The existing paved shoulders are adequate for the bike usage through this corridor. In addition, there are no sidewalks along the majority of the US 17 corridor.

In the future, there are plans for a mixed use path to parallel part of US 17, which would provide a safe route for both pedestrians and cyclists to use. During later planning phases, specific amenities for cyclists and pedestrians should be considered, such as widening the outside lane width to 14 feet where there is curb and gutter to accommodate bikes. In the absence of curb and gutter, a wide paved shoulder would be adequate for bicycles.

6.3 BUILD ALTERNATIVE 1

6.3.1 Roadway Improvements

Build Alternative 1 evaluates improvements to the Design Year (2035) No-Build scenario, widening US 17 to add one additional through lane in each direction and upgrade to include a median where there is not one present. Additionally, the intersections in the study area were improved by adding turn lanes, traffic signals, or superstreet intersections where necessary to improve them to an acceptable LOS. Despite the added capacity from the additional through lanes and specific intersection improvements, not all intersections were able to obtain acceptable operations through feasible improvements, specifically through the southern portion of the study area. Without the Hampstead Bypass in place, the forecasted volumes would require more enhanced improvements, such as widening to provide eight or ten through lanes or upgrading the facility to a freeway in order to obtain acceptable operations along its length. Study of these types of designs were not part of the scope for this Build Alternative but may be more desirable than enhanced superstreet configurations (triple left-turn lanes) that were considered in this alternative. The base year and design year volumes used in the Build Alternative 1 are shown in Figure 6-2 and Figure 6-3, respectively. The primary improvements considered at the study intersections as part of this alternative beyond the additional through lanes, as described below, are shown in Figure 6-4.

US 17 and SR 1571 (Scotts Hill Loop Road)

- Construct an exclusive WB U-turn lane on US 17 in addition to the existing exclusive left-turn lane.
- Construct an additional NB right-turn lane on SR 1571 (Scotts Hill Loop Road)

US 17 and SR 1572 (Sidbury Road)

- Construct one exclusive EB U-turn and one exclusive left-turn lane on US 17 in addition to the existing exclusive left-turn lane to provide one left/U-turn lane and dual left-turn lanes.
- Construct an additional exclusive WB right-turn lane on US 17 to provide dual right-turn lanes.
- Construct two additional SB right-turn lanes on SR 1572 (Sidbury Road) to provide triple right-turn lanes.

US 17 and SR 1571 (Scotts Hill Loop Road)

- Construct a shared WB left/U-turn lane on US 17 in addition to the existing exclusive left-turn lane.
- Construct an additional NB right-turn lane on SR 1571 (Scotts Hill Loop Road)

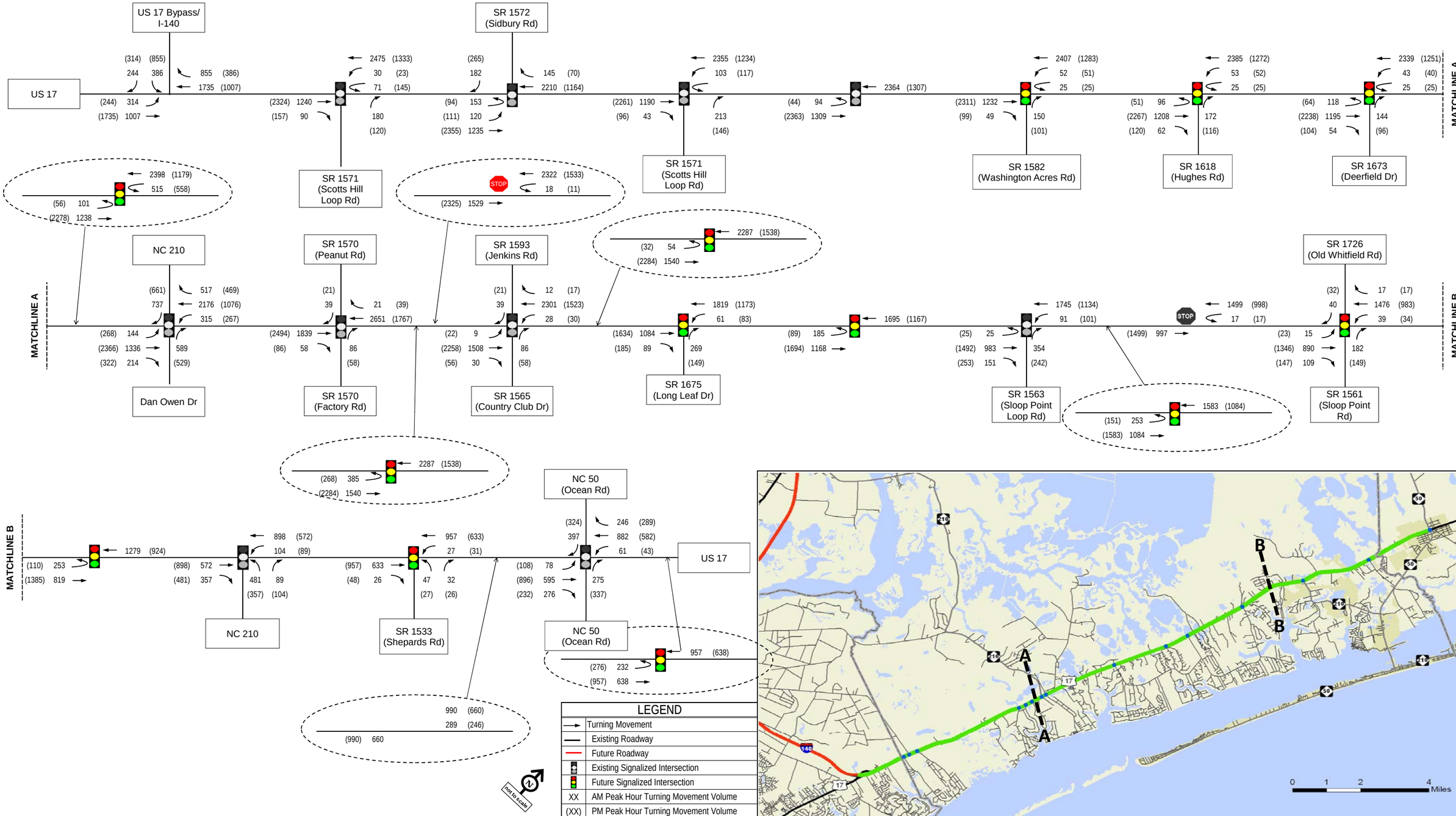

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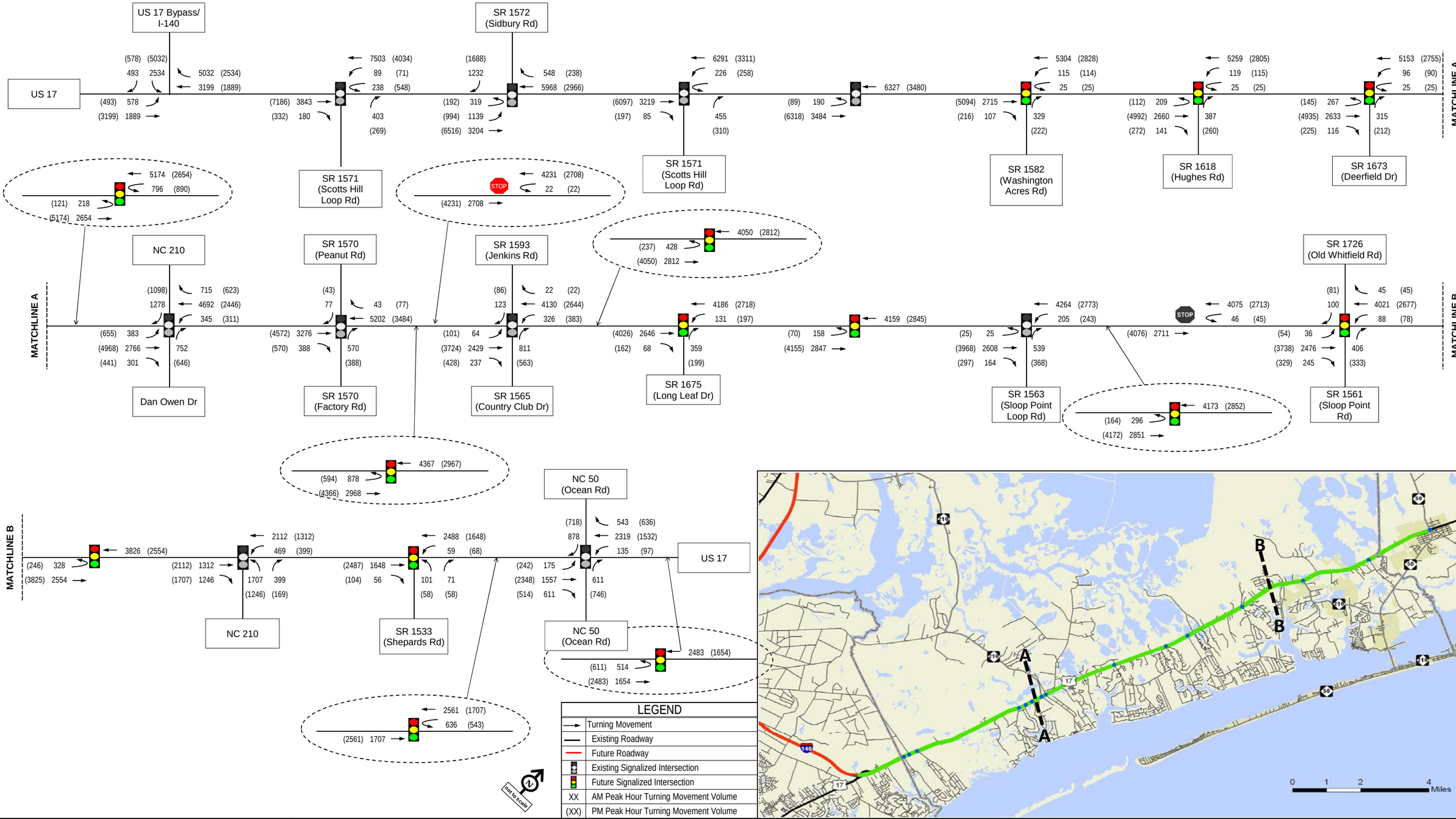
Figure 6-2
Base Year (2008) Build Alternative 1
- AM and PM Peak Hour Volumes



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US 17 Feasibility Study
from I-140/US 17 Bypass to NC 50
(FS-0803B)

Figure 6-3
Design Year (2035) Build Alternative 1 -
AM and PM Peak Hour Volumes

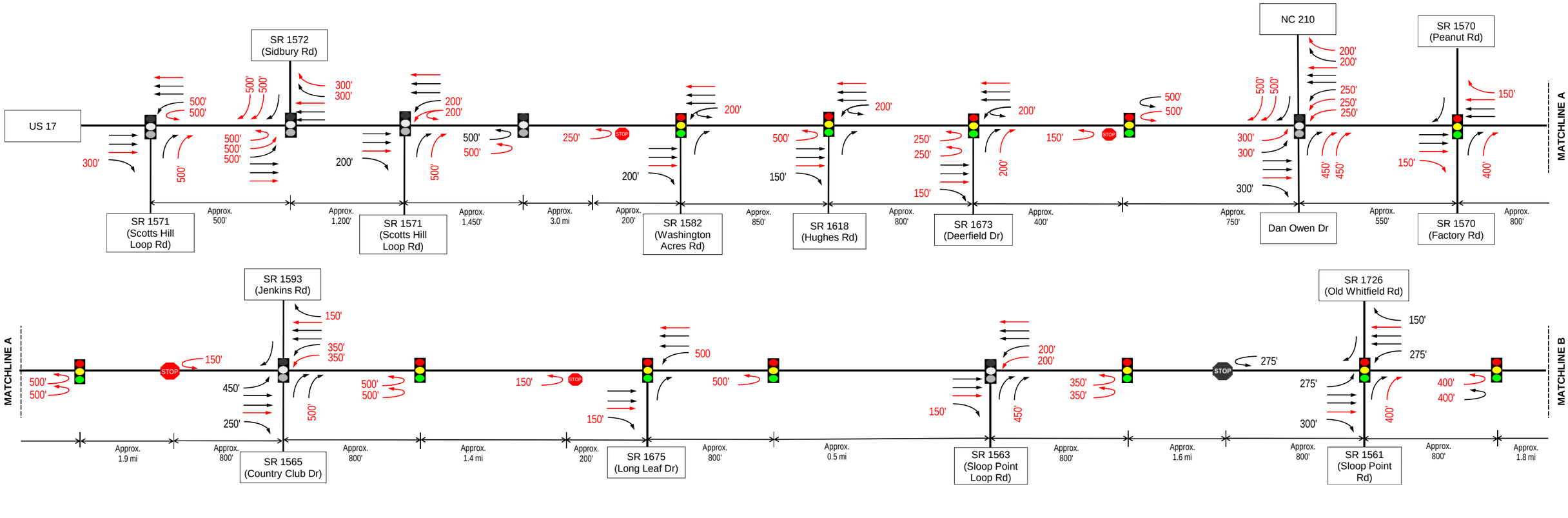

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Figure 6-4
Build Alternative 1 - Lane Configurations
and Traffic Control

- Extend the existing WB left-turn lane to provide appropriate storage

US 17 and U-turn east of SR 1571 (Scotts Hill Loop Road)

- Construct exclusive EB U-turn lane on US 17 to provide dual U-turn lanes

US 17 and SR 1582 (Washington Acres Road)

- Convert the existing unsignalized intersection to a signalized superstreet intersection
- Construct an exclusive EB U-turn lane on US 17 under stop control
- Extend the existing WB left-turn lane to provide appropriate storage

US 17 and SR 1618 (Hughes Road)

- Convert the existing unsignalized intersection to a signalized superstreet intersection.
- Construct an exclusive EB U-turn lane on US 17
- Extend the existing WB left-turn lane to provide appropriate storage

US 17 and SR 1673 (Deerfield Drive)

- Convert the existing unsignalized intersection to a signalized superstreet intersection.
- Construct two exclusive EB U-turn lanes on US 17 to provide dual U-turns
- Construct an additional NB right-turn lane on SR 1673 (Deerfield Drive) to provide dual right-turn lanes

Extend the existing WB left-turn and EB right-turn lanes to provide appropriate storage *US 17 and U-turn point between SR 1673 (Deerfield Drive) and NC 210/Dan Owen Drive*

- Construct a new median opening with stop control and an exclusive U-turn lane on EB US 17
- Implement a signalized U-turn movement with dual U-turn lane on WB US 17

US 17 and NC 210/Dan Owen Drive

- Convert the existing signalized intersection to a superstreet intersection
- Construct an additional exclusive EB left-turn lane on US 17 to provide dual left-turn lanes
- Construct two additional exclusive WB left-turn lanes on US 17 to provide triple turn lanes
- Construct an additional exclusive WB right-turn lane on US 17 to provide dual right-turn lanes
- Construct two additional exclusive NB right-turn lanes on Dan Owen Drive to provide triple right-turn lanes
- Construct two additional exclusive SB right-turn lanes on NC 210 to provide triple right-turn lanes
- Extend the existing turn lanes to provide appropriate storage

US 17 and SR 1570 (Peanut Road/Factory Road)

- Convert the intersection to a right-in/right-out intersection
- Signalize EB and NB approaches
- Construct an additional exclusive EB right-turn lane on US 17
- Construct an additional exclusive WB right-turn lane on US 17
- Construct an additional exclusive NB right-turn lane on SR 1570 (Factory Road) to provide dual right-turn lanes

US 17 and U-turn point east of SR 1570 (Peanut Road/Factory Road)

- Construct a new median opening with signal control and two exclusive EB U-turn lanes on US 17

US 17 and U-turn point west of SR 1593 (Jenkins Road)/SR 1565 (Country Club Drive)

- Construct a new median opening with stop control and an exclusive WB U-turn lane on US 17

US 17 and SR 1593 (Jenkins Road)/SR 1565 (Country Club Drive)

- Convert the existing signalized intersection to a superstreet intersection
- Construct an additional exclusive WB left-turn lane on US 17 to provide dual left-turn lanes
- Restripe the existing NB approach to provide dual right-turn lanes
- Extend the existing WB turn lanes to provide appropriate storage

US 17 and U-turn point east of SR 1593 (Jenkins Road)/SR 1565 (Country Club Drive)

- Construct a new median opening with signal control and two EB exclusive U-turn lanes on US 17

US 17 and SR 1675 (Long Leaf Drive)

- Convert the existing stop control intersection to superstreet intersection
- Restripe the existing NB approach to provide an exclusive right-turn lane
- Construct an exclusive EB U-turn lane operating under stop control
- Extend the existing EB right-turn lane to provide appropriate storage

US 17 and U-turn point east of SR 1675 (Long Leaf Drive)

- Construct a new median opening with signal control and an exclusive EB U-turn lane on US 17

US 17 and SR 1563 (Sloop Point Loop Road)

- Convert the existing signalized intersection into superstreet intersection
- Construct an additional exclusive WB left-turn lane on US 17 to provide dual left-turn lanes
- Restripe the existing NB approach to provide exclusive dual right-turn lanes
- Extend the existing turn lanes to provide appropriate storage

US 17 and U-turn point east of SR 1563 (Sloop Point Loop Road)

- Construct a new median opening with signal control and two exclusive EB U-turn lanes on US 17

US 17 and SR 1561 (Sloop Point Road)/ SR 1726 (Old Whitfield Road)

- Convert the planned superstreet intersection from stop control to signal control
- Construct an additional exclusive NB right-turn lane on SR 1561 (Sloop Point Road) to provide dual right-turn lanes

US 17 and U-turn point east of SR 1561 (Sloop Point Road)/ SR 1726 (Old Whitfield Road)

- Convert the planned stop controlled median opening to signal control
- Construct an additional EB U-turn lane on US 17 to provide dual U-turn lanes

US 17 and NC 210

- Construct an additional EB right-turn lane on US 17 to provide dual right-turn lanes
- Construct an additional WB left-turn lane on US 17 to provide dual left-turn lanes
- Construct two additional NB left-turn lanes on NC 210 to provide triple left-turn lanes

- Extend the existing turn lanes to provide appropriate storage

US 17 and SR 1533 (Shepards Road)

- Convert the existing stop controlled intersection into a signalized intersection
- Extend the existing turn lanes to provide appropriate storage

US 17 and U-turn point west of NC 50 (Ocean Road)

- Construct a new median opening with signal control and two exclusive WB U-turn lanes on US 17 to provide dual U-turn lanes

US 17 and NC 50 (Ocean Road)

- Convert the existing signalized intersection into a superstreet intersection
- Restripe the existing SB approach to provide dual exclusive right-turn lanes
- Restripe the existing NB approach to provide dual exclusive right-turn lanes
- Extend the existing turn lanes to provide appropriate storage

US 17 and U-turn point east of NC 50 (Ocean Road)

- Construct a new median opening with signal control and two exclusive EB U-turn lanes on US 17

6.3.2 Capacity Analysis

The capacity analysis results for this scenario include the aforementioned geometric improvements. In summary, the geometrics in this alternative include an additional through lane in both directions along the study corridor and the implementation of superstreet configurations along the majority of the corridor along with additional turn lanes where needed.

6.3.2.1 Base Year (2008)

If the Build Alternative 1 geometrics were in place with the base year (2008) travel demands, all intersections would operate at acceptable LOS.

6.3.2.2 Design Year (2035)

The results of this analysis indicate that the implementation of consecutive superstreet configurations and additional turn lanes as needed improve the overall operations of the corridor. In this scenario, the Hampstead Bypass is not included, thus the through volumes along US 17 are at their highest. It should be noted that the through volumes on US 17 are very directional in nature, thus the AM peak hour favors the northbound direction and the PM peak hour favors the southbound direction. Despite this trend, the intersections that are projected to operate at failing LOS under this scenario have significantly less delay and queuing than during the Design Year (2035) No-Build scenario.

Table 6-2 summarizes the level of service results for the Base Year (2008) and Design Year (2035) Build Alternative 1 scenarios.

6.3.3 Failure Year Analysis

For any signalized intersection projected to fail under the Build Alternative 1 scenario, a failure year analysis was completed to determine at what point the intersection would reach failure. The methodology for this analysis included analyzing the Base Year 2008 volumes with the Build Alternative 1 improvements in place. Then a straight line interpolation of delay between the 2008 and 2035 years indicated at which point the delay would reach a failing level. Table 6-3 indicates the signalized intersections that are projected to fail by 2035 despite the Build Alternative 1

improvements and during what year the failure is expected. It should be noted that the 2008 forecast volumes accounted for multiple large-scale developments that have been delayed due to the recent economy. Because of this, the projected growth at some locations is skewed for the short term, indicating higher than likely traffic demand. Table 6-3 provides a conservative estimate of when those intersections may see a failure in peak hour operations; however, in reality, those failures projected for the near-term (2011-2015) are unlikely to occur that soon.

Table 6-2
2008 and 2035 Build Alternative 1 - LOS Summary

ID	Intersection	Proposed Traffic Control	Build Alternative 1			
			Base Year (2008)		Design Year (2035)	
			AM	PM	AM	PM
1	US 17 & SR 1571 (Scotts Hill Loop Road)	Superstreet Signal	B (WB-C) 15.9 sec	B (WB-C) 15.8 sec	**F (NB-F) 112.5 sec**	**F (EB-F) 483.8 sec**
2	US 17 & SR 1572 (Sidbury Road)	Superstreet Signal	A (SB-C) 9.7 sec	A (SB-C) 8.6 sec	**F (WB-F) 381.1 sec**	**F (SB-F) 137.5sec**
3	US 17 & SR 1571 (Scotts Hill Loop Road)	Superstreet Signal	A (NB-D) 8.6 sec	A (NB-D) 6.7 sec	C (NB-F) 27.2 sec	**F (EB-F) 309.7 sec**
	US 17 Eastbound U-Turn Point	Superstreet Signal	A (EB-D) 7.3 sec	A (EB-C) 4.1 sec	**F (WB-F) 327.5 sec**	B (EB-F) 14.6 sec
4	US 17 & SR 1582 (Washington Acres Road)	Superstreet Signal	A (NB-C) 9.3 sec	A (NB-D) 9.8 sec	C (NB-E) 31.1 sec	**F (EB-F) 259.3 sec**
	US 17 Eastbound U-Turn Point	Superstreet Signal	A (EB-D) 3.4 sec	A (EB-C) 2.4 sec	**F (WB-F) 239.5 sec**	A (EB-D) 5.7 sec
5	US 17 & SR 1618 (Hughes Road)	Superstreet Signal	A (NB-C) 6.2 sec	A (NB-D) 5.3 sec	C (NB-F) 21.7 sec	C (NB-F) 25.1 sec
	US 17 Eastbound U-Turn Point	Superstreet Signal	A (EB-D) 5.8 sec	A (EB-C) 3.0 sec	**F (WB-F) 218.4 sec**	A (EB-D) 8.3 sec
6	US 17 & SR 1673 (Deerfield Drive)	Superstreet Signal	A (NB-C) 5.1 sec	A (NB-D) 4.4 sec	A (NB-D) 9.7 sec	**F (NB-F) 312.1 sec**
	US 17 Eastbound U-Turn Point	Stop Controlled	(EB-B)	(EB-B)	**(EB-E)**	(EB-C)
7	EB US 17 & WB U-Turns	Superstreet Signal	A (WB-C) 10.0 sec	B (WB-D) 15.7 sec	D (WB-E) 39.8 sec	**F (EB-F) 342.4 sec**
	EB US 17 & Dan Owen Drive	Superstreet Signal	B (NB-C) 11.7 sec	B (NB-D) 14.0 sec	D (NB-E) 37.4 sec	**F (EB-F) 265.1 sec**
	WB US 17 & NC 210	Superstreet Signal	B (SB-D) 17.3 sec	B (SB-B) 11.1 sec	**F (WB-F) 253.3 sec**	D (SB-E) 36.1 sec
8	EB US 17 & SR 1570 (Factory Road)	Superstreet Signal	A (NB-C) 4.6 sec	A (NB-D) 3.3 sec	**E (NB-F) 76.0 sec**	**F (EB-F) 222.0 sec**
	WB US 17 & SR 1570 (Peanut Road)	Stop Controlled	(SB-B)	(SB-A)	(SB-C)	(SB-C)
	WB US 17 and EB U-Turns	Superstreet Signal	B (EB-D) 15.0 sec	B (EB-C) 10.1 sec	**F (EB-F) 212.3 sec**	C (EB-D) 29.7 sec
9	EB US 17 & WB U-Turns	Stop Controlled	(WB-B)	(WB-C)	(WB-C)	**(WB-F)**
	EB US 17 & SR 1565 (Country Club Drive)	Superstreet Signal	A (NB-B) 6.6 sec	A (NB-B) 7.3 sec	D (NB-E) 39.5 sec	**F (NB-F) 94.0 sec**
	WB US 17 & SR 1593 (Jenkins Road)	Superstreet Signal	A (SB-D) 2.6 sec	A (SB-D) 2.1 sec	**F (SB-F) 91.4 sec**	A (EB-E) 6.7 sec
	WB US 17 & EB U-Turns	Superstreet Signal	A (EB-D) 5.2 sec	A (EB-D) 3.2 sec	**F (EB-F) 93.7 sec**	B (EB-D) 14.5 sec
10	US 17 & SR 1675 (Long Leaf Drive)	Superstreet Signal	B (NB-B) 12.6 sec	A (NB-C) 9.7 sec	C (NB-E) 31.7 sec	**F (SB-F) 88.8 sec**
	EB US 17 & WB U-Turns	Superstreet Signal	B (EB-C) 12.4 sec	B (EB-B) 11.6 sec	**F (EB-F) 80.4 sec**	B (EB-D) 16.1 sec

LEGEND: X (XX-X) – Overall LOS (Lowest Operating Approach and LOS), signalized intersection
XX.X sec – overall delay in seconds, signalized intersection
(XX-X) –Lowest Operating Approach and LOS, unsignalized intersection
Bold indicates LOS E/F conditions

Table 6-2 - cont
2008 and 2035 Build Alternative 1 - LOS Summary

ID	Intersection	Proposed Traffic Control	Build Alternative 1			
			Base Year (2008)		Design Year (2035)	
			AM	PM	AM	PM
11	US 17 & SR 1563 (Sloop Point Loop Road)	Superstreet Signal	B (NB-B) 10.9 sec	B (NB-C) 10.1 sec	C (NB-D) 25.7 sec	**F (NB-F) 83.8sec**
	US 17 & EB U-Turns	Superstreet Signal	B (EB-B) 10.1 sec	A (EB-B) 7.1 sec	**F (EB-F) 88.2 sec**	B (EB-D) 14.1 sec
12	US 17 & WB U-Turns	Stop Controlled	(WB-B)	(WB-B)	(WB-C)	**(WB-F)**
	US 17 WB & SR 1726 (Old Whitfield Road)	Superstreet Signal	A (SB-B) 3.8 sec	A (SB-B) 3.7 sec	**E (SB-F) 63.7 sec**	B (SB-E) 10.6 sec
	US 17 EB & SR 1561 (Sloop Point Road)	Superstreet Signal	A (NB-B) 7.8 sec	A (NB-B) 7.5 sec	B (NB-D) 18.1 sec	**E (NB-F) 56.3 sec**
	US 17 & EB U-Turns	Superstreet Signal	A (EB-B) 9.4 sec	A (EB-B) 6.3 sec	D (EB-F) 51.8 sec	B (EB-D) 13.2 sec
13	US 17 & NC 210	Conventional Signal	B (NB-C) 13.6 sec	B (NB-C) 13.0 sec	D (NB-D) 40.7 sec	D (NB-E) 45.2 sec
14	US 17 & SR 1533 (Shepards Road)	Conventional Signal	A (NB-D) 4.1 sec	A (NB-D) 3.3 sec	A (NB-D) 9.4 sec	B (NB-E) 12.8 sec
15	US 17 & WB U-Turns	Superstreet Signal	A (WB-B) 8.9 sec	B (WB-D) 11.3 sec	B (WB-C) 15.9 sec	B (WB-D) 19.4 sec
	US 17 WB & NC 50/Ocean Road	Superstreet Signal	B (SB-C) 10.3 sec	B (SB-D) 19.6 sec	C (SB-E) 34.1 sec	C (SB-D) 21.8 sec
	US 17 EB & NC 50/Ocean Road	Superstreet Signal	A (NB-C) 9.1 sec	B (NB-D) 13.1 sec	B (NB-C) 14.9 sec	C (NB-D) 24.9 sec
	US 17 & EB U-Turns	Superstreet Signal	A (EB-C) 8.7 sec	B (EB-D) 15.8 sec	C (EB-D) 20.2 sec	C (EB-D) 20.4 sec

LEGEND: X (XX-X) – Overall LOS (Lowest Operating Approach and LOS), signalized intersection
XX.X sec – overall delay in seconds, signalized intersection
(XX-X) –Lowest Operating Approach and LOS, unsignalized intersection
Bold indicates LOS E/F conditions

Table 6-3
Build Alternative 1 - Intersection Failure Year Analysis

ID	Intersection	Failure Year
1	US 17 & SR 1571 (Scotts Hill Loop Road)	2012
2	US 17 & SR 1572 (Sidbury Road)	2013
3	US 17 & SR 1571 (Scotts Hill Loop Road)	2014
	US 17 Eastbound U-Turn Point	2014
4	US 17 & SR 1582 (Washington Acres Road)	2016
	US 17 Eastbound U-Turn Point	2016
5	US 17 Eastbound U-Turn Point (Hughes Road)	2017
6	US 17 & SR 1673 (Deerfield Drive)	2015
7	EB US 17 & Dan Owen Drive	2013
	WB US 17 & NC 210	2014
8	EB US 17 & SR 1570 (Factory Road)	2017
	WB US 17 & SR 1570 (Peanut Road)	2014
	WB US 17 and EB U-Turns	2015
9	EB US 17 & SR 1565 (Country Club Drive)	2020
	WB US 17 & SR 1593 (Jenkins Road)	2031
	WB US 17 & EB U-Turns	2031
10	US 17 & SR 1675 (Long Leaf Drive)	2032
	EB US 17 & WB U-Turns	2035
11	US 17 & SR 1563 (Sloop Point Loop Road)	2034
	US 17 & EB U-Turns	2032

6.4 BUILD ALTERNATIVE 2

6.4.1 Roadway Improvements

Similar to Build Alternative 1, Build Alternative 2 evaluates the option of adding a through lane on US 17 in each direction. However, the Hampstead Bypass is assumed to be in place hence reducing the total through traffic along US 17 between I-140/US 17 Bypass and SR 1561 (Sloop Point Road)/SR 1726 (Old Whitfield Road). The base year and design year volumes used in this analysis are shown in Figure 6-5 and Figure 6-6, respectively. The recommended improvements, described below, are shown in Figure 6-7:

US 17 and SR 1571 (Scotts Hill Loop Road)

- Construct an exclusive WB U-turn lane on US 17 in addition to the existing exclusive left-turn lane
- Construct an additional NB right-turn lane on SR 1571 (Scotts Hill Loop Road)
- Extended the existing turn lanes to provide adequate storage

US 17 and SR 1572 (Sidbury Road)

- Construct exclusive EB U-turn lane and a left-turn lane on US 17 in addition to the existing exclusive left-turn lane to provide one exclusive U-turn and dual left-turn lanes.

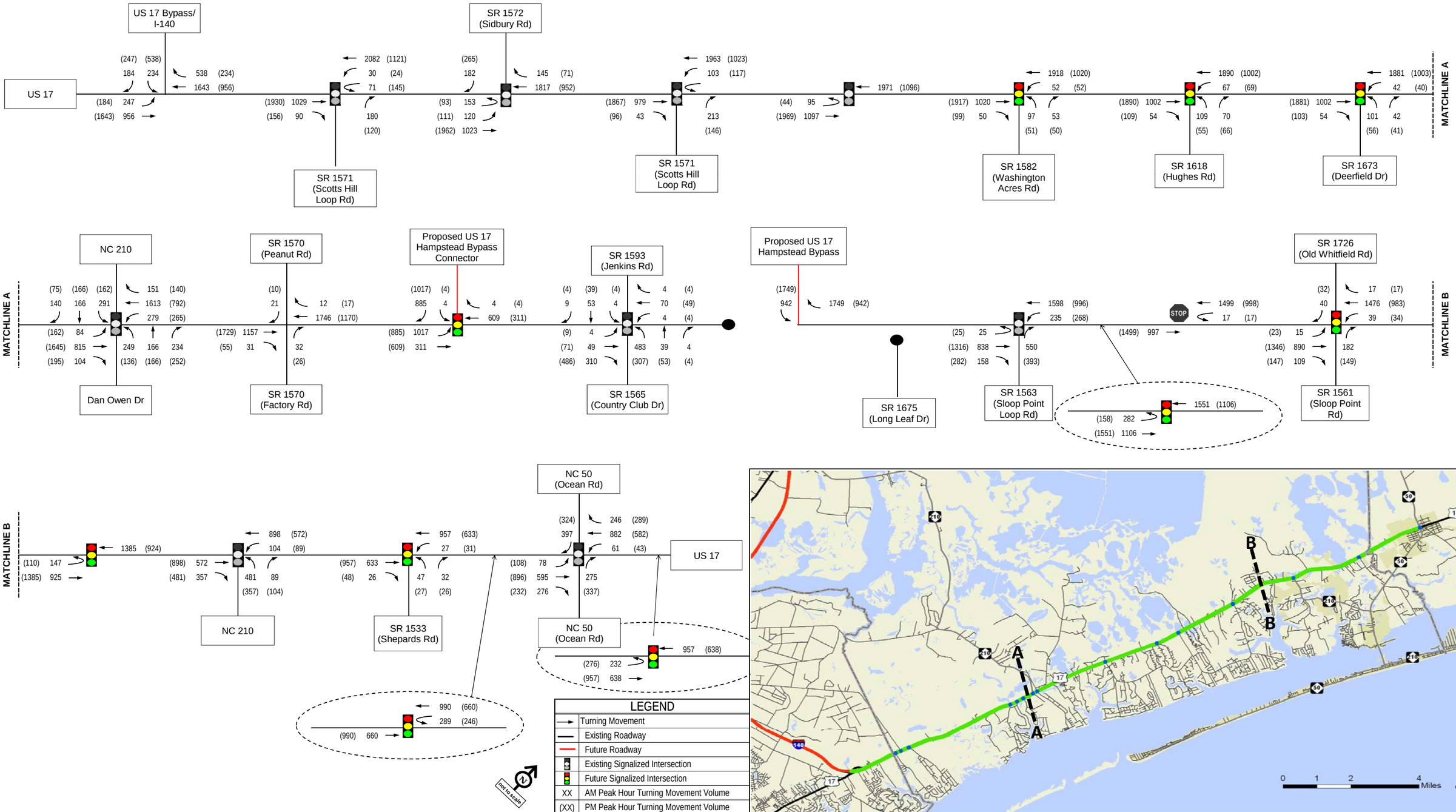

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Figure 6-5
Base Year (2008) Build Alternative 2 -
AM and PM Peak Hour Volumes

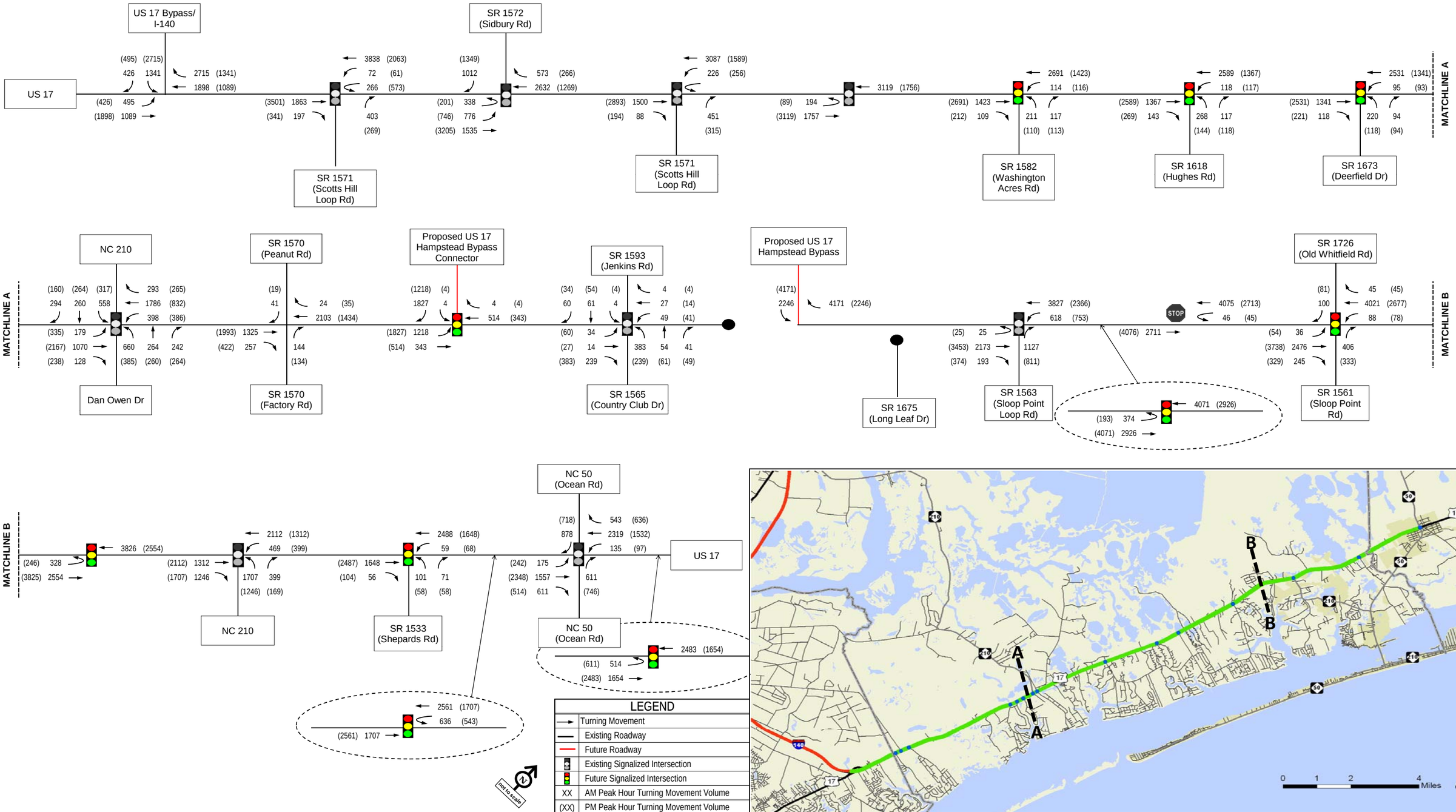

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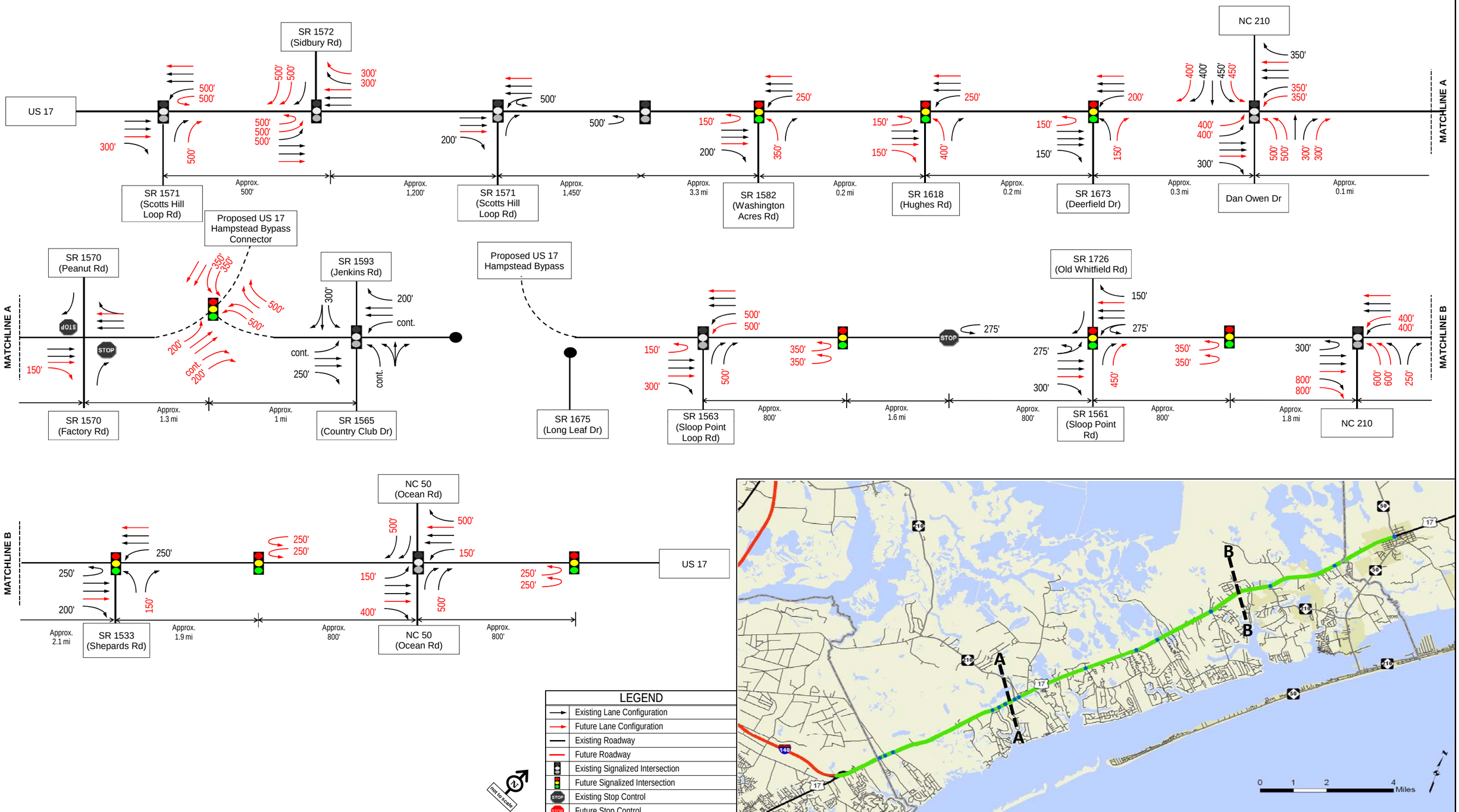
Figure 6-6
Design Year (2035) Build Alternative 2 -
AM and PM Peak Hour Volumes



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US 17 Feasibility Study
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Figure 6-7
Build Alternative 2 - Lane Configurations
and Traffic Control

- Construct an additional exclusive WB right-turn lane on US 17 to provide dual right-turn lanes.
- Construct two additional SB right-turn lanes on SR 1572 (Sidbury Road) to provide triple right-turn lanes.
- Extend the existing turn lanes to provide adequate storage

US 17 and SR 1582 (Washington Acres Road)

- Convert the existing stop control intersection into a signalized intersection
- Construct an exclusive EB U-turn lane on US 17
- Construct an exclusive NB left-turn lane on SR 1582 (Washington Acres Road)
- Extend the existing WB left-turn lane to provide adequate storage

US 17 and SR 1618 (Hughes Road)

- Convert the existing stop control intersection into a signalized intersection
- Construct an exclusive EB U-turn lane on US 17
- Construct an exclusive NB left-turn lane on SR 1618 (Hughes Road)
- Construct an exclusive EB right-turn lane
- Extend the existing WB left-turn lane to provide adequate storage

US 17 and SR 1673 (Deerfield Drive)

- Convert the existing stop control intersection into a signalized intersection
- Construct an exclusive EB U-turn lane on US 17
- Construct an exclusive NB right-turn lane on SR 1673 (Deerfield Drive)
- Extend the existing WB left-turn lane to provide adequate storage

US 17 and NC 210/Dan Owen Drive

- Construct an additional exclusive EB left-turn lane on US 17 to provide dual left-turn lanes
- Construct an additional exclusive WB left-turn lanes on US 17 to provide dual turn lanes
- Construct exclusive NB left-turn lanes on Dan Owen Drive to provide dual left-turn lanes
- Construct an additional exclusive NB right-turn lane on Dan Owen Drive to provide dual right-turn lanes
- Construct additional exclusive SB left-turn lanes on NC 210 to provide dual left-turn lanes
- Construct an additional exclusive SB right-turn lane on NC 210 to provide dual right-turn lanes

US 17 and SR 1570 (Peanut Road/Factory Road)

- Convert the intersection to a right-in/right-out intersection
- Signalize EB and NB approaches
- Construct an exclusive EB right-turn lane on US 17

US 17 and Proposed US 17 Hampstead Bypass Connector

- Construct a new intersection with signal control
- Construct an exclusive NB left-turn lane on US 17
- Construct two exclusive NB right-turn lanes on US 17
- Construct two exclusive SB left-turn lanes on Proposed US 17 Hampstead Bypass connector to provide dual left-turn lanes
- Construct two exclusive WB left-turn lanes on US 17 to provide dual left-turn lanes
- Construct two exclusive WB right-turn lanes on US 17 to provide dual right-turn lanes

US 17 and SR 1593 (Jenkins Road)/SR 1565 (Country Club Drive)

- No improvements are recommended at this intersection

US 17 and SR 1675 (Long Leaf Drive)

- Cul-de-sac this intersection, shifting access to SR 1563 (Sloop Point Loop Road)

US 17 and SR 1563 (Sloop Point Loop Road)

- Convert the existing signalized intersection into a superstreet intersection.
- Construct an additional exclusive WB left-turn lane on US 17 to provide dual left-turn lanes
- Restripe the existing NB approach to provide exclusive dual right-turn lanes
- Construct an exclusive EB U-turn lane on US 17
- Extend EB right-turn lane to provide adequate storage

US 17 and U-turn point east of SR 1563 (Sloop Point Loop Road)

- Construct a new median opening with signal control and two exclusive EB U-turn lanes on US 17

US 17 and U-turn point west of SR 1561 (Sloop Point Road)/ SR 1726 (Old Whitfield Road)

- No improvements are recommended at this median opening

US 17 and SR 1561 (Sloop Point Road)/ SR 1726 (Old Whitfield Road)

- This intersection is currently being converted to a superstreet intersection
- Construct an additional exclusive NB right-turn lane on SR 1561 (Sloop Point Road) to provide dual right-turn lanes

US 17 and U-turn point east of SR 1561 (Sloop Point Loop Road)/ SR 1726 (Old Whitfield Road)

- Convert the existing stop controlled median opening to signal control
- Construct an additional EB U-turn lane on US 17 to provide dual U-turn lanes

US 17 and NC 210

- Construct an additional EB right-turn lane on US 17 to provide dual right-turn lanes
- Construct an exclusive EB U-turn lane on US 17
- Construct an additional WB left-turn lane in US 17 to provide dual left-turn lanes
- Construct two additional NB left-turn lanes on NC 210 to provide triple left-turn lanes
- Extend existing turn lanes to provide adequate storage

US 17 and SR 1533 (Shepards Road)

- Convert the existing stop controlled intersection into a signalized intersection
- Extend existing NB right-turn lane to provide adequate storage

US 17 and U-turn point west of NC 50 (Ocean Road)

- Construct a new median opening with signal control and two exclusive WB U-turn lanes on US 17 to provide dual U-turn lanes

US 17 and NC 50 (Ocean Road)

- Convert the existing signalized intersection into a superstreet intersection
- Restripe the existing SB approach to provide dual exclusive right-turn lanes
- Restripe the existing NB approach to provide dual exclusive right-turn lanes
- Extend existing turn lanes to provide adequate storage

US 17 and U-turn point east of NC 50 (Ocean Road)

- Construct a new median opening with signal control and two exclusive EB U-turn lanes on US 17

6.4.2 Capacity Analysis

The capacity analysis results for this scenario include the aforementioned geometric improvements. In summary, the geometrics in this alternative include an additional through lane in both directions along the study corridor and the implementation of superstreet configurations along the portion of the corridor northeast of where the Hampstead Bypass ties back into US 17. Southwest of this point, improvements primarily included additional turn lanes at conventional intersections where needed.

6.4.2.1 Base Year (2008)

If the Build Alternative 2 geometrics were in place with the base year (2008) travel demands, all intersections would operate at acceptable LOS.

6.4.2.2 Design Year (2035)

The results of this analysis indicate that the completion of the Hampstead Bypass relives congestion along the southern portion of the study area significantly. Under the Build Alternative 2 conditions, the study area intersections between I-140/US 17 Bypass and the Hampstead Bypass Connector are generally recommended to operate as conventional traffic signals, with additional capacity for the cross streets accommodated through the addition of exclusive turn lanes. North of where the Hampstead Bypass ties back into existing US 17, the recommended geometry is similar to that of Build Alternative 1, implementing superstreet configurations as well as additional turn lanes on the cross streets.

Table 6-4 summarizes the level of service results for the Base Year (2008) and Design Year (2035) Build Alternative 2 scenarios.

6.4.3 Failure Year Analysis

For any signalized intersection projected to fail under the Build Alternative 2 scenario, a failure year analysis was completed to determine at what point the intersection would reach failure. The same methodology utilized in the Build Alternative 1 analysis was used in this analysis. Table 6-5 indicates the signalized intersections that are projected to fail by 2035 despite the Build Alternative 2 improvements and during what year the failure is expected.

Table 6-4
2008 and 2035 Build Alternative 2 - LOS Summary

ID	Intersection	Proposed Traffic Control	Build Alternative 2			
			Base Year (2008)		Design Year (2035)	
			AM	PM	AM	PM
1	US 17 & SR 1571 (Scotts Hill Loop Road)	Superstreet Signal	B (NB-D) 17.4 sec	C (WB-D) 29.8 sec	D (SB-D) 35.1 sec	**F (EB-F) 216.2 sec**
2	US 17 & SR 1572 (Sidbury Road)	Superstreet Signal	C (SB-D) 25.9 sec	B (SB-C) 19.8 sec	**E (NB-F) 70.2 sec**	C WB-C) 23.3 sec
3	US 17 & SR 1571 (Scotts Hill Loop Road)	Superstreet Signal	B (NB-D) 13.0 sec	A (NB-D) 7.6 sec	B (NB-D) 17.5 sec	C (NB-F) 22.9 sec
	US 17 Eastbound U-Turn Point	Superstreet Signal	A (EB-C) 8.7 sec	A (EB-B) 7.2 sec	C (EB-F) 23.1 sec	A (EB-C) 8.5 sec
4	US 17 & SR 1582 (Washington Acres Road)	Conventional Signal	B (NB-E) 11.0 sec	A (NB-E) 9.8 sec	B (NB-D) 17.7 sec	B (NB-E) 19.1 sec
5	US 17 & SR 1618 (Hughes Road)	Conventional Signal	B (NB-E) 10.1 sec	A (NB-D) 6.4 sec	B (NB-D) 13.4 sec	A (NB-E) 9.8 sec
6	US 17 & SR 1673 (Deerfield Drive)	Conventional Signal	A (NB-E) 8.2 sec	A (NB-D) 4.6 sec	B (NB-D) 10.3 sec	A (NB-E) 8.3 sec
7	US 17 & NC 210/Dan Owen Drive	Conventional Signal	D (SB-E) 40.6 sec	D (SB-E) 36.0 sec	**E (NB-F) 66.2 sec**	**E (SB-F) 62.6 sec**
8	US 17 & SR 1570 (Factory Road/Peanut Road)	Stop Controlled	(SB-B)	(SB-B)	(SB-C)	(SB-B)
	US 17 & Proposed Hampstead Bypass Connector	Conventional Signal	B (WB-C) 12.7 sec	A (WB-C) 8.5 sec	B (WB-C) 15.8 sec	B (WB-D) 10.3 sec
9	US 17 & SR 1593 (Jenkins Road)/ SR 1565 (Country Club Drive)	Conventional Signal	C (SB-D) 24.4 sec	B (SB-D) 16.1 sec	C (SB-D) 30.0 sec	C (SB-E) 34.9 sec
11	US 17 & SR 1563 (Sloop Point Loop Road)	Superstreet Signal	C (NB-D) 24.6 sec	B (NB-D) 19.9 sec	**E (NB-E) 57.1 sec**	**F (NB-F) 110.8 sec**
	US 17 & EB U-Turns	Superstreet Signal	B (EB-E) 15.2 sec	B (EB-E) 11.4 sec	**F (EB-F) 93.6 sec**	B (EB-E) 13.4 sec
12	US 17 & WB U-Turns	Stop Controlled	(WB-B)	(WB-B)	(WB-C)	**(WB-F)**
	US 17 WB & SR 1726 (Old Whitfield Road)	Superstreet Signal	A (SB-F) 5.1 sec	A (SB-F) 5.7 sec	**E (SB-F) 61.1 sec**	A (SB-E) 6.6 sec
	US 17 EB & SR 1561 (Sloop Point Road)	Superstreet Signal	B (NB-D) 10.2 sec	A (NB-D) 8.3 sec	B (NB-D) 18.0 sec	D (NB-F) 52.3 sec
	US 17 & EB U-Turns	Superstreet Signal	B (EB-F) 10.6 sec	B (EB-F) 11.5 sec	D (EB-F) 51.0 sec	B (EB-E) 13.3 sec
13	US 17 & NC 210	Conventional Signal	B (NB-D) 16.4 sec	B (NB-D) 14.2 sec	D (NB-D) 38.1 sec	D (NB-E) 45.2 sec
14	US 17 & SR 1533 (Shepards Road)	Conventional Signal	A (NB-D) 6.0 sec	A (NB-D) 5.9 sec	A (NB-D) 9.4 sec	B (NB-E) 13.7 sec
15	US 17 & WB U-Turns	Superstreet Signal	B (WB-C) 10.7 sec	A (WB-C) 9.2 sec	B (WB-C) 15.9 sec	C (WB-D) 21.4 sec
	US 17 WB & NC 50/Ocean Road	Superstreet Signal	B (SB-D) 17.1 sec	B (SB-D) 19.3 sec	C (SB-E) 34.1 sec	B (SB-D) 19.4 sec
	US 17 EB & NC 50/Ocean Road	Superstreet Signal	B (NB-D) 15.5 sec	B (NB-D) 15.3 sec	B (NB-C) 14.9 sec	C (NB-D) 24.4 sec
	US 17 & EB U-Turns	Superstreet Signal	B (EB-D) 14.2 sec	B (EB-D) 17.1 sec	C (EB-D) 20.2 sec	B (EB-C) 15.1 sec

LEGEND: X (XX-X) – Overall LOS (Lowest Operating Approach and LOS), signalized intersection
XX.X sec – overall delay in seconds, signalized intersection
(XX-X) –Lowest Operating Approach and LOS, unsignalized intersection
Bold indicates LOS E/F conditions

Table 6-5
Build Alternative 2 - Intersection Failure Year Analysis

ID	Intersection	Failure Year
1	US 17 & SR 1571 (Scotts Hill Loop Road)	2020
2	US 17 & SR 1572 (Sidbury Road)	2022
11	US 17 & SR 1563 (Sloop Point Loop Road)	2026
	US 17 & EB U-Turns	2030

6.5 BUILD ALTERNATIVE 3

6.5.1 Roadway Improvements

This alternative utilizes the same volumes used in the Build Alternative 2 analysis. Alternative 3 also includes the same improvements as Alternative 2 through the connection of the Hampstead Bypass to the existing US 17. Northeast of the Hampstead Bypass, however, US 17 is evaluated as a freeway facility. The Hampstead Bypass is planned to be a four-lane freeway at its end where it ties back into US 17. Thus, the study corridor is also evaluated as a four-lane freeway from that point to the SR 1563 (Sloop Point Loop Road) interchange (approximately one mile). From this interchange to NC 210 (approximately 4 miles), the freeway widens to a six-lane typical section. From NC 210, the cross section is proposed to drop again to a four-lane freeway through the remainder of the freeway facility (approximately 3 miles). The transitions between the four-lane and six-lane segments would occur at interchanges where entrance and exit ramps can be used to add and drop through lanes.

In addition to the freeway facility laneage, analysis was done to determine the geometrics required at the interchange ramps to provide acceptable operations at the freeway access points. The following descriptions are of the recommended interchange configurations associated with Alternative 3.

SR 1563 (Sloop Point Loop Road)

The first interchange location occurs at Sloop Point Loop Road, approximately 1 mile north of the point where the Hampstead Bypass rejoins US 17. This intersection is recommended to be upgraded to a standard diamond interchange. The ramp interchanges are recommended to be traffic signals with two approach lanes on the exit ramps. Exclusive turn lanes onto the US 17 ramps are also recommended along Sloop Point Loop Road to assist the turning movement volumes.

SR 1563 (Sloop Point Road)/SR 1726 (Old Whitfield Road)

The next interchange location occurs at Sloop Point Road, approximately 1.9 miles north of the Sloop Point Loop Road interchange. This location is also recommended to be a standard diamond interchange. The ramp interchanges are recommended to be stop controlled intersections with a shared through/right-turn lane and an exclusive left-turn lane on both of the exit ramps. Exclusive left-turn and right-turn lanes onto the US 17 ramps are recommended along Sloop Point Road/Old Whitfield Road to assist the turning movement volumes.

NC 210

The next interchange location occurs at NC 210, approximately 2.0 miles north of the Sloop Pont Road/Old Whitfield Road interchange. This location is recommended to operate under a diverging diamond interchange configuration. The turning movement volumes between NC 210 and northbound US 17 are very high during both peak hours; thus, a conventional interchange design

would not result in adequate operations at the ramp intersections. This unconventional interchange design would require the traffic along NC 210 to cross to the opposite side of the roadway than it would typically travel, prior to crossing the interchange bridge. The high left-turning volume from NC 210 can then turn onto the US 17 ramp without conflict, as if it were a right-turn movement. This type of interchange is very efficient as it allows for a two-phase signal at all involved intersections which provides optimal traffic operations.

SR 1533 (Shepards Road)

The next interchange location occurs at Shepards Road, approximately 2.0 miles north of the NC 210 interchange. This location is recommended to operate as a partial clover interchange with loops in the northeast and southwest quadrants. The ramp intersections are recommended to operate under stop control with single approach lanes on each ramp. Due to relatively low volume projections at this interchange, no exclusive turn lanes are needed. The proposed interchange at this location involves land that is currently part of an existing small private airport with a single runway.

Frontage Roads

Frontage roads would be constructed along most of the length of the freeway section, providing access existing properties and developments along US 17. These frontage roads are located approximately 54 feet from the edge of the freeway and tie into each of the interchange locations.

6.5.2 Capacity Analysis

The capacity analysis for this scenario mirrors that of Build Alternative 2 from I-140/US 17 Bypass to the location where the Hampstead Bypass ties back into US 17 with intersection LOS determined using *Synchro* software. Northeast of this point, the facility is upgraded to a freeway; thus, capacity analysis was completed using *Highway Capacity Software Plus* (*HCS+*) for freeway segments. Approximately one mile southwest of the NC 50/Ocean Boulevard intersection, the freeway facility transitions back into the six-lane divided facility, shown in Build Alternative 2, to tie back into the existing roadway. This cross section continues through the NC 50/Ocean Boulevard intersection; thus the lane geometrics, traffic volumes, and LOS results for the US 17 and NC 50/Ocean Boulevard intersection are the same for Build Alternative 3 as they are for Build Alternative 2. *Synchro* intersection capacity analysis was also completed for the interchange ramp intersections through the freeway facility.

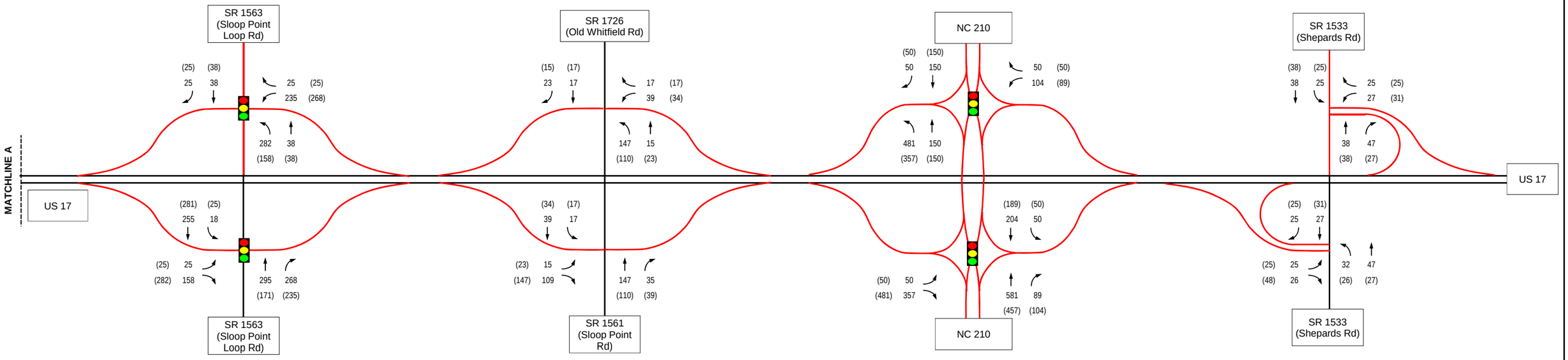
The volumes and lane geometry associated with Build Alternative 3 are identical to those used in Build Alternative 2, south of where the proposed Hampstead Bypass ties back into US 17, near SR 1565 (Country Club Drive). The base year and design volumes and interchange geometry north of this point are shown in Figure 6-8 and Figure 6-9, respectively. The interchange geometry used in the analysis is shown in Figure 6-10.

6.5.2.1 Base Year (2008)

If the Build Alternative 3 geometrics were in place with the base year (2008) travel demands, all intersections would operate at acceptable LOS and all freeway segments would operate acceptably.

6.5.2.2 Design Year (2035)

Based on the capacity analysis for the freeway facility, nearly all freeway segments are projected to operate acceptably under the recommended configurations. An exception to this is the two lane section at Sloop Point Loop Road (a basic section, merge section and diverge section) in the northeast-bound direction. These segments are projected to operate at LOS E/F during the PM peak hour because there are only two through lanes in either direction through this segment. At SR



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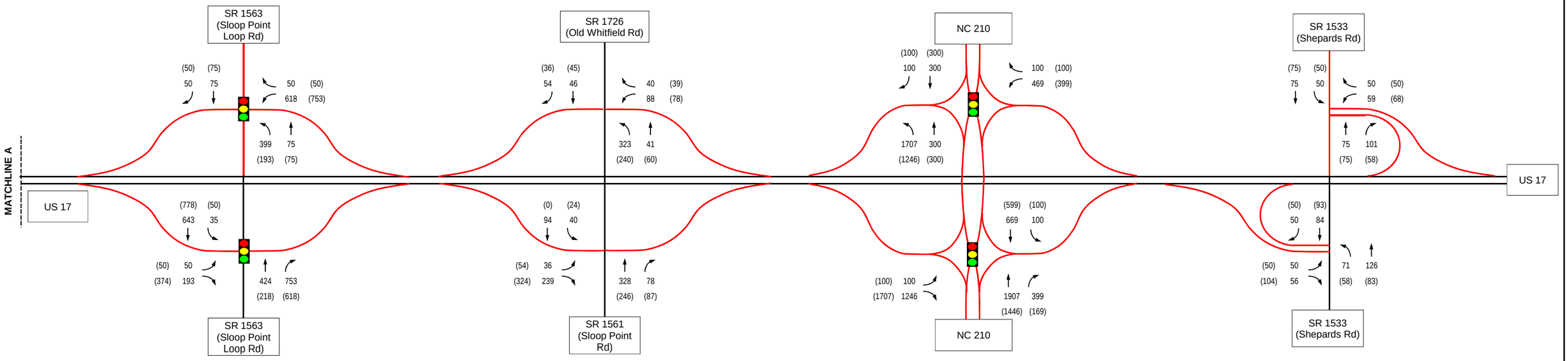
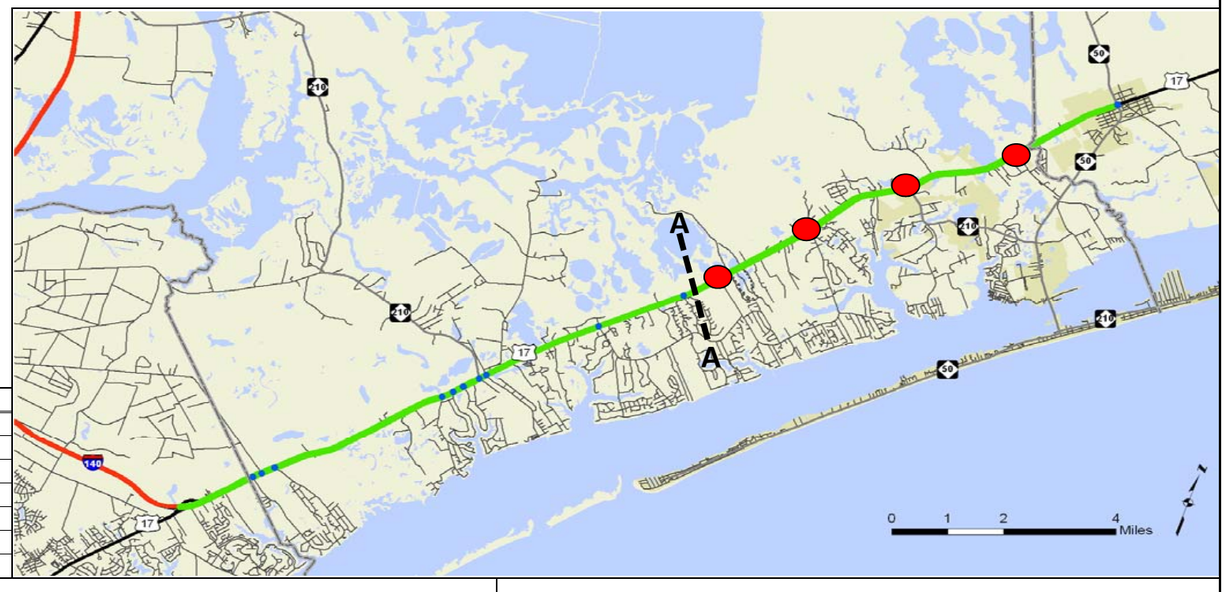
US 17 Feasibility Study
from I-140/US 17 Bypass to NC 50
(FS-0803B)

Figure 6-8
Base Year (2008) Build Alternative 3 -
AM and PM Peak Hour Volumes





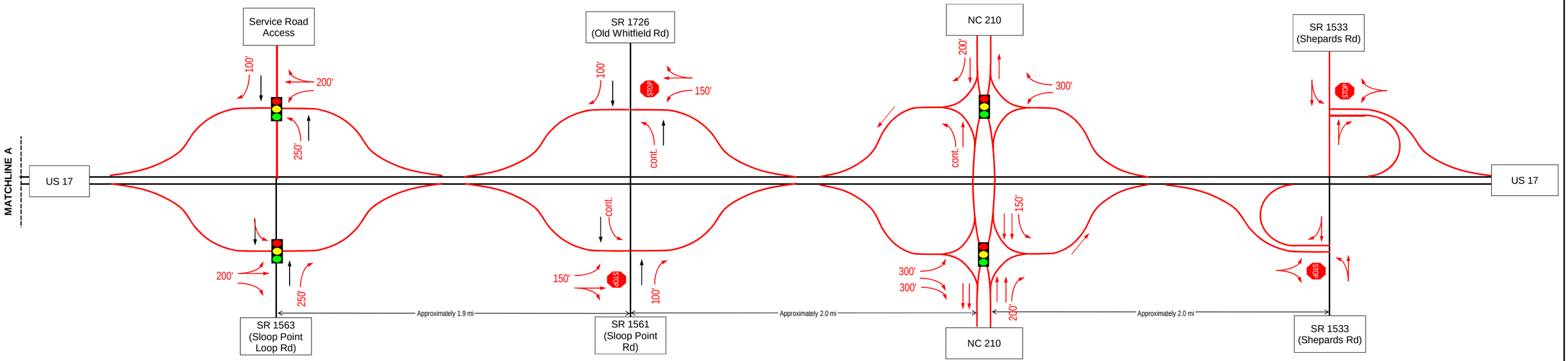
LEGEND	
→	Turning Movement
	Existing Roadway
	Future Roadway
	Existing Signalized Intersection
	Future Signalized Intersection
XX	AM Peak Hour Turning Movement Volume
(XX)	PM Peak Hour Turning Movement Volume

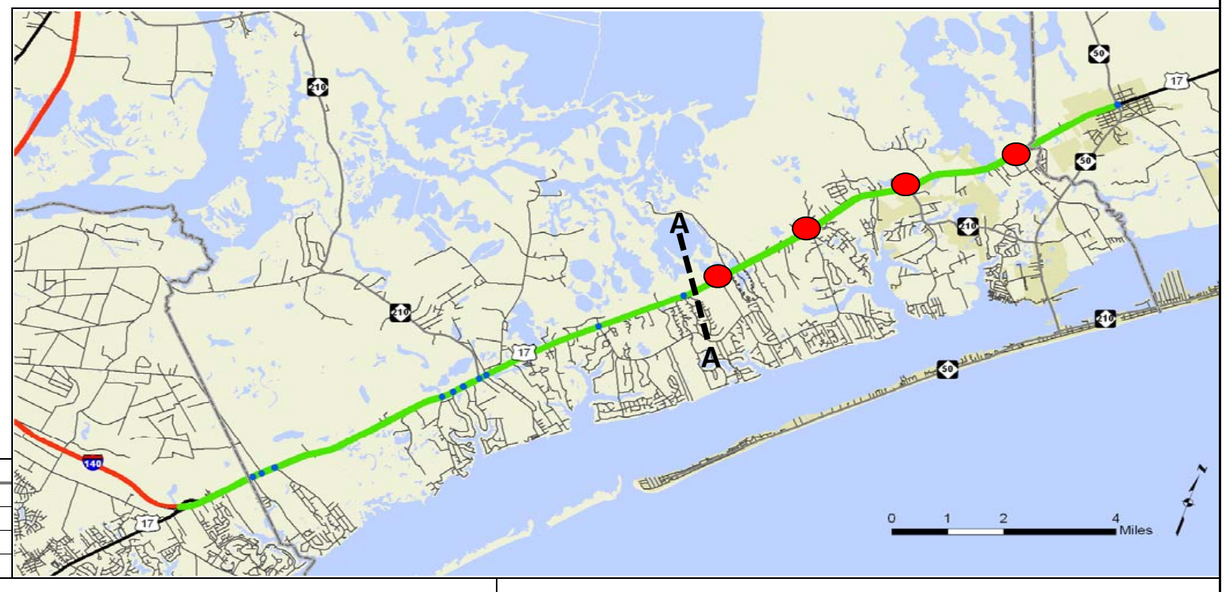
not to scale

MARTIN ALEXIOU BRYSON

US 17 Feasibility Study
from I-140/US 17 Bypass to NC 50
(FS-0803B)

Figure 6-9
Design Year (2035) Build Alternative 3 -
AM and PM Peak Hour Volumes





LEGEND
Future Lane Configuration
Future Roadway
Future Signalized Intersection
Future Stop Control

Not to scale

MARTIN ALEXIOU BRYSON

US 17 Feasibility Study
from I-140/US 17 Bypass to NC 50
(FS-0803B)

Figure 6-10
Build Alternative 3 - Lane Configurations and Traffic Control

1563 (Sloop Point Loop Road), it is recommended that the entrance ramp on the northbound side be continued to form a third through lane, continuous through the NC 210 interchange. Additionally, in the southbound direction, the outside through lane would serve as the exit ramp lane, allowing the cross-section to drop to four lanes and to tie into the proposed Hampstead Bypass, which is being planned as a four-lane divided facility. Additionally, the merge section and basic freeway segments at this location in the southbound direction will also operate at LOS E/F during the AM peak hour. These freeway capacity analysis results are summarized in Table 6-6; Table 6-7 summarizes the intersection capacity LOS results at the interchange ramp intersections. All LOS results for intersections south of the freeway facility are identical to the Build Alternative 2 results.

It should be noted that the capacity analysis indicates that the travel demand on the new freeway facility warrants six lanes at the location where the Hampstead Bypass ties into to US 17; however, the proposed Hampstead Bypass cross-section at this location is a four-lane facility due to the presence of the Red Cockaded Woodpecker habitats and colonies, which is an endangered species. As part of that project, agreements with the regulatory agencies have resulted in the restriction of the cross-section through this area to a four-lane divided facility. If the facility requires widening in the future, it should be considered to widen to the inside to minimize impacts to the protected habitat.

The last segment that would operate over capacity under the Build Alternative 3 conditions is the entrance ramp at NC 210 in the southbound direction during the AM peak hour.

Table 6-6
2008 and 2035 Build Alternative 3 - Freeway Facility Capacity Analysis Results

Eastbound Segments	Segment Type	Build Alternative 3			
		Base Year (2008)		Design Year (2035)	
		AM	PM	AM	PM
EB US 17, west of Sloop Point Loop Road	Basic Freeway	A	B	C	**E**
EB US 17, Sloop Point Loop Road Exit Ramp	Diverge Segment	A	B	C	**E**
EB US 17, Sloop Point Loop Road Entrance Ramp	Merge Segment	A	B	D	**F**
EB US 17, between Sloop Point Loop Road and Sloop Point Road	Basic Freeway	A	A	B	C
EB US 17, Sloop Point Road Exit Ramp	Diverge Segment	A	B	B	C
EB US 17, Sloop Point Road Entrance Ramp	Merge Segment	A	A	B	C
EB US 17, between Sloop Point Road and NC 210	Basic Freeway	A	A	B	C
EB US 17, NC 210 Exit Ramp	Diverge Segment	A	B	C	D
EB US 17, NC 210 Entrance Ramp	Merge Segment	A	B	B	C
EB US 17, between NC 210 and Shepards Road	Basic Freeway	A	A	B	C
EB US 17, Shepards Road Exit Ramp	Diverge Segment	A	A	B	C
EB US 17, Shepards Road Entrance Ramp	Merge Segment	A	B	B	C
EB US 17, east of Shepards Road	Basic Freeway	A	A	C	D

Westbound Segments	Segment Type	Build Alternative 3			
		Base Year (2008)		Design Year (2035)	
		AM	PM	AM	PM
WB US 17, east of Shepards Road	Basic Freeway	A	A	C	B
WB US 17, Shepards Road Exit Ramp	Diverge Segment	A	A	C	B
WB US 17, Shepards Road Entrance Ramp	Merge Segment	A	A	B	B
WB US 17, between Shepards Road to NC 210	Basic Freeway	A	A	C	B
WB US 17, NC 210 Exit Ramp	Diverge Segment	A	A	C	B
WB US 17, NC 210 Entrance Ramp	Merge Segment	B	B	**E**	C
WB US 17, between NC 210 to Sloop Point Road	Basic Freeway	A	A	C	B
WB US 17, Sloop Point Road Exit Ramp	Diverge Segment	A	A	C	B
WB US 17, Sloop Point Road Entrance Ramp	Merge Segment	B	A	C	B
WB US 17, between Sloop Point Road to Sloop Point Loop Road	Basic Freeway	A	B	D	C
WB US 17, Sloop Point Loop Road Exit Ramp	Diverge Segment	B	B	D	C
WB US 17, Sloop Point Loop Road Entrance Ramp	Merge Segment	B	B	**F**	C
WB US 17, west of Sloop Point Loop Road	Basic Freeway	B	A	**F**	B

Table 6-7
2008 and 2035 Build Alternative 3 - Interchange Ramp Intersections Analysis Results

Intersection	Proposed Traffic Control	Build Alternative 3			
		Base Year (2008)		Design Year (2035)	
		AM	PM	AM	PM
US 17 EB Ramp and Sloop Point Loop Road	Conventional Signal	A (EB-B) 4.5 sec	A (EB-B) 5.1 sec	A (EB-B) 4.5 sec	B (EB-D) 12.4 sec
US 17 WB Ramp and Sloop Point Loop Road	Conventional Signal	C (WB-D) 20.0 sec	C (WB-D) 23.4 sec	D (WB-D) 35.8 sec	C (NB-C) 25.7 sec
US 17 EB Ramp and Sloop Point Road	Stop Controlled	(EB-A)	(EB-A)	(EB-B)	(EB-B)
US 17 WB Ramp and Sloop Point Road	Stop Controlled	(WB-B)	(WB-B)	(WB-C)	(WB-B)
US 17 EB Ramp and NC 210	Diverging Diamond Signal	A (SB-B) 5.1 sec	A (SB-B) 4.8 sec	B (WB-C) 22.5 sec	C (SB-E) 21.8 sec
US 17 WB Ramp and NC 210	Diverging Diamond Signal	A (SB-A) 6.9 sec	A (SB-A) 6.0 sec	C (SB-D) 27.5 sec	B (SB-B) 13.2 sec
US 17 EB Ramp and Shepards Road	Stop Controlled	(EB-A)	(EB-A)	(EB-B)	(EB-B)
US 17 WB Ramp and Shepards Road	Stop Controlled	(WB-A)	(WB-A)	(WB-B)	(WB-B)

LEGEND: X (XX-X) – Overall LOS (Lowest Operating Approach and LOS), signalized intersection
XX.X sec – overall delay in seconds, signalized intersection
(XX-X) –Lowest Operating Approach and LOS, unsignalized intersection

6.5.3 Failure Year Analysis

The intersections south of the Hampstead Bypass that are projected to fail in 2035 would fail during the same year reported in the Build Alternative 2 failure year analysis. The Scotts Hill Loop Road intersection is projected to fail by 2020, while the Sidbury Road intersection is projected to fail by 2022. The freeway facility and the associated ramp intersections are not projected to fail before the design year (2035).

6.6 IMPACTS OF ALTERNATIVES

Each of the alternatives are unique in their improvements. Table 6-8 provides a comparison of the quantitative impacts of each alternative.

It should be noted that this table indicates that there is minimal impact to historic resources along the corridor, meaning that it is unlikely that the Build Alternatives would directly impact the historic structures. Poplar Grove Plantation, specifically, is listed on the National Register of Historic Places and is located adjacent to the existing US 17 right-of-way. While widening improvements may not directly impact the building, they could cause indirect and adverse impacts. These impacts would be determined by the North Carolina State Historic Preservation Office (SHPO) at the time when the project is being evaluated for environmental impacts under the National Environmental Policy Act (NEPA).

The impacted wetland acreage estimates are derived from the wetlands delineated for the R-3300 (Hampstead Bypass) and U-4751 (Military Cutoff Road Extension) projects along with the National Wetlands Inventory (NWI) GIS data outside of those projects' study area.

Table 6-8
Alternatives Major Impact Comparison

Impact	Build Alternative 1	Build Alternative 2	Build Alternative 3
Relocations - Business	36	29	72
Relocations - Residences	18	20	98
Relocations - Churches	2	2	4
Wetlands Impacted	5.2 acres	4.3 acres	52 acres
Major Stream Crossings	4	4	4
Probable USTs	4	4	4
Historic Sites- no property impact anticipated	1	1	1
Properties Potentially Eligible for the Historic Register	3	3	3

Additionally, the existing culverts along the study corridor will require upgrading to accommodate the increased cross sections. There are four existing box culverts which are the largest existing drainage structures. No existing bridges are located in the study area. The existing culverts would be impacted by widening US 17 under all three alternatives. Table 6-9 details the required extension of existing culverts to accommodate the analyzed alternatives.

Table 6-9 Impacts to Existing Culverts

Culvert Location	Build Alternative 1	Build Alternative 2	Build Alternative 3
	Minimum Required Extension (feet)		
8'x10' RCBC north of Scotts Hill Loop Road	40	40	40
4'x8' RCBC south of Sloop Point Road	40	40	40 +185' in new culverts
6'x8' RCBC north of Sloop Point Road	50	50	190
6'x9' RCBC north of Shepards Run	40	40	160

7. OPINION OF PROBABLE COST

Cost estimates were completed for the Build Alternatives including estimation of right-of-way costs, utility relocation costs, and construction costs. These estimates are based on the conceptual designs found in the appendix. The corridor was divided into two segments for cost estimation purposes. One segment includes the corridor from the I-140 interchange north to Leeward Lane; the second begins at Leeward Lane and continues north to NC 50 in Holly Ridge. This split occurs at the point where the Hampstead Bypass is expected to tie into US 17. Figure 7-1 illustrates the segments used in the cost estimations.

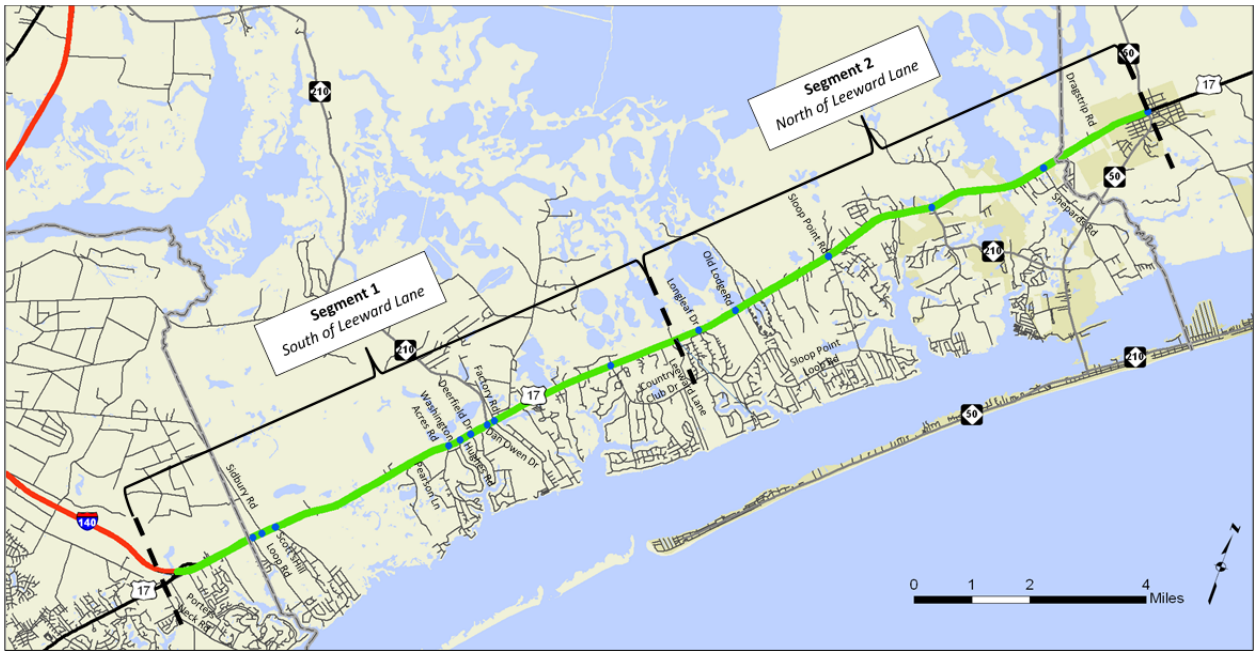


Figure 7-1 Cost Estimation Segments

Table 7-1 summarizes the cost estimates for each component of each alternative, by segment, and provides a total tally of estimated cost per alternative.

Table 7-1
Estimated Costs

Segment	Build Alternative 1		Build Alternative 2		Build Alternative 3	
	South of Leeward Lane	North of Leeward Lane	South of Leeward Lane	North of Leeward Lane	South of Leeward Lane	North of Leeward Lane
Right of Way	$ 32,100,000	$ 18,900,000	$ 27,200,000	$ 15,900,000	$ 27,700,000	$ 89,900,000
Utility Relocation	$ 2,400,000	$ 2,400,000	$ 2,200,000	$ 2,400,000	$ 2,200,000	$ 2,400,000
Construction*	$ 48,000,000	$ 54,000,000	$ 38,000,000	$ 54,000,000	$ 38,000,000	$ 98,000,000
Total		*$ 157,800,000*		*$ 139,700,000*		*$ 258,200,000*

*Utility Construction is included in this estimate

As shown in the table, Build Alternative 2 is the least expensive option. This option includes right-of-way needed to widen the existing roadway to accommodate three lanes in both directions; however, because of the presence of the Hampstead Bypass, this alternative does not incur some of

the costs included in Build Alternative 1. Specifically, there are no new superstreet configurations between I-140/US 17 Bypass and Hampstead Bypass to install; instead, this approximately 8.7 mile segment could be improved using more conventional methods, such as additional turning lanes and signal optimization to accommodate the future travel demand. Additionally, the two-mile segment from Grandview Drive to Leeward Lane is not widened or improved from the existing configurations due to the tying in of US 17 to the Hampstead Bypass; thus, there is no cost of acquiring right-of-way or widening along this segment. The segment from Hampstead Bypass to NC 50, though, would still require the implementation of multiple superstreet configurations.

The most expensive alternative is Build Alternative 3, which includes the conversion of approximately half of the corridor into a freeway. This alternative has a considerably higher right-of-way cost estimate and construction cost estimate than the other alternatives, due to space required for interchange ramps as well as service roads that will be required to provide access to parcels along US 17.

8. BENEFIT-COST ANALYSIS

A benefit-cost analysis was completed using the NCDOT Redbook Wizard (2009 update) tool, which is based on the *User Benefit Analysis for Highways* publication (AASHTO, 2003). This tool accounts for costs of the existing facility and the improved scenarios. Additionally, it converts the user benefits of an improved facility to a dollar amount.

The User Benefit is a combination of the operational benefits for the user and the user benefit from construction. User benefit is defined as the advantages, privileges, or cost reductions that accrue to highway drivers through the use of one highway facility as compared to another. Operational user benefits include a dollar amount for user value of time, user operating costs, and user accident reduction benefits.

The Capital Cost of a project includes the total investment required to prepare a highway for improvement or service, including engineering design and supervision, right-of-way acquisition, construction, signals and signage, and landscaping. The capital cost is unique to each Build Alternative.

The Net Benefit of an alternative is the Total User Benefit less the Capital Cost. The Benefit-Cost Ratio is the Total User Benefit dollar amount divided by the Capital Cost dollar amount.

Table 8-1 summarizes the key values considered in the benefit-cost analysis.

Table 8-1
Benefit-Cost Analysis Summary

Build Alternative 1	**Build Alternative 2**	**Build Alternative 3**
User Benefits		
$ 345,000,000	$ 301,800,000	$ 307,500,000
Capital Costs		
$ 157,800,000	$ 139,700,000	$ 258,200,000
Net Benefits		
$ 187,200,000	$ 162,100,000	$ 49,300,000
Benefit-Cost Ratio		
2.2	**2.2**	**1.2**

Based on the analysis, Build Alternative 1 and 2 have the greatest benefit-cost ratios, with Build Alternative 3 having the lowest benefit-cost ratio.

9. CONCLUSIONS AND RECOMMENDATIONS

Based on the data presented in this study, it is recommended that Alternative 2 is implemented along the US 17 corridor between the I-140 /US 17 Bypass interchange in Kirkland and the NC 50 (Ocean Road) intersection in Holly Ridge. This alternative includes widening the existing facility to a six-lane divided roadway and includes intersection improvements along the length of the corridor. Intersection improvements range from additional turn lanes to implementing superstreet configurations at some locations.

The recommendation of this alternative is based on multiple aspects of the project. It should first be noted, however, that Alternative 2 incorporates the proposed Hampstead Bypass (TIP No. R-3300) and the resulting effects of this project on the future traffic volumes of the corridor. The Hampstead Bypass would lower the traffic volumes along the first half of the corridor as it would draw through traffic off the existing US 17 facility. This TIP project is currently being studied, and although the exact preferred alternative has not been identified, it is understood that a bypass alternative which ties into the existing facility near Leeward Lane is the likely outcome of that Environmental Impact Statement. Right-of-way acquisition for the Hampstead Bypass is planned for 2016 and construction, which does not have an established timeline, is funded at nearly $200,000,000. Given this base assumption, Alternative 2 is the recommended alternative.

Environmental Impacts

Alternative 2 results in the fewest combined relocations (business, church and residential) when compared to the other two alternatives. Additionally, this alternative impacts the least amount of wetland area, while remaining on the same level as other alternatives regarding impacts such as stream crossings, UST locations and historic resource impacts.

Estimated Cost

Alternative 2 has the lowest estimated cost due in part to a segment of the facility that would not be improved due to the presence of the Hampstead Bypass tie-in. This results in a decrease in cost in all areas including right-of-way, utilities, and construction costs. Also, the Hampstead Bypass results in lowered volumes along the southern portion of US 17; this allows for smaller scale, more conventional improvements, such as additional turn lanes at intersections, to be implemented rather than the more expensive superstreet configuration required to handle larger traffic volumes.

Benefit-Cost Analysis

As described previously, the AASHTO Redbook Benefit Cost Analysis method was used to rank the alternatives. This methodology resulted in Build Alternative 1 and 2 having equal benefit-cost ratios when considering user benefits, safety benefits and overall costs. However, Build Alternative 1 does not account for the construction of the Hampstead Bypass as previously mentioned.

Given the presented data, Alternative 2 is the recommended alternative.

APPENDIX

Appendix A

Traffic Forecasts

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY
GOVERNOR

LYNDO TIPPETT
SECRETARY

November 17, 2008

MEMORANDUM TO: Florentino Rasay Abadilla, PE
Program Development Branch

FROM: Darryl D. Austin
Transportation Planning Branch

SUBJECT: Traffic Forecast for TIP Project # FS-0803B
New Hanover, Pender, Onslow Counties
US 17 Widening from Proposed I-140 Wilmington Bypass
to the curb and gutter section in Holly Ridge

Please find attached the 2008 / 2035 Traffic Forecast for the above mentioned project. Project FS-0803B is defined as the widening of existing US 17 form the proposed I-140 (Wilmington Bypass) to the curb and gutter section in Holly Ridge. This project does not lie within the Wilmington MPO area.

The previous forecasts for TIP Projects FS-0803, FS-0703A, R-3300, U-4738 and U-4751 were reviewed during the development of this forecast. The Traffic Engineer for Division 3, Dan Cumbo, PE, and Transportation Planning Branch Engineers were consulted during the development of this forecast.

The following scenarios are provided:

- 2008 Base Year No-Build
- 2008 Base Year (Build R-3300 & U-4751)
- 2035 Future Year (Without R-3300 & U-4751)
- 2035 Future Year Build

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LOCATION:
TRANSPORTATION BUILDING
1 SOUTH WILMINGTON STREET
RALEIGH NC

Certain assumptions were made in the development of the forecast:

Fiscal Constraint: The future year forecasts are based on the 2009-2015 State TIP (projects which include construction money). Additionally the following unfunded projects were assumed constructed in the future year:

- R-3300 – is unfunded and scheduled for ROW Acquisition in 2013
- U-4751 – is unfunded and scheduled for ROW Acquisition in 2013

Development Activity: This project is in the Cape Fear RPO but is located outside of the area covered by the Wilmington Regional model. The following assumptions have been made when developing the future year 2035 traffic forecast:

- The proposed I-140 (Wilmington Bypass R-2633) on new location was taken into account in the Future Year 2035
- The construction of SR 1409 (Military Cutoff Road) on new location between US 17 Business and I-140 east of Wilmington (U-4751) is completed.
- The construction of the Cape Fear Skyway Bridge (U-4738) on new location in New Hanover County is assumed completed.
- The construction of US 17 Bypass (Hampstead Bypass) on new location between I-140 east of Wilmington and US 17 East of Hampstead (R-3300) is assumed completed.

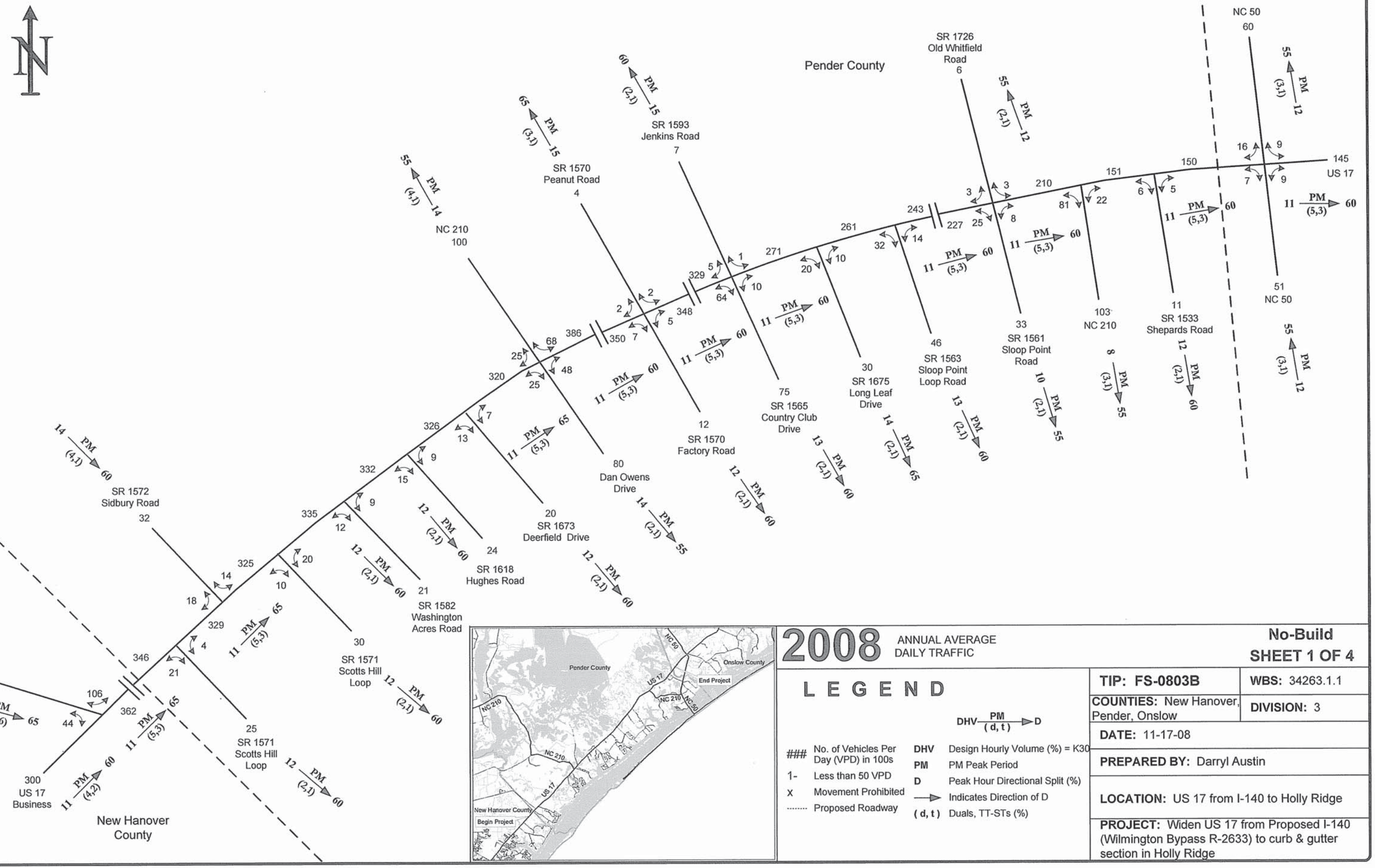
Methodology for Projecting Future Year Traffic (2035): Traffic growth rates obtained from historical trends, and specific information on planned developments were considered during the forecast development. Turning Movement Counts and Electronic Hourly Counts were requested and obtained from Traffic Surveys at various locations within the project study corridor evaluated for this forecast report. Completed traffic forecast developed for TIP projects R-3300 completed in June, 2008 and FS-0703A completed in February, 2008 were the primary tools utilized during the development of this forecast document. The Wilmington Regional Transportation Model was also instrumental during the development of this forecast.

To determine any intermediate years, a straight-line interpolation may be used. AADT volumes may be extrapolated for years after 2035. If you have any questions, or if I can be of further assistance, please do not hesitate to call me at (919)-715-5482, or e-mail me at daustin@ncdot.gov.

cc: FILE (Pender County, TIP Project FS-0803B)

cc: (*via e-mail with PDF attachments*):
Jay Bennett, PE, Roadway Design Unit
Deborah Hutchings, PE, Transportation Planning Branch
James Upchurch, Transportation Planning Branch

BenJetta L. Johnson, PE, Congestion Management Section
Hardee Cox, Roadway Inventory Information Systems Section



2008 ANNUAL AVERAGE DAILY TRAFFIC

No-Build
SHEET 1 OF 4

LEGEND

DHV — PM (d, t) → D

###	No. of Vehicles Per Day (VPD) in 100s	DHV	Design Hourly Volume (%) = K30
1-	Less than 50 VPD	PM	PM Peak Period
x	Movement Prohibited	D	Peak Hour Directional Split (%)
.....	Proposed Roadway	→	Indicates Direction of D
		(d, t)	Duals, TT-STs (%)

TIP: FS-0803B

WBS: 34263.1.1

COUNTIES: New Hanover, Pender, Onslow

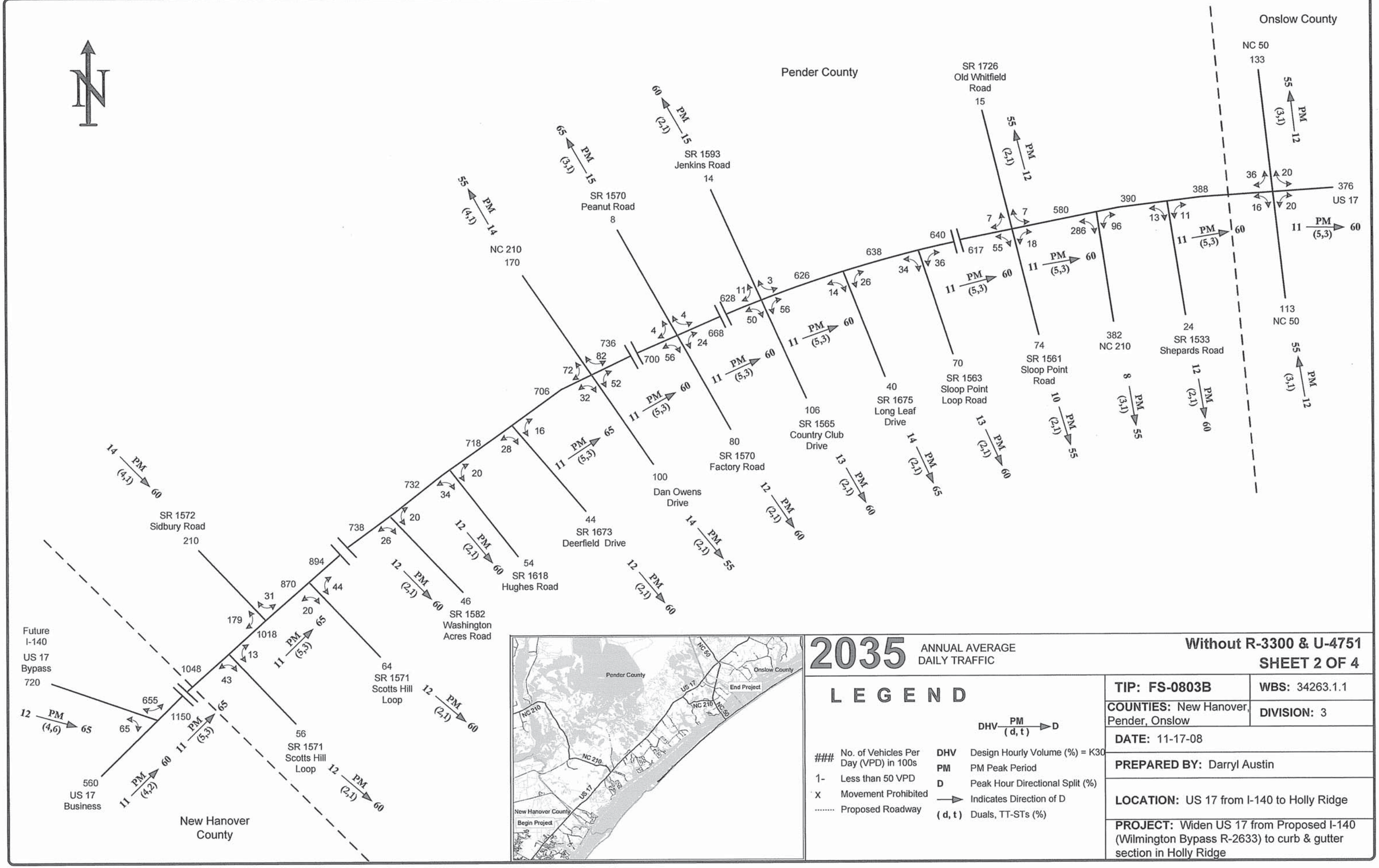
DIVISION: 3

DATE: 11-17-08

PREPARED BY: Darryl Austin

LOCATION: US 17 from I-140 to Holly Ridge

PROJECT: Widen US 17 from Proposed I-140 (Wilmington Bypass R-2633) to curb & gutter section in Holly Ridge



2035 ANNUAL AVERAGE DAILY TRAFFIC

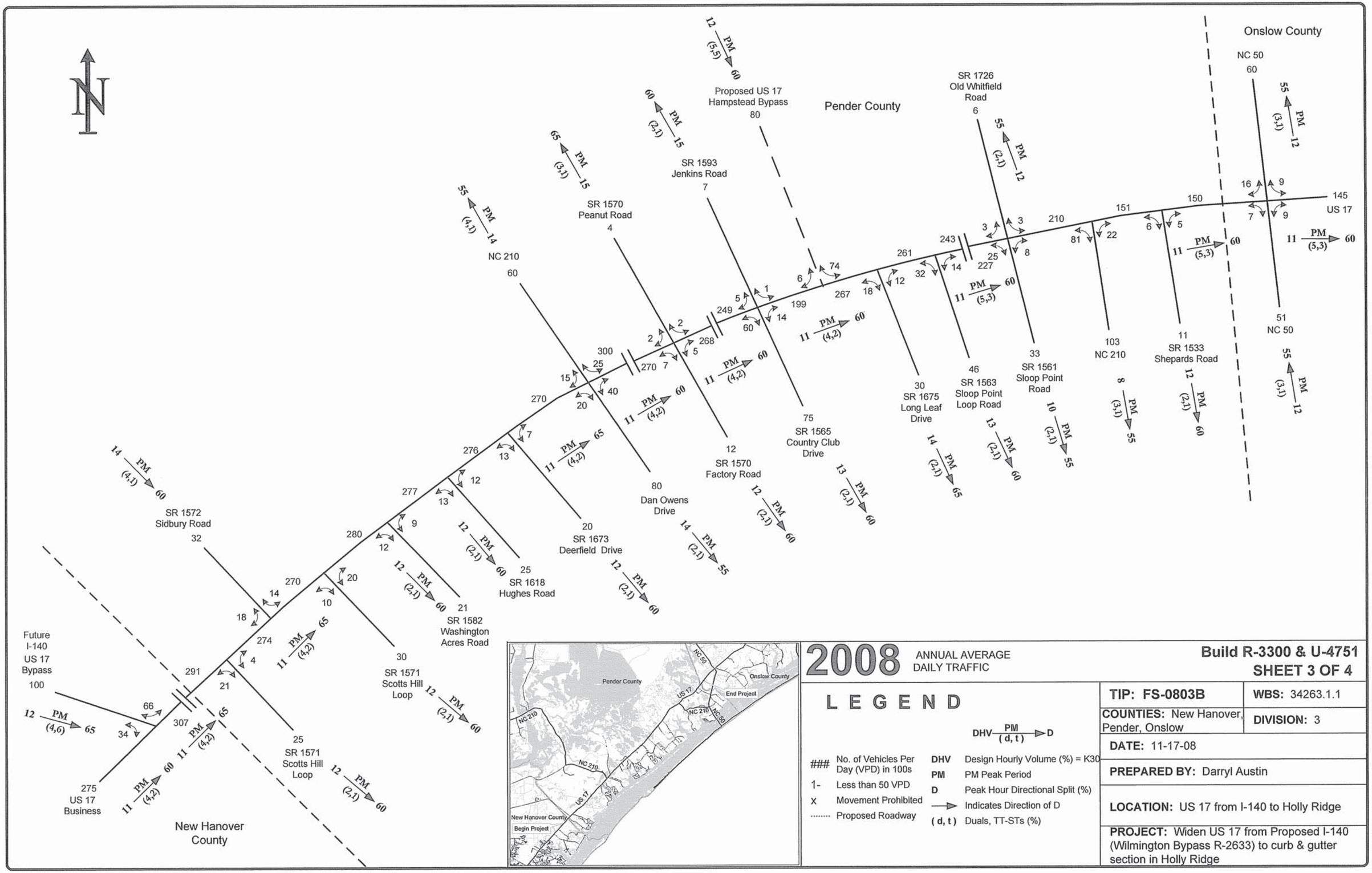
Without R-3300 & U-4751
SHEET 2 OF 4

LEGEND

DHV — PM (d, t) → D

###	No. of Vehicles Per Day (VPD) in 100s	DHV	Design Hourly Volume (%) = K30
1-	Less than 50 VPD	PM	PM Peak Period
X	Movement Prohibited	D	Peak Hour Directional Split (%)
.....	Proposed Roadway	→	Indicates Direction of D
		(d, t)	Duals, TT-STs (%)

TIP: FS-0803B
WBS: 34263.1.1
COUNTIES: New Hanover, Pender, Onslow
DIVISION: 3
DATE: 11-17-08
PREPARED BY: Darryl Austin
LOCATION: US 17 from I-140 to Holly Ridge
PROJECT: Widen US 17 from Proposed I-140 (Wilmington Bypass R-2633) to curb & gutter section in Holly Ridge



2008 ANNUAL AVERAGE DAILY TRAFFIC

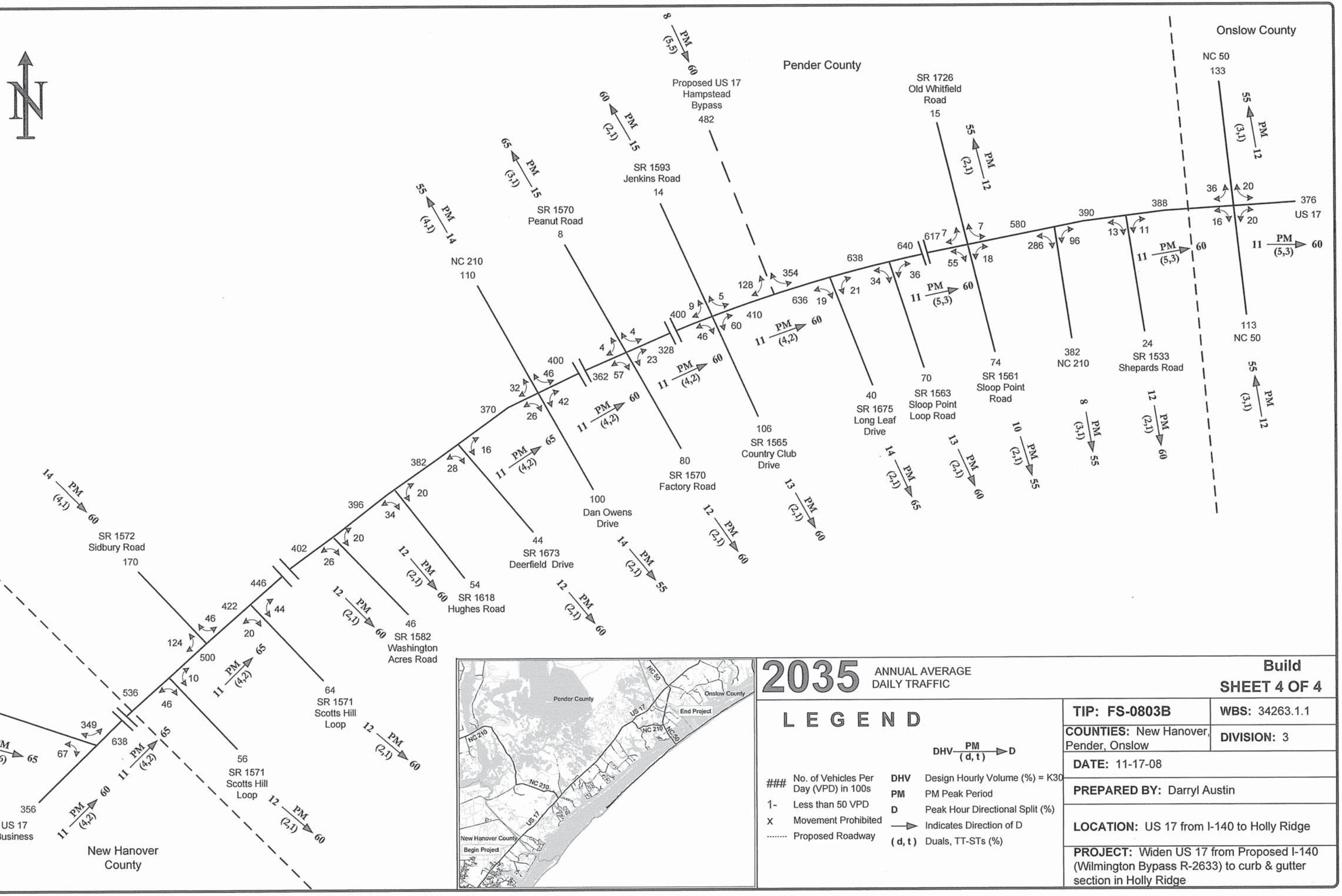
Build R-3300 & U-4751
SHEET 3 OF 4

LEGEND

DHV — PM (d, t) → D

###	No. of Vehicles Per Day (VPD) in 100s	DHV	Design Hourly Volume (%) = K30
1-	Less than 50 VPD	PM	PM Peak Period
X	Movement Prohibited	D	Peak Hour Directional Split (%)
.....	Proposed Roadway	→	Indicates Direction of D
		(d, t)	Duals, TT-STs (%)

TIP: FS-0803B
WBS: 34263.1.1
COUNTIES: New Hanover, Pender, Onslow
DIVISION: 3
DATE: 11-17-08
PREPARED BY: Darryl Austin
LOCATION: US 17 from I-140 to Holly Ridge
PROJECT: Widen US 17 from Proposed I-140 (Wilmington Bypass R-2633) to curb & gutter section in Holly Ridge



2035 ANNUAL AVERAGE DAILY TRAFFIC

Build

SHEET 4 OF 4

LEGEND

DHV PM (d, t) D

###	No. of Vehicles Per Day (VPD) in 100s	DHV	Design Hourly Volume (%) = K30
1-	Less than 50 VPD	PM	PM Peak Period
X	Movement Prohibited	D	Peak Hour Directional Split (%)
.....	Proposed Roadway	→	Indicates Direction of D
		(d, t)	Duals, TT-STs (%)

TIP: FS-0803B

WBS: 34263.1.1

COUNTIES: New Hanover, Pender, Onslow

DIVISION: 3

DATE: 11-17-08

PREPARED BY: Darryl Austin

LOCATION: US 17 from I-140 to Holly Ridge

PROJECT: Widen US 17 from Proposed I-140 (Wilmington Bypass R-2633) to curb & gutter section in Holly Ridge

Appendix B

Conceptual Designs

(Digital version available upon request)