Mid-Currituck Bridge
Traffic and Revenue Report

Prepared for:

NORTH CAROLINA
Turnpike Authority

Prepared by:

Stantec

September 29, 2025

Table of Contents

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The North Carolina Turnpike Authority (NCTA) retained Stantec Consulting Services, Inc. (Stantec) to conduct a Level 2 Traffic and Revenue (T&R) study for the proposed Mid-Currituck Bridge (NCDOT STIP Project No. R-2576) between Aydlett and Corolla. If built, the two-lane toll bridge would be the northernmost crossing of Currituck Sound and save substantial mileage and travel time for drivers traveling between the northern parts of the Outer Banks and the mainland. The reduced congestion on the Wright Memorial Bridge (WMB) would also save travel time for those drivers that choose to continue to use the WMB.

Results of this study will be used by NCTA to assess the feasibility of various options and make planning decisions. This study compares two scenarios: a "Base Case" in which NCTA delivers the project, collects tolls, and maintains the express lanes as well as a "High Case" in which a private entity takes on these responsibilities through a Public Private Partnership with the North Carolina Department of Transportation. The assumptions in the High Case reflect a higher risk level acceptable to a private entity, however the actual assumptions used by a concessionaire may differ from those presented herein.

Due to the seasonal nature of the traffic patterns to the Outer Banks, Stantec and its subconsultant, Quality Counts, conducted a data collection program in July 2022 and June 2023, collecting traffic count data, travel time and speed data, as well as origin-destination data. J. Scott Lane, AICP, CPTED, a 30-year veteran of planning and policy based in Raleigh, North Carolina, reviewed the county and TAZ-level inputs to the North Carolina Regional Travel Demand Model Region 17 (NCRTDM R17) and proposed refinements based on the latest available socioeconomic data, a review of local area plans and tax data, as well as interviews with planning officials, rental property companies, and hotels. The forecasts revised by Mr. Lane were reviewed by Stantec and further adjustments were made to reflect a slightly more conservative outlook appropriate for this Level 2 study.

Stantec developed 2030 (pro forma), 2040, and 2050 travel demand models by incorporating the calibration adjustments made to the 2023 model and the revised socioeconomic forecasts into a toll diversion model based off the NCRTDM R17. Stantec estimates that the Mid-Currituck Bridge would generate about 46.3 million transactions and $731 million in gross revenue (in 2023 dollars) for the Base Case in the 50-year period from 2032 through 2081. For the High Case, Stantec estimates the project would generate about 38.8 million transactions and $1.01 billion in gross revenue (in 2023 dollars). The High Case assumes a toll policy that maximizes revenue, resulting in higher toll rates and revenue and fewer transactions. The Base Case annual gross revenue and transactions are shown in Table ES.1.1 and Table ES.1.2, respectively. The High Case annual gross revenue and transactions are shown in Table ES.1.3 and Table ES.1.4, respectively.

Table ES.1.1:Base Case Estimated Annual Gross Toll Revenues, 2032 - 2081 ($2023 thousands)

Base Case	Estimated Annual Revenues w/Ramp Up ($000)				
Year	Passenger Car ETC	Passenger Car CASH	Commercial Vehicle ETC	Commercial Vehicle CASH	Total
2032	$8,028	$1,522	$134	$11	$9,696
2033	$9,172	$1,738	$154	$13	$11,078
2034	$10,333	$1,958	$175	$15	$12,481
2035	$10,964	$2,077	$187	$16	$13,243
2036	$11,052	$2,092	$189	$16	$13,350
2037	$11,141	$2,108	$192	$16	$13,458
2038	$11,230	$2,124	$195	$17	$13,566
2039	$11,320	$2,140	$198	$17	$13,675
2040	$11,411	$2,157	$200	$17	$13,786
2041	$11,461	$2,164	$202	$17	$13,845
2042	$11,511	$2,171	$205	$18	$13,904
2043	$11,562	$2,178	$207	$18	$13,964
2044	$11,613	$2,184	$209	$18	$14,024
2045	$11,663	$2,191	$211	$18	$14,084
2046	$11,714	$2,198	$213	$19	$14,145
2047	$11,766	$2,205	$216	$19	$14,206
2048	$11,817	$2,212	$218	$19	$14,267
2049	$11,869	$2,220	$220	$19	$14,328
2050	$11,921	$2,227	$223	$20	$14,390
2051	$11,969	$2,233	$225	$20	$14,447
2052	$12,018	$2,239	$227	$20	$14,505
2053	$12,066	$2,246	$229	$21	$14,562
2054	$12,115	$2,252	$232	$21	$14,620
2055	$12,164	$2,259	$234	$21	$14,678
2056	$12,214	$2,265	$237	$21	$14,737
2057	$12,263	$2,272	$239	$22	$14,795
2058	$12,313	$2,278	$241	$22	$14,854
2059	$12,362	$2,285	$244	$22	$14,913
2060	$12,413	$2,291	$246	$23	$14,973
2061	$12,463	$2,298	$249	$23	$15,032
2062	$12,513	$2,304	$251	$23	$15,092
2063	$12,564	$2,311	$254	$23	$15,152
2064	$12,615	$2,318	$257	$24	$15,213
2065	$12,666	$2,324	$259	$24	$15,273
2066	$12,717	$2,331	$262	$24	$15,334
2067	$12,769	$2,337	$265	$25	$15,395
2068	$12,820	$2,344	$267	$25	$15,457
2069	$12,872	$2,351	$270	$25	$15,518
2070	$12,924	$2,358	$273	$26	$15,580
2071	$12,977	$2,364	$276	$26	$15,643
2072	$13,029	$2,371	$278	$26	$15,705
2073	$13,082	$2,378	$281	$27	$15,768
2074	$13,135	$2,385	$284	$27	$15,831
2075	$13,188	$2,392	$287	$28	$15,894
2076	$13,241	$2,398	$290	$28	$15,958
2077	$13,295	$2,405	$293	$28	$16,021
2078	$13,349	$2,412	$296	$29	$16,085
2079	$13,403	$2,419	$299	$29	$16,150
2080	$13,457	$2,426	$302	$29	$16,214
2081	$13,512	$2,433	$305	$30	$16,279

Note: First three years of forecast include ramp-up factors of 75, 85, and 95 percent, respectively.

Table ES.1.2: Base Case Estimated Annual Toll Transactions 2032-2081 (thousands)

Base Case	Estimated Annual Transactions w/Ramp Up (000)				
Year	Passenger Car ETC	Passenger Car CASH	Commercial Vehicle ETC	Commercial Vehicle CASH	Total
2032	562	78	5	0	645
2033	641	89	6	0	736
2034	721	100	7	0	828
2035	763	106	7	0	876
2036	768	106	7	0	882
2037	773	107	7	0	887
2038	777	107	7	0	892
2039	782	108	7	0	898
2040	787	109	7	0	903
2041	789	109	8	0	905
2042	790	109	8	0	908
2043	792	109	8	0	910
2044	794	109	8	0	912
2045	796	110	8	0	914
2046	798	110	8	0	916
2047	800	110	8	0	918
2048	802	110	8	0	920
2049	804	110	8	0	922
2050	805	110	8	1	925
2051	807	110	8	1	926
2052	809	111	8	1	928
2053	810	111	9	1	930
2054	812	111	9	1	932
2055	814	111	9	1	934
2056	815	111	9	1	936
2057	817	111	9	1	938
2058	819	111	9	1	940
2059	820	112	9	1	941
2060	822	112	9	1	943
2061	824	112	9	1	945
2062	825	112	9	1	947
2063	827	112	9	1	949
2064	829	112	10	1	951
2065	830	112	10	1	953
2066	832	112	10	1	955
2067	834	113	10	1	957
2068	835	113	10	1	959
2069	837	113	10	1	961
2070	839	113	10	1	962
2071	840	113	10	1	964
2072	842	113	10	1	966
2073	844	113	10	1	968
2074	846	113	11	1	970
2075	847	114	11	1	972
2076	849	114	11	1	974
2077	851	114	11	1	976
2078	852	114	11	1	978
2079	854	114	11	1	980
2080	856	114	11	1	982
2081	858	114	11	1	984

Note: First three years of forecast include ramp-up factors of 75, 85, and 95 percent, respectively.

Table ES.1.3: High Case Estimated Annual Gross Toll Revenues, 2032 - 2081 ($2023 thousands)

High Case	Estimated Annual Revenues w/Ramp Up ($000)				
Year	Passenger Car ETC	Passenger Car CASH	Commercial Vehicle ETC	Commercial Vehicle CASH	Total
2032	$10,532	$1,618	$69	$6	$12,224
2033	$12,096	$1,863	$80	$7	$14,045
2034	$13,700	$2,114	$92	$8	$15,914
2035	$14,614	$2,260	$100	$8	$16,983
2036	$14,810	$2,295	$103	$9	$17,217
2037	$15,009	$2,331	$107	$9	$17,455
2038	$15,210	$2,367	$110	$9	$17,696
2039	$15,414	$2,404	$113	$10	$17,940
2040	$15,620	$2,441	$117	$10	$18,188
2041	$15,732	$2,463	$120	$10	$18,326
2042	$15,845	$2,484	$124	$10	$18,465
2043	$15,959	$2,506	$128	$11	$18,605
2044	$16,074	$2,528	$132	$11	$18,746
2045	$16,189	$2,551	$137	$12	$18,888
2046	$16,306	$2,573	$141	$12	$19,032
2047	$16,423	$2,596	$146	$12	$19,176
2048	$16,541	$2,618	$150	$13	$19,322
2049	$16,660	$2,641	$155	$13	$19,469
2050	$16,780	$2,665	$160	$14	$19,618
2051	$16,875	$2,684	$165	$14	$19,737
2052	$16,970	$2,703	$170	$14	$19,858
2053	$17,066	$2,723	$175	$15	$19,979
2054	$17,163	$2,743	$180	$15	$20,102
2055	$17,260	$2,763	$186	$16	$20,225
2056	$17,358	$2,783	$191	$16	$20,349
2057	$17,457	$2,803	$197	$17	$20,474
2058	$17,555	$2,824	$203	$17	$20,600
2059	$17,655	$2,844	$210	$18	$20,726
2060	$17,755	$2,865	$216	$19	$20,854
2061	$17,856	$2,886	$222	$19	$20,983
2062	$17,957	$2,907	$229	$20	$21,112
2063	$18,058	$2,928	$236	$20	$21,243
2064	$18,161	$2,949	$243	$21	$21,374
2065	$18,264	$2,970	$251	$22	$21,506
2066	$18,367	$2,992	$258	$22	$21,640
2067	$18,471	$3,014	$266	$23	$21,774
2068	$18,576	$3,036	$274	$24	$21,910
2069	$18,681	$3,058	$283	$24	$22,046
2070	$18,787	$3,080	$291	$25	$22,183
2071	$18,893	$3,102	$300	$26	$22,322
2072	$19,000	$3,125	$309	$27	$22,462
2073	$19,108	$3,148	$319	$28	$22,602
2074	$19,216	$3,170	$329	$29	$22,744
2075	$19,325	$3,193	$339	$29	$22,887
2076	$19,435	$3,217	$349	$30	$23,031
2077	$19,545	$3,240	$360	$31	$23,176
2078	$19,656	$3,264	$371	$32	$23,322
2079	$19,767	$3,287	$382	$33	$23,469
2080	$19,879	$3,311	$393	$34	$23,618
2081	$19,992	$3,335	$405	$35	$23,768

Note: First three years of forecast include ramp-up factors of 75, 85, and 95 percent, respectively.

Table ES.1.4: High Case Estimated Annual Toll Transactions 2032-2081 (thousands)

High Case	Estimated Annual Transactions w/Ramp Up (000)				
Year	Passenger Car ETC	Passenger Car CASH	Commercial Vehicle ETC	Commercial Vehicle CASH	Total
2032	449	55	2	0	506
2033	513	63	2	0	579
2034	579	71	2	0	652
2035	614	76	2	0	693
2036	619	77	2	0	699
2037	625	78	3	0	705
2038	630	78	3	0	711
2039	635	79	3	0	717
2040	641	80	3	0	724
2041	644	81	3	0	728
2042	647	81	3	0	732
2043	651	82	3	0	736
2044	654	83	3	0	740
2045	657	83	3	0	744
2046	661	84	3	0	748
2047	664	84	3	0	752
2048	668	85	3	0	756
2049	671	85	4	0	760
2050	675	86	4	0	765
2051	677	87	4	0	768
2052	680	87	4	0	771
2053	682	87	4	0	774
2054	685	88	4	0	777
2055	687	88	4	0	780
2056	690	89	4	0	783
2057	692	89	4	0	786
2058	695	90	4	0	790
2059	698	90	5	0	793
2060	700	91	5	0	796
2061	703	91	5	0	799
2062	705	92	5	0	803
2063	708	92	5	0	806
2064	711	93	5	0	809
2065	713	93	5	0	812
2066	716	94	5	0	816
2067	718	95	6	0	819
2068	721	95	6	0	822
2069	724	96	6	0	826
2070	726	96	6	0	829
2071	729	97	6	0	832
2072	732	97	6	0	836
2073	734	98	7	0	839
2074	737	98	7	0	843
2075	740	99	7	0	846
2076	743	99	7	0	850
2077	745	100	7	1	853
2078	748	100	8	1	857
2079	751	101	8	1	860
2080	754	102	8	1	864
2081	756	102	8	1	867

Note: First three years of forecast include ramp-up factors of 75, 85, and 95 percent, respectively.

Abbreviations and Acronyms

AAA	American Automobile Association
AADT	Average Annual Daily Traffic: The annual amount of traffic passing through a location divided by 365.
ACS	American Community Survey
ATR	Automatic Traffic Recorder
BEA	US Bureau of Economic Analysis
BLS	United States Bureau of Labor Statistics
CAGR	Compound Annual Growth Rate: The year-over-year growth rate of an investment over a specified period of time.
CPI-U	Consumer Price Index for All Urban Consumers
CBP	County Business Patterns
E-I	External-Internal
ECUBBR	East Carolina University Bureau of Business Research
ETC	Electronic Toll Collection
HBO	Home-Based-Other
HBW	Home-Based-Work
INRIX	A global company which provides a variety of Internet services and mobile applications pertaining to road traffic and driver services.
LEHD	Longitudinal Employer-Household Dynamics
LODES	Origin-Destination Employment Statistics
MCB	Mid-Currituck Bridge
MD	Midday (10 AM-3 PM)
MPO	Metropolitan Planning Organization
MTP	Metropolitan Transportation Plan
MSA	Metropolitan Statistical Area
NCDOT	North Carolina Department of Transportation

NCTA	North Carolina Turnpike Authority
NHB	Non-Home-Based
NT	Nighttime (7 PM-6 AM)
O/D	Origin-Destination
ODME	Origin and Destination Matrix Estimation
OES	Occupational Employment Statistics
PPP or P3	Public-Private Partnership
QCEW	Quarterly Census of Employment and Wages
RMSE	Root Mean Squared Error
T&R	Traffic and Revenue
TAZ	Traffic Analysis Zone: The discrete geographic structure used as the basis for travel demand models.
TCRP	Transit Cooperative Research Program
TDM	Toll Diversion Model
TOD	Time-of-day
VOT	Value of Time
VBO	Visitor-Based-Other
VMT	Vehicle-Miles Traveled
W&P	Woods and Poole Economics
WBB	Washington Baum Bridge
WMB	Wright Memorial Bridge

1.0 INTRODUCTION

The North Carolina Turnpike Authority (NCTA) retained Stantec Consulting Services, Inc. (Stantec) to prepare this Level 2 update to the 2018 Investment-grade Traffic and Revenue (T&R) Study for the proposed Mid-Currituck Bridge (MCB). The MCB is part of NCDOT STIP Project No. R-2576 and is a proposed new two-lane tolled bridge in Currituck County crossing the Currituck Sound between Aydlett on the mainland and Corolla on the Outer Banks.

1.1 STUDY PURPOSE

The purpose of this Level 2 study is to conduct a comparative analysis of the project under a traditional public (Base Case) and a potential P3 (High Case) delivery. This study includes forecasts of likely toll traffic and gross toll revenues for both financing scenarios for calendar years 2032 (estimated opening year) through 2081. The T&R results from this project will be appropriate for planning and investigations into financial feasibility; they are not appropriate for a public project financing.

1.2 PROJECT DESCRIPTION

The Outer Banks, a stretch of peninsulas and barrier islands located off the coast of North Carolina and Virginia, are popular beach-front vacation destinations that attract tourists from the surrounding region and nationwide, particularly during the warmer months of the year. The MCB is part of NCDOT STIP Project No. R-2576 and is a proposed new two-lane tolled bridge in Currituck County crossing the Currituck Sound between Aydlett on the mainland and Corolla on the Outer Banks. The project area for this study includes the northern Outer Banks area and extends from the North Carolina/Virginia border south to Kitty Hawk and includes the Currituck County peninsula on the mainland and its Outer Banks, as well as the Dare County Outer Banks. The Currituck County peninsula is bounded by Camden County and the North River on the west, the Albemarle Sound on the south, and the Currituck Sound on the east. The Outer Banks are bounded by the Currituck Sound on the west and the Atlantic Ocean on the east. The project area is south of the Virginia Beach-Norfolk, Virginia (Hampton Roads) metropolitan area.

In the project area, US 158 is the primary north-south route on the mainland and NC 12 is the primary north-south route on the Outer Banks. The Wright Memorial Bridge (WMB) is part of US 158 and connects the mainland with the Outer Banks. Additional access to this area of the Outer Banks includes the Washington Baum Bridge (WBB), located about 16 miles to the south of the WMB – and ferry service to Hatteras and Ocracoke Islands, located over 75 miles to the south of the WMB. The local governments have proposed the construction of a tolled (third) bridge crossing, the Mid-Currituck Bridge (MCB) in Currituck County, to improve access to the northern Outer Banks. The project is included in the most recent NCDOT State Transportation Improvement Plan (STIP) as Project No. R-2576.

1.3 CONSULTANT TEAM

Stantec led the T&R Study team and was responsible for project management, coordination, data collection, calibration and validation of the T&R forecasting models, and forecasting traffic and gross toll revenues for the MCB.

Several firms assisted Stantec in the preparation of this Study:

- J. Scott Lane, AICP, CPTED, provided an independent review of the socioeconomic conditions; future population, employment, and land use development were forecasted.
- Quality Counts provided traffic volume and vehicle classification data using automatic traffic recorders (ATRs) at select locations within the study area and conducted video surveys to capture volumes and vehicle classifications. Quality Counts also conducted travel time runs in the study area. All of these efforts were prescribed by Stantec.
- StreetLight Data, Inc., a big data analytics provider, provided detailed origin-destination data for study area trips including those using the existing WMB and WBB crossings to and from the Outer Banks for June (Shoulder), July (Peak), and Oct-Apr (Off-Peak) during 2021-2022. These data were vetted and summarized by Stantec for use in the development of the travel demand model.

1.4 ORGANIZATION OF THE REPORT

The remainder of this report is organized in the following chapters:

Chapter 2 – Existing Traffic Trends and Characteristics. This chapter describes the existing transportation facilities in the study area and defines baseline traffic conditions for these roads. This includes a summary of traffic counts, travel time data, and other information used in developing the forecasts.

Chapter 3 – Socioeconomic Review and Forecasts. This chapter describes historical trends as well as existing and forecasted socioeconomic conditions, and the assumptions used to assess future development in the study area.

Chapter 4 – Travel Demand and Toll Diversion Modeling. This chapter explains the methodology used to produce travel demand forecasts for the MCB. The toll diversion model developed by Stantec and the results of the model validation are also described.

Chapter 5 – Toll Traffic and Gross Revenue Forecasts. This chapter presents the T&R forecasts for the MCB project and summarizes the assumptions and conditions used in preparing those forecasts.

2.0 EXISTING TRAFFIC TRENDS AND CHARACTERISTICS

2.1 EXISTING PROJECT STUDY AREA

The project study area shown in **Figure 2.1** encompasses the Outer Banks within North Carolina, the mainland areas of North Carolina just west of the Outer Banks, and northward into the Chesapeake/Norfolk/Virginia Beach areas of Virginia. The existing transportation facilities can be categorized as follows:

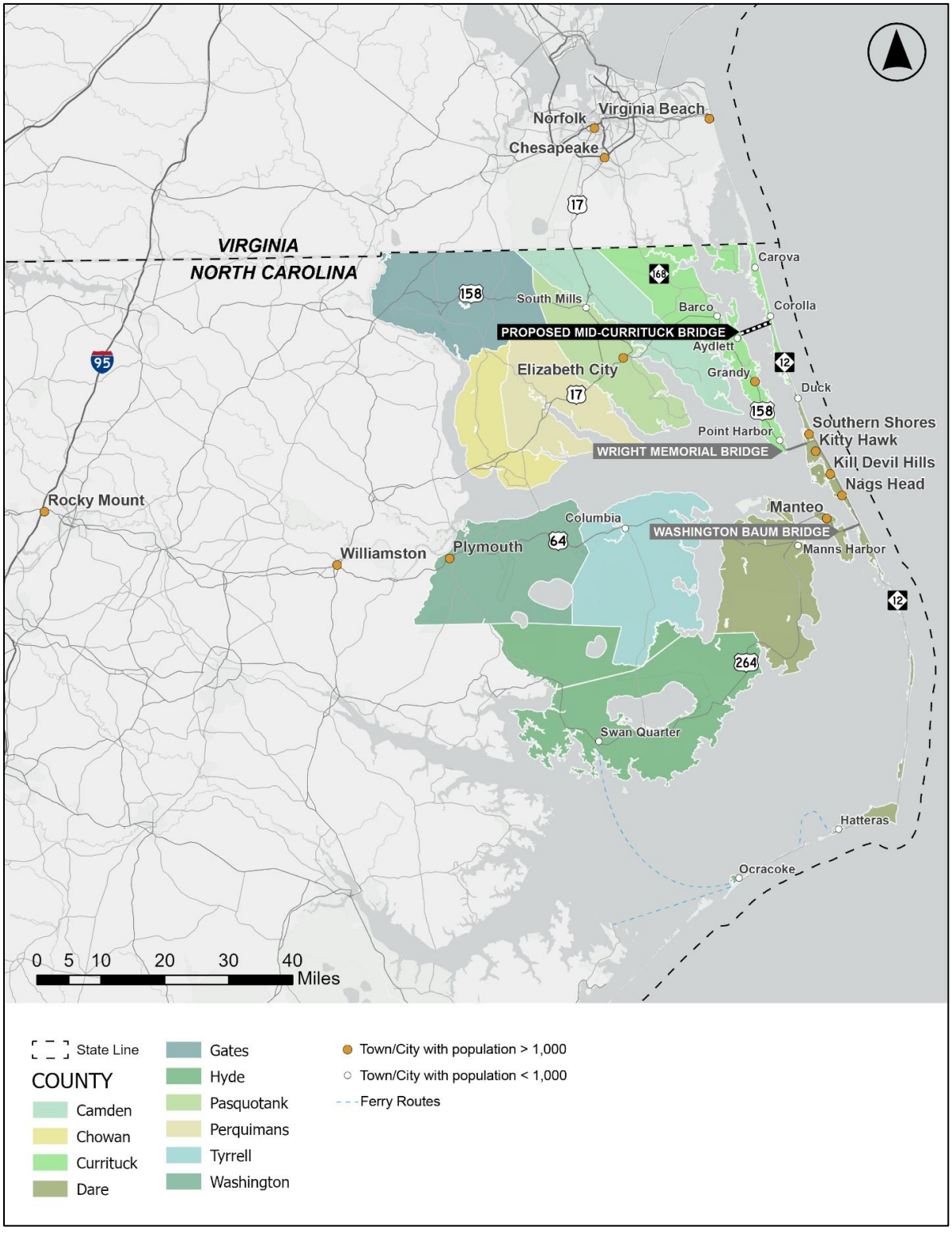
- The existing crossings including the Wright Memorial Bridge (WMB), part of US 158, which connects the mainland with the Outer Banks; the Washington Baum Bridge (WBB), located about 16 miles to the south of the WMB; and ferry service to Hatteras and Ocracoke Islands, located over 75 miles to the south of the WMB.

- The major roadways on the Outer Banks including US 158 and NC 12.

- The major roadways on the mainland that provide access to the existing bridges to the Outer Banks. US 158, NC 168, VA 168, and US 17 connect the northern and western areas of North Carolina and Virginia to the WMB. US 64 and US 264 provide access to the Outer Banks from the western and southern portions of North Carolina and states to the south via the WBB. I-95 provides access to these routes for long distance trips.

These study area roadways are shown in **Figure 2.1** and are discussed in detail in the following sections.

Figure 2.1: Project Study Area



2.1.1 Existing Crossings

Two bridges currently serve most of the traffic directly to and from the Outer Banks: the WMB (US 158) and the WBB (US 64). Ferry service is also provided between the mainland and the Outer Banks from both Cedar Island and Swan Quarter to Ocracoke; however, ridership is minimal compared to the bridge volumes. There is also an intra-Outer Banks ferry service between Ocracoke and Hatteras.

2.1.1.1 Wright Memorial Bridge

The non-tolled WMB is part of US 158 and is currently the northernmost crossing to the Outer Banks. The bridge connects Point Harbor on the mainland with Kitty Hawk and Southern Shores on the Outer Banks. Each span of the 2.8-mile double-span bridge consists of two 12-foot lanes with no shoulder. The bridge has a posted speed limit of 55 miles per hour (mph). In 2023, the WMB carried 55 percent of the total bridge crossing traffic onto the Outer Banks. The WMB predominantly serves vehicles arriving from regions located to the northwest and north, including large metropolitan statistical areas in the northeast United States such as Virginia Beach/Norfolk, Washington DC/Arlington, Philadelphia/Camden, and New York/Newark.

The discussion of existing traffic in this report is primarily focused on trips currently using the WMB since these trips have the greatest potential to divert to the proposed MCB.

2.1.1.2 Washington Baum Bridge

The non-tolled WBB is part of US 64 and comprises the southernmost bridge crossing to the Outer Banks. It is located to the east of the 5.5-mile Virginia Dare Memorial Bridge (the US 64 Bypass), which crosses over the Croatan Sound from Manns Harbor (on the mainland) in the west to Roanoke Island (Manteo) in the east. The WBB is the eastern crossing of US 64 over Roanoke Sound between Roanoke Island (Manteo) and the Outer Banks, where it connects to US 158 and NC 12 in Nags Head. It is just over one mile long, contains two 12-foot lanes in each direction with no shoulder, and has a posted speed limit of 55 mph. One must travel over both the Virginia Dare Memorial Bridge (or the outlying Manns Harbor Bridge) and the WBB to travel from the mainland to the Outer Banks. These bridges primarily serve vehicles arriving from the south, southwest, and west regions such as Raleigh and Charlotte in North Carolina, South Carolina, Georgia, and Florida. The WBB carried the other 45 percent of the total bridge crossing traffic onto the Outer Banks in 2023; however, much of this traffic reflects movements between Roanoke Island (Manteo) and the Outer Banks.

For the purposes of this study, the analysis and discussion refer to the WBB in a secondary manner. Because of the existing topography of the mainland and the access routes available to the existing bridges, few current trips are likely to divert from the WBB to the proposed MCB.

2.1.1.3 Ferry Service

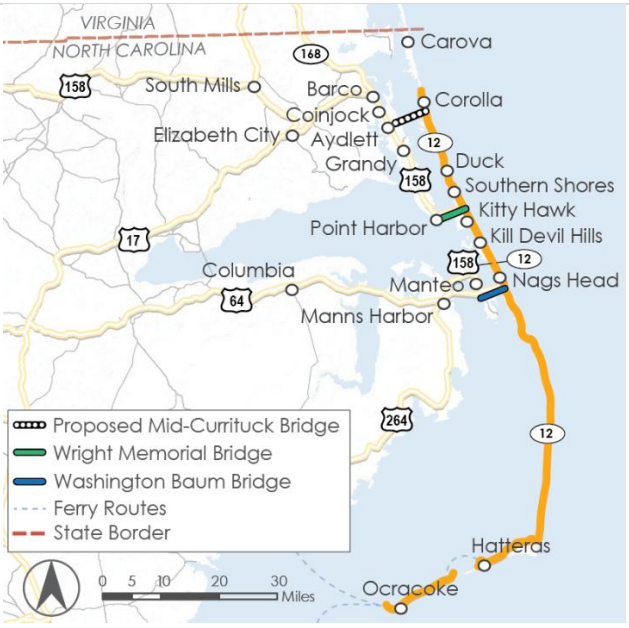
Ferry services from Cedar Island and Swan Quarter, on the mainland, to Ocracoke Island, an island in the Outer Banks, operate year-round. Ocracoke Island is not accessible from the mainland via roadways. An additional free ferry operates from the northern tip of Ocracoke Island to Hatteras to access the northern Outer Banks including the towns of Kitty Hawk and Duck. The ferry routes and their respective trip lengths and one-way fares are as follows:

- Cedar Island to Ocracoke – 2 hours, 15 minutes ($15 fare),
- Swan Quarter to Ocracoke – 2 hours, 40 minutes ($15 fare), and
- Ocracoke Island to Hatteras – 1 hour (no fare).

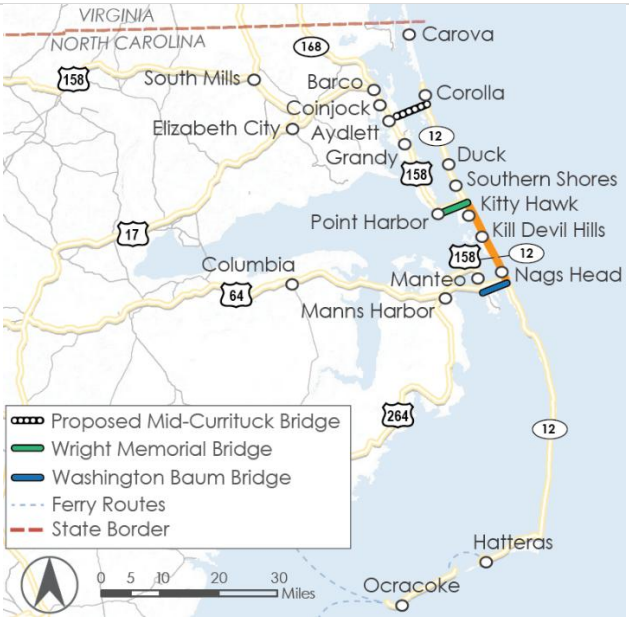
Ferry ridership from Cedar Island and Swan Quarter (on the mainland) to Ocracoke Island (on the Outer Banks) represents a very small portion of the traffic arriving on the Outer Banks from the mainland. No diversions from the existing ferry services to the proposed MCB are expected.

2.1.2 Roadways on the Outer Banks

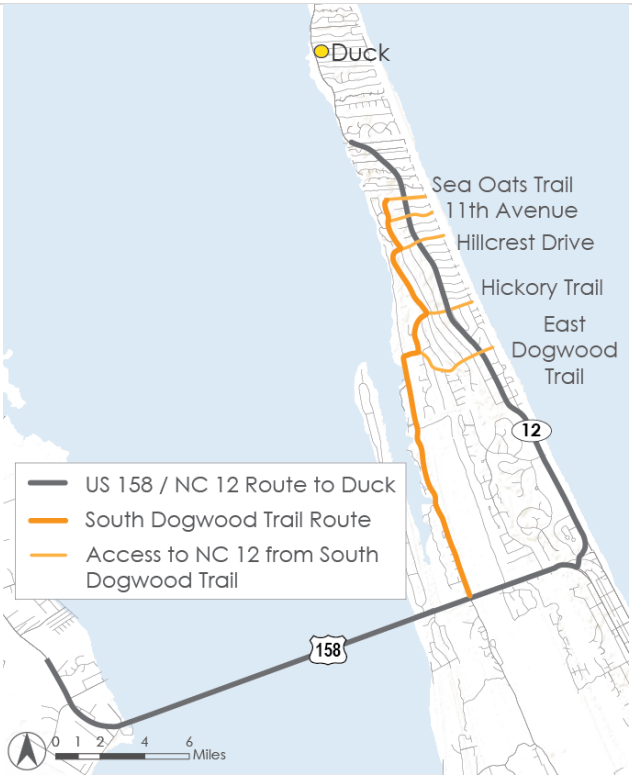
NC 12 is a two-lane state highway. It spans the entire length of the Outer Banks (about 110 miles), from Corolla in the north to Ocracoke in the south. Note that there is no continuous roadway between Hatteras and Ocracoke, this section is serviced via ferry. The posted speed limit ranges from 25 to 55 mph and is typically 35 mph within residential areas. NC 12 is the only north-south thoroughfare from Corolla to Kitty Hawk and is also referred to as Ocean Boulevard. In this area, NC 12 has residential development along most of its length with commercial development concentrated in Duck and Corolla. NC 12 is known as Virginia Dare Trail south of Southern Shores and is characterized by residential development and some limited commercial development. South of the WBB, NC 12 continues south on the Marc Basnight Bridge (formerly known as the Herbert C. Bonner Bridge) toward Hatteras. In this area, development is primarily residential.



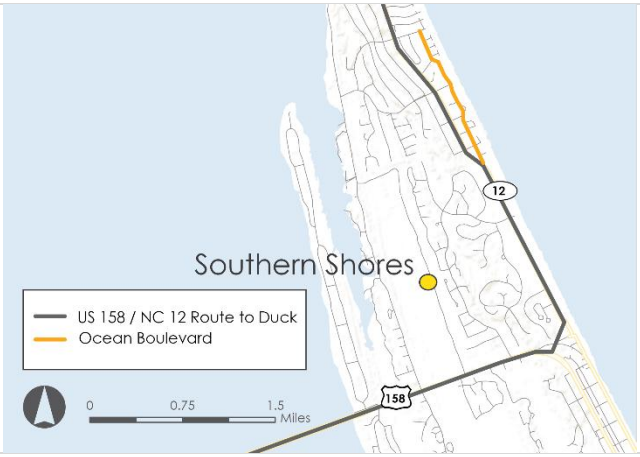
US 158 on the Outer Banks is a 16-mile north-south highway, known locally as Croatan Highway, that connects the WMB through Kitty Hawk, Kill Devil Hills, and Nags Head, to the WBB. It runs parallel to, and west of, NC 12 and is the most traveled roadway on the Outer Banks. The posted speed limit on this four-lane divided highway is 50 mph along the Outer Banks. Most of the larger scale commercial and retail development on the Outer Banks are located along US 158.



South Dogwood Trail is a residential two-lane street with a 25-mph speed limit. It extends north from US 158 near the eastern approach to the WMB and connects to East Dogwood Trail, Hickory Trail, Hillcrest Drive, 11th Avenue and Sea Oats Trail. These five intersecting routes provide access to NC 12. Sea Oats Trail is the northernmost access point to NC 12 from South Dogwood Trail and is located about one mile south of the Duck town center. The low speed limit and narrow roadway limit travel speeds on this route, but it is used by some travelers as an alternative to NC 12 during periods of significant congestion. Vehicles turning left onto NC 12 from the South Dogwood Trail outlets cause congestion to worsen on NC 12.



Ocean Boulevard is a residential two-lane street with a 25-mph speed limit. It extends north from NC 12, runs parallel to and east of NC 12, and connects to Hickory Trail. Travelers may use this route as an alternative to NC 12 to access the residential developments along the coast.

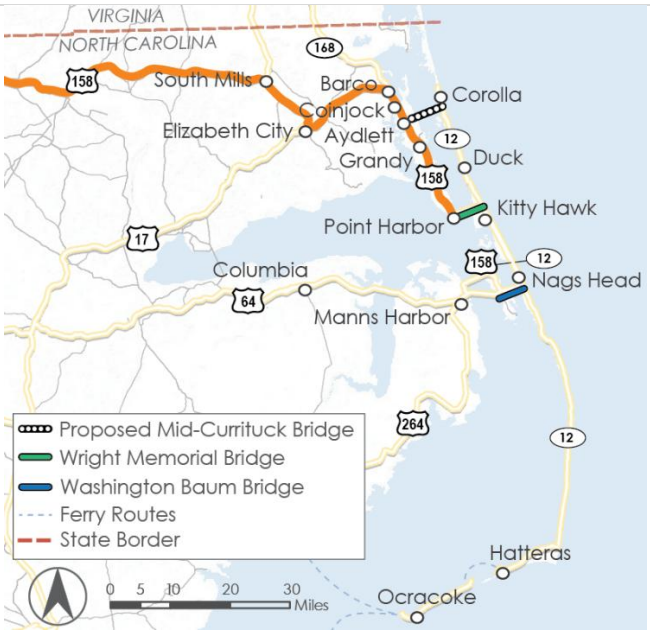


2.1.3 Mainland Roadways

2.1.3.1 Mainland Roadways Approaching the Wright Memorial Bridge

US 158 extends westward about 28 miles over the WMB from the Outer Banks and travels in a north-south direction through Point Harbor, Grandy, Aydlett and Coinjock to Barco. In this area, US 158 is a four-lane highway with a center turning lane that mainly passes through rural areas with pockets of development. There are two signalized intersections in Grandy. US 158 merges with NC 168 in Barco. To the west of Barco, US 158 is an east-west, four-lane highway that passes through Elizabeth City. It continues west to I-95, through Winston-Salem, and terminates in Mocksville, NC.

The speed limit ranges from 45 to 55 mph along the length of US 158 within the study area.



NC 168 is a north-south, four-lane highway extending between the Virginia State Line and US 158 for about 34 miles. NC 168 is signalized, and the posted speed limit varies between 45 and 55 mph.

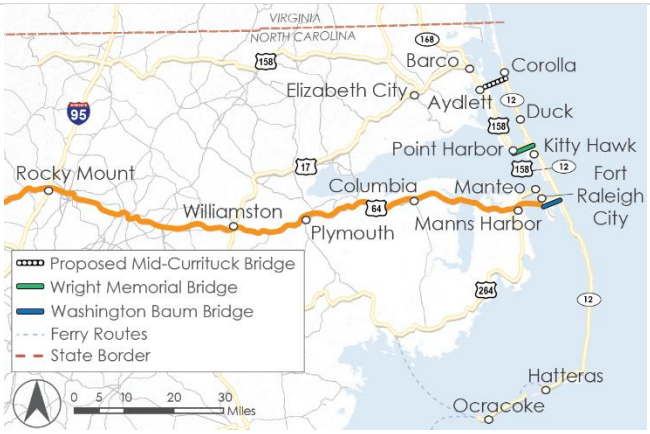
North of the State Line, the roadway is known as **VA 168**. Vehicles traveling from Chesapeake / Norfolk / Virginia Beach use this facility to access the Outer Banks. The southern six miles of this unsignalized highway comprises the Chesapeake Expressway, a toll road. Since May 2021, passenger car tolls for this facility are $9.00 on weekends from mid-May to mid-September and $4.00 at all other times.

North of US 158, **US 17** is a north-south, four-lane highway that runs parallel to NC 168 from the Chesapeake area, along the Great Dismal Swamp, to Elizabeth City. In this area, the highway is unsignalized with posted speed limits between 45 and 70 mph. US 17 connects to US 158 in Elizabeth City.

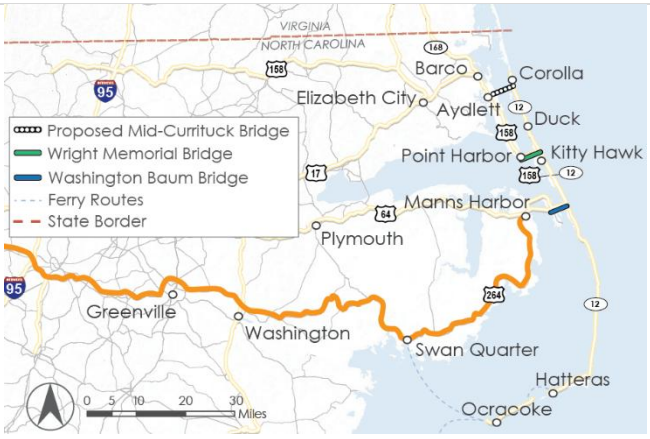
South of US 158, **US 17** is a four-lane facility between Elizