Final Report | JUNE 2018

Project Level Traffic Forecast
STIP Project No. R-5851

US 17 (Ocean Highway W) and
NC 904 (Longwood Road NW/Seaside Road SW)

Brunswick County, North Carolina
WBS # 47539.1.1

PREPARED FOR:

PREPARED BY:

June 28, 2018

MEMORANDUM TO: Michael L. Bass, Jr.
NCDOT Division 3

FROM: Terry C. Arellano, PE
VHB Engineering NC, P.C.

SUBJECT: Traffic Forecast for STIP Project R-5851, US 17 (Ocean Highway W) and NC 904 (Longwood Drive NW/Seaside Road SW) Intersection Improvement, Brunswick County

Please find the attached **2018/2045 Traffic Forecast** for the above-mentioned project. NCDOT Division 3 is proposing STIP Project No. R-5851 in Brunswick County, which will improve the existing US 17 (Ocean Highway) & NC 904 (Longwood Road/Seaside Road) intersection to a superstreet.

This forecast has been reviewed and approved by the Transportation Planning Division on June 22, 2018.

There is no previous traffic forecast for R-5851. The following people involved in local land use and/or transportation planning were contacted for additional information relative to the development of the forecast: Marc Pages, Brunswick County Planning Department; Hiram Marziano, Town of Sunset Beach Planning & Inspections Director; Mark Hoeweler, Grand Strand Area Transportation Study (GSATS); Alan Pytcher, NCDOT Division 3 Project Engineer; Jeffrey Garrett, NCDOT Division 3, District 3 Deputy Engineer; Iris McCombs, NCDOT Brunswick County Maintenance Engineer; and Phillip Geary, PE, NCDOT GSATS Coordinator.

The following scenarios are provided in this forecast:

- Scenario 1 – 2018 Base Year No-Build
- Scenario 2 – 2045 Design Year No-Build

Fiscal Constraint: Since this project is located within the Grand Strand Area Transportation Study (GSATS) planning jurisdiction, the future year forecasts assume construction of projects within North Carolina as listed within the GSATS 2040 Metropolitan Transportation Plan (MTP). Currently, the GSATS 2040 MTP includes no other projects in the project vicinity.

Forecast Methodology: The 2018 Base Year No-Build traffic forecast was developed primarily based upon traffic counts taken for this forecast, as well as historic traffic counts and trends. The 2045 Design Year No-Build traffic forecast was developed based on historical annual average daily traffic (AADT) counts, 2018 traffic counts, and model growth derived from the GSATS 2040 travel demand model.

Interpolation: Straight-line interpolation may be used to determine volumes during any intermediate years. AADT volumes may be extrapolated for up to two years immediately following 2045. If it is determined that

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any of these assumptions have become inconsistent with the project and surrounding area activity, a request should be made for updated projections at this location.

If you have any questions or I can be of further assistance, please do not hesitate to call me at 984-960-5102, or e-mail me at tarellano@vhb.com.

cc: (Final distribution for your records via e-mail as PDF attachments)
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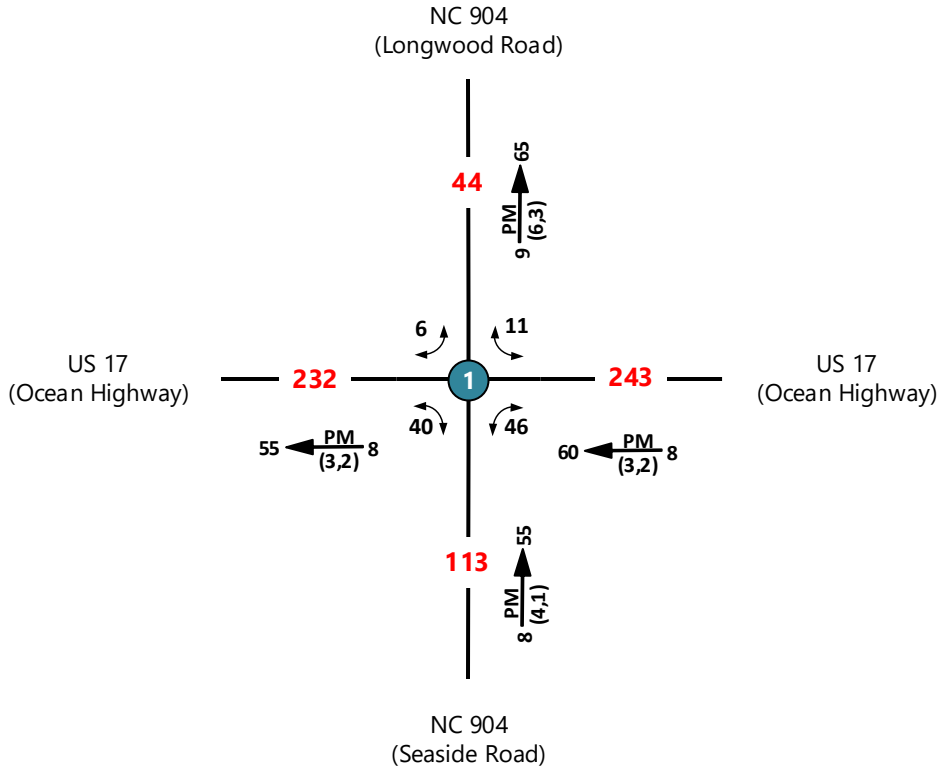
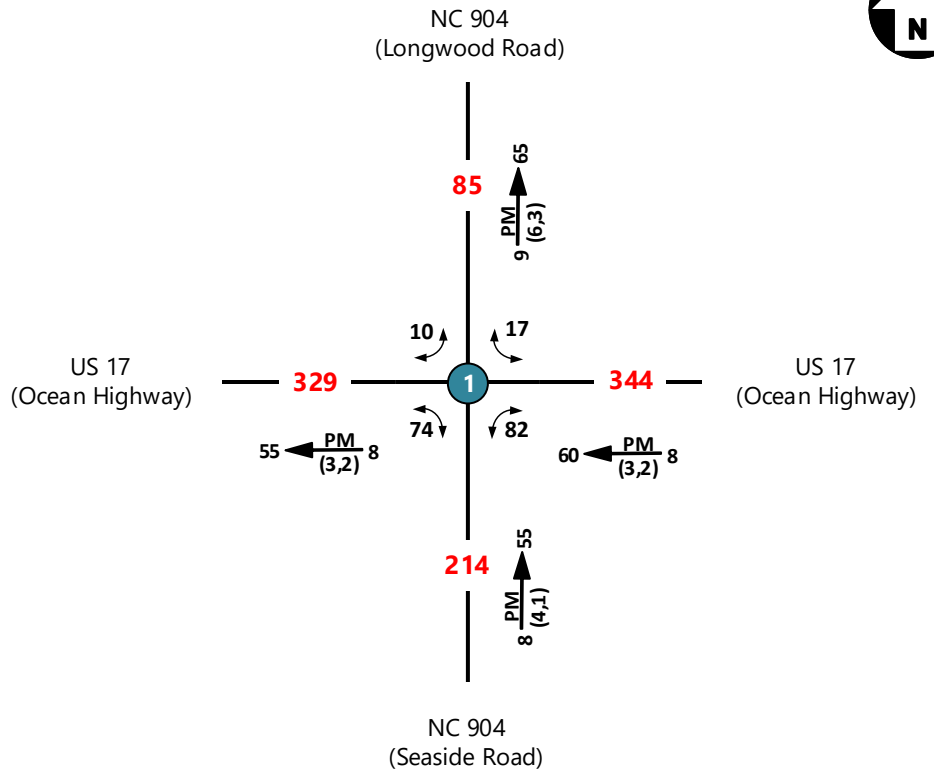
File Copy: R-5851, Brunswick County



2018



2045

Average Annual Daily Traffic

No-Build Alternative

L E G E N D

###	No. of Vehicles per Day (VPD) in 100s	PM	PM Peak Hour
		D	Peak Hour Directional Split (%)
—	Existing Roadway		Indicates Direction of D
		(d,t)	Duals, TTSTs (%)
		K	Design Hour Factor (%)
		X	Movement Prohibited
		1-	Less than 50 VPD

D ← PM (d,t) K

TIP: R-5851

WBS: 47539.1.1

DIVISION: 3

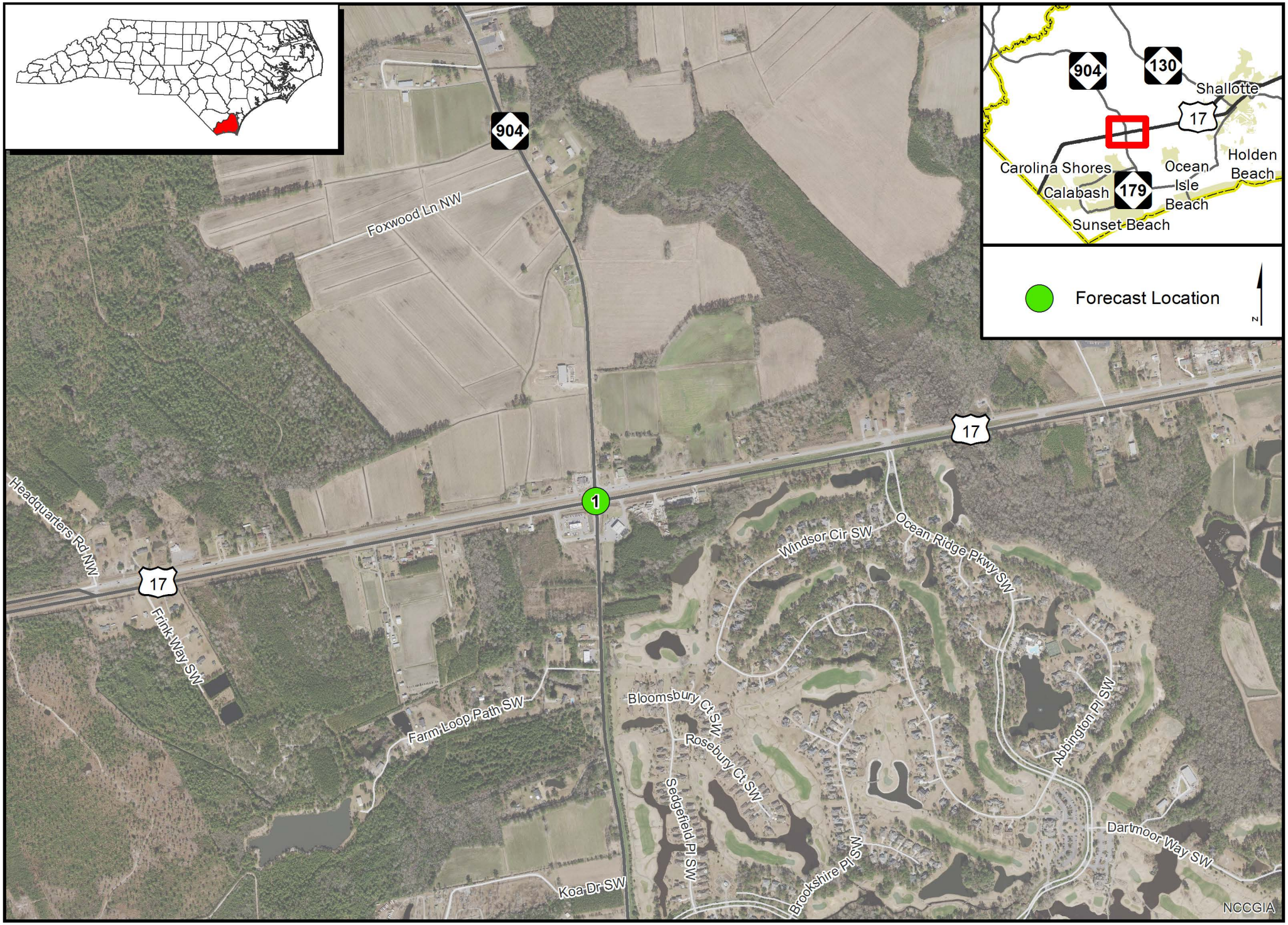
COUNTY: Brunswick

DATE: June 22, 2018

PREPARED BY: VHB Engineering NC, P.C.

LOCATION: US 17 (Ocean Highway W) and NC 904 (Longwood Road NW/Seaside Road SW)

PROJECT: US 17 and NC 904 Intersection Improvement



U-5851: US 17 and NC 904 Intersection Improvement

TRAFFIC FORECAST LOCATIONS

0 0.5 1 Miles

November 2017

US 17 (Ocean Highway W) and NC 904 (Longwood Road NW/Seaside Road SW)
North Carolina State TIP Project No. R-5851
Brunswick County, North Carolina

- Project Request Information

STIP Project No. R-5851 in Brunswick County is proposed to convert the existing US 17 (Ocean Highway W) and NC 904 (Longwood Road NW/Seaside Road SW) intersection to a superstreet. The NCDOT 2018–2027 STIP includes Project R-5851 with right-of-way scheduled for 2023 and construction scheduled for 2025.

This traffic forecast includes a 2018 base year and a 2045 design year, and this memorandum documents the forecast development of the following two scenarios:

- **2018 Base Year No-Build Scenario.** The traffic forecast for this scenario was developed to establish existing conditions of the project. It assumes the existing roadway network in the forecasted area.
- **2045 Design Year No-Build Scenario.** This scenario represents the future year traffic conditions without the subject project.

Traffic forecasts for Build scenarios were not developed since the proposed project will only improve the intersection and traffic volumes are not anticipated to change.

The forecast was developed by using historic traffic growth data within the study area in conjunction with growth rates observed within the Grand Strand Area Transportation Study (GSATS) 2040 Model, the travel demand model for the GSATS area, adopted by the GSATS Policy Committee in November 2017.

The data provided in the forecasts include all components necessary for capacity and level of service computations, geometric design, pavement design, air quality analysis, and noise analysis. Specifically, the data includes annual average daily traffic (AADT), vehicle classifications, peak-hour factors, directional split percentages, and turning movement estimates for the study area intersection.

To determine traffic volumes for any intermediate years, straight-line interpolation may be used. AADT volumes may be extrapolated for up to two years immediately following 2045.

- Forecast History

No traffic forecast has been previously completed for R-5851 or for other projects within this study area.

- Area Information

This project is located in Brunswick County, in NCDOT Division 3, north of the Sunset Beach town limits. Brunswick County is located in the southeastern section of the state, bounded by Columbus, New Hanover and Pender Counties in North Carolina and Horry County in South Carolina.

- MPO Plans & Tools

Brunswick County is represented by the GSATS, which serves as the Metropolitan Planning Organization (MPO) for the Myrtle Beach metropolitan area. The GSATS 2040 Metropolitan Transportation Plan (MTP) does not include improvements to either US 17 (Ocean Highway W) or NC 904 (Longwood Road

NW/Seaside Road SW) in the project area, or to other roadways which may affect travel demand near the study intersection.

The GSATS 2040 Model includes the study intersection. Based upon GSATS staff's recommendation, growth rates for the study intersection derived from model runs provided by GSATS were considered in the development of the traffic forecast for R-5851. In addition, the growth rates from the North Carolina Statewide Model Gen 2.3 (NCSWM Gen2.3) was reviewed as part of the development of this forecast.

- Route Information

US 17 (Ocean Highway W) is a four-lane roadway functionally classified as an Other Principal Arterial, serving as Brunswick County's principal north to south roadway. Two-lane NC 904 (Longwood Road NW/Seaside Road SW) is functionally classified as a Minor Collector. Both routes connect to multiple tourist locations along North Carolina's coast.

- Population, Employment, and Land Use

The 2016 population in Brunswick County was 119,167 according to U.S. Census Bureau estimates. This reflects an annual growth rate of 3.32% since 1990. In more recent years, slower growth rates have been observed: 3.10% per year from 2000–2016 and 1.74% from 2010–2016. The 2016 population in the nearby Town of Sunset Beach was 3,762, which reflects annual growth rates of 10.06% since 1990, 4.63% since 2000, and a less aggressive annual growth rate of 0.87% since 2010.

Annual historical employment data from 1990 to 2016 obtained from the North Carolina Employment Security Commission (NCESC) and Bureau of Labor Statistics for Brunswick County indicates that employment has grown at an annual rate of 2.72% between 1990 and 2016, 1.99% between 2000 and 2016, and 2.28% per year between 2010 and 2016.

Table 1 summarizes the historic population and employment estimates and growth rates for the county and town.

Table 1: Population and Employment Historical Growth Rates

Location	Category	Estimate				Growth Rate		
		1990	2000	2010	2016	1990-2016	2000-2016	2010-2016
Brunswick County	Population	50,985	73,143	107,431	119,167	3.32%	3.10%	1.74%
	Employment	23,201	33,976	40,701	46,600	2.72%	1.99%	2.28%
Town of Sunset Beach	Population	311	1,824	3,572	3,762	10.06%	4.63%	0.87%

Population Source: The U.S. Census Bureau estimates

Employment Source: U.S. DoL BLS Data Finder (https://beta.bls.gov/dataViewer/view/timeseries/LAUCN370190000000005)

Current land use in the study area is predominantly rural, including undeveloped, residential, agricultural, and some commercial uses.

- Traffic Count Information and Historical AADT Data

AADT volumes from 2002 to 2016 were gathered from the NCDOT Traffic Survey Group (TSG) for US 17 (Ocean Highway W) and NC 904 (Longwood Road NW/Seaside Road SW). The historical AADT count data, locations, and years from 2002 – 2016 are presented in **Table 2**.

Turning movement counts for the study intersection were collected for this forecast over a 16-hour period between the hours of 6 AM and 10 PM on January 11, 2018. 48-hour classification counts were also collected for the two locations listed below from 7 AM on January 10, 2018 to 7 AM on January 12, 2018:

- US 17 (Ocean Highway W), East of NC 904 (Longwood Road NW/Seaside Road SW)
- NC 904 (Longwood Road NW/Seaside Road SW), South of US 17 (Ocean Highway W)

Table 3 shows the application of conversion factors to the raw counts to obtain daily counts, and seasonal factors to generate estimated AADTs.

- Determination of Design Factors

Design data, which include heavy vehicle percentages (duals and TTSTs), directional distribution factors (D), and peak hour factors (K), were derived from design data developed from intersection turning movement counts collected in 2018. The selection of peak hour factor, directional distribution design data, and truck percentages is shown in **Table 4**.

- 2018 Base Year No-Build Forecast

The 2018 Base Year No-Build Scenario assumes that existing roadway conditions are present. Independent techniques were employed to determine the 2018 Base Year No-Build forecast volumes. These techniques are discussed in detail below:

- Estimating AADT Using Historical Data Extrapolation: This method of determining the 2018 Base Year No-Build Scenario forecast volumes consisted of extrapolating historical trends using the historical AADT data shown in **Table 2**. Independent linear trend analyses were performed on the data between 2002 – 2016 and 2007 – 2016. The results of each were compared against one another and are shown in **Table 2**.
- Estimating AADT Using 2018 Intersection Turning Movement Counts: Establishing the 2018 Base Year No-Build Scenario forecast volumes using the 16-hour intersection turning movement counts consisted of applying a mathematical formula. The 16-hour intersection turning movement counts collected in 2018 were converted to raw segment daily traffic volumes and projected to AADT volumes by multiplying the appropriate seasonal adjustment factors.

The estimated AADT volumes yielded from the techniques described above were compared with and verified through the NCDOT historical AADT data, especially the published AADT data for year 2016. After comparing all results, the forecast value was selected, giving preference to the field data collected in 2018. Typically, the latest published NCDOT AADT is used as the forecast value when the collected field data is lower than the published AADT. However, the 2016 published AADT is an outlier compared to the previous year and compared to the 5-year and 10-year extrapolated historical trends. Therefore, the collected field data along US 17 (Ocean Highway W) west of NC 904 (Longwood Road NW/Seaside Road SW) is used as the forecast value since it follows the historical trend. Historical data and trend analysis using the above methods are shown in **Table 5** along with the forecast values.

Upon establishing the 2018 Base Year No-Build AADT forecast volumes, turning movements for the study intersection were estimated. The turning movement percentages were taken from intersection turning movement data collected in 2018. The traffic forecast diagram presents the 2018 Base Year No-Build AADT forecast volumes and turning movements for the study intersection.

Table 2: NCDOT Historical AADT Data

County	Label	ID	Road Name			Historical AADT															Historical AADT extrapolated to 2018 (10-year)+	Historical AADT extrapolated to 2018 (15-year)++
			Intersection Location	Route	Selected Segment	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016		
A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W	X	Y
Formula Calculations						NCDOT AADT Maps															IF(SUM(M:W)>0,MROUND(FORECAST(2018,M:W,M:W), 200),"")	IF(SUM(G:W)>0,MROUND(FORECAST(2018,G:W,G:W), 200),"")
Brunswick	N	1	US 17 (Ocean Highway) at NC 904 (Longwood Road/Seaside Road)	NC 904 (Longwood Road)	North of US 17 (Ocean Highway)	3,400	3,500	3,900	3,700	4,300	4,400	3,700	4,100	3,600	3,700	3,800	3,700		4,000	4,300	4,000	4,000
	E			US 17 (Ocean Highway)	East of NC 904 (Longwood Road)	18,000	19,000	21,000	20,000	24,000	25,000	23,000	27,000		21,000	22,000	23,000	22,000	21,000		19,800	23,800
	S			NC 904 (Seaside Road)	South of US 17 (Ocean Highway)	6,200	9,200	8,500	10,000	11,000	13,000	14,000			10,000	12,000	11,000	11,000	9,700	11,000	9,400	12,000
	W			US 17 (Ocean Highway)	West of NC 904 (Longwood Road)	17,000	17,000	20,000	18,000	22,000	23,000	21,000	21,000	17,000	18,000	19,000	21,000		19,000	25,000	21,000	22,000

+ Using 10 year trend line (2007-2016)

++ Using 15 year trend line (2002-2016)

Table 3: 2018 Class Counts, Applied Seasonal Factors and Calculated 2018 AADT

County	Label	ID	Road Name			TMC/Class Count		16 Hour Count	16 Hr to Daily Factor**	Daily Counts	NCDOT Seasonal Factors		Annualized Daily Count	Estimated AADT
			Intersection Location	Route	Selected Segment	Date	Day				ATR Group	Factor*		
A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q
Formula Calculations										J/K			N*L	MROUND(P,100)
Brunswick	N	1	US 17 (Ocean Highway) at NC 904 (Longwood Road/Seaside Road)	NC 904 (Longwood Road)	North of US 17 (Ocean Highway)	1/11/2018	Thursday	3,178	0.93	3,428	2	1.27	4,354	4,400
	E			US 17 (Ocean Highway)	East of NC 904 (Longwood Road)			17,729	0.93	19,125	2	1.27	24,289	24,300
	S			NC 904 (Seaside Road)	South of US 17 (Ocean Highway)			8,194	0.93	8,839	2	1.27	11,226	11,200
	W			US 17 (Ocean Highway)	West of NC 904 (Longwood Road)			16,913	0.93	18,245	2	1.27	23,171	23,200

* *Seasonal factor taken from NCDOT_Seasonal Factors FEB 2011 U-2817.xls*

** *16 Hr to Daily factors taken from Traffic_Factors_2015.xlsx for all locations*

Table 4: Design Data (Peak Hour Factor, Directional Distribution, and Truck Percentages)

County	Label	ID	Road Name			K – Peak Hour Factor	D – Directional Distribution	Truck Percentages (Duals)		Truck Percentages (TT-ST)		Selected Values			
			Intersection Location	Route	Selected Segment	2018 TMCs[1]	2018 TMCs[1]	2018 TMCs[1]	2015 Traffic Data[2]	2018 TMCs[1]	2015 Traffic Data[2]	K - Peak Hour Factor	D - Directional Distribution	Truck Percentages (Dual)	Truck Percentages (TT-ST)
A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R
Formula Calculations												Manual	Manual	Manual	Manual
Brunswick	N	1	US 17 (Ocean Highway) at NC 904 (Longwood Road/Seaside Road)	NC 904 (Longwood Road)	North of US 17 (Ocean Highway)	9%	63%	5%	6%	2%	3%	9%	65%	6%	3%
	E			US 17 (Ocean Highway)	East of NC 904 (Longwood Road)	8%	58%	3%	3%	2%	2%	8%	60%	3%	2%
	S			NC 904 (Seaside Road)	South of US 17 (Ocean Highway)	8%	53%	4%	3%	1%	1%	8%	55%	4%	1%
	W			US 17 (Ocean Highway)	West of NC 904 (Longwood Road)	8%	57%	3%	3%	2%	2%	8%	55%	3%	2%

[1] *Data extracted from turning movement and class count data collected by VHB in January 2018*

[2] *Data extracted from NCDOT TPB Traffic Survey Group's 2015 Traffic Data Event Shapefile*

Table 5: 2018 Base Year Counts and No-Build Forecast

County	Label	ID	Road Name			Latest Historical NCDOT Data		Historical AADT extrapolated to 2018 (10-year)+	Historical AADT extrapolated to 2018 (15-year)++	2018 Project Specific AADT	2018 Traffic Forecast
			Intersection Location	Route	Selected Segment	Year	AADT			TMC ***	
A	B	C	D	E	F	G	H	J	K	L	M
Formula Calculations						Table 2 - Column V OR W		Table 2 - Column X	Table 2 - Column Y	Table 3 - Column Q	K or L or Manual
Brunswick	N	1	US 17 (Ocean Highway) at NC 904 (Longwood Road/Seaside Road)	NC 904 (Longwood Road)	North of US 17 (Ocean Highway)	2016	4,300	4,000	4,000	4,400	4,400
	E			US 17 (Ocean Highway)	East of NC 904 (Longwood Road)	2015	21,000	19,800	23,800	24,300	24,300
	S			NC 904 (Seaside Road)	South of US 17 (Ocean Highway)	2016	11,000	9,400	12,000	11,200	11,300
	W			US 17 (Ocean Highway)	West of NC 904 (Longwood Road)	2016	25,000	21,000	22,000	23,200	23,200

+ Using 10 year trend line (2007-2016)

++ Using 15 year trend line (2002-2016)

**** Adjusted Project Specific 16-hour Turning Movement Counts - collected in January 2018*

- Traffic Growth Rates

The historical traffic growth along US 17 (Ocean Highway W) shows moderate growth ranging from 0.8-1.1% annually from 2002 – 2016, whereas growth along NC 904 (Longwood Road NW/Seaside Road SW) has ranged from 0.6 – 1.6% annually during the same period. Based upon the recommendation of GSATS staff, this was compared to growth reflected in the GSATS 2040 Model. Model growth along US 17 (Ocean Highway W) was consistent with historical growth in the study area, but the model reflected higher growth along NC 904 (Longwood Road NW/Seaside Road SW). Since the model accounts for anticipated growth along NC 904, the model growth rate for this facility was utilized in the development of the 2045 design year forecast. The resulting traffic growth rates are presented in **Table 6**.

- 2045 Design Year No-Build Forecast

The 2045 Design Year No-Build forecast assumes that the subject project, converting the existing US 17 (Ocean Highway W) & NC 904 (Longwood Road NW/Seaside Road SW) intersection to a superstreet, is not constructed. The percent growth rates were applied to the 2018 No-Build AADT forecast volumes to produce 2045 No-Build AADT forecast volumes. The estimated AADT volumes were adjusted as necessary to ensure the balancing of the intersection volumes and factors. Values in **Table 7** show the results of the growth rates between 2018 and 2045 No-Build scenarios.

Upon establishing the 2045 Design Year No-Build AADT forecast volumes, the intersection was balanced to produce the turning movement forecast volumes. The turning movement percentages were taken from the field data collected in 2018.

The design factors for 2045 Design Year No-Build scenarios were developed based on the 2018 No-Build scenario design factors. Since there is not enough evidence to suggest that the 2045 Design Year No-Build design data in the study area will differ from the existing condition, it is assumed that the design data in the study area are constant between 2018 and 2045.

The forecast diagram presents the 2045 Design Year No-Build AADT forecast volumes and turning movements for the study intersection.

Table 6: Linear Regression and Compound Annual Growth Rate

Source	Label	ID	Route	Selected Segment	Linear Regression Equation	Predicted Volume for 2002	Predicted Volume for 2018	2015 No-Build Model Volume	2040 No-Build Model Volume	Compound Annual Growth Rate
A	B	C	D	E	F	G	H	J	K	L
Formula Calculations					Calculated based on Available Historic Data - See Linear Reg	F (x=2002)	F (x=2018)	F (x=2002)	F (x=2018)	= $[(H/G)^{(1/(2040-2018)}]$-1
Historical AADT	N	1	NC 904 (Longwood Road)	North of US 17 (Ocean Highway)	y = 24.175x - 44694	3,704	4,091	---	---	0.6%
	S		NC 904 (Seaside Road)	South of US 17 (Ocean Highway)	y = 167.1x - 325181	9,353	12,027	---	---	1.6%
	Sum of Y-Lines				---	**13,058**	**16,118**	**---**	**---**	**1.3%**
	E	1	US 17 (Ocean Highway)	East of NC 904 (Longwood Road)	y = 186.6x - 352770	20,803	23,789	---	---	0.8%
	W		US 17 (Ocean Highway)	West of NC 904 (Longwood Road)	y = 222.28x - 426634	18,371	21,927	---	---	1.1%
	Sum of Mainline US 17				**---**	**39,174**	**45,716**	**---**	**---**	**1.0%**
Model	N	1	NC 904 (Longwood Road)	North of US 17 (Ocean Highway)	---	---	---	4,591	11,498	3.7%
	S		NC 904 (Seaside Road)	South of US 17 (Ocean Highway)	---	---	---	8,003	11,165	1.3%
	Sum of Y-Lines				**---**	**---**	**---**	**12,594**	**22,663**	**2.4%**
	E	1	US 17 (Ocean Highway)	East of NC 904 (Longwood Road)	---	---	---	26,263	33,820	1.0%
	W		US 17 (Ocean Highway)	West of NC 904 (Longwood Road)	---	---	---	27,033	41,495	1.7%
	Sum of Mainline US 17				**---**	**---**	**---**	**53,296**	**75,315**	**1.4%**

[1] *Model Mainline Growth calculated as =[Sum(Project Corridor Model Link Volumes in 2040) / Sum(Project Corridor Model Link Volumes in 2015)]^[1/(2040-2015)]-1*

[2] *Model Y-Line Growth calculated as =[Sum(Model Y-Line Link Volumes in 2040) / Sum(Model Y-Line Link Volumes in 2015)]^[1/(2040-2015)]-1*

Table 7: 2045 Design Year No-Build AADT Forecast Volumes and Growth

County	Label	ID	Road Name			2018 Base Year No-Build Forecast Volume	No Build Compound Annual Growth Rate*	2045 No-Build Volume from AAGR	2045 No-Build AADT Forecast Volume
			Intersection Location	Route	Selected Segment				
A	B	C	D	E	F	G	H	J	K
Formula Calculations						Table 5 - Column M	Table 6 - Column L	$G*(1+H)^{(2045-2018)}$	L OR Manual
Brunswick	N	1	US 17 (Ocean Highway) at NC 904 (Longwood Road/Seaside Road)	NC 904 (Longwood Road)	North of US 17 (Ocean Highway)	4,400	2.4%	8,347	8,500
	E			US 17 (Ocean Highway)	East of NC 904 (Longwood Road)	24,300	1.3%	34,440	34,400
	S			NC 904 (Seaside Road)	South of US 17 (Ocean Highway)	11,300	2.4%	21,438	21,400
	W			US 17 (Ocean Highway)	West of NC 904 (Longwood Road)	23,200	1.3%	32,881	32,900

** Note: Annual average growth rate from GSATS model and historical data is used to calculate the future year No-Build forecast volume. Refer to report for details.*

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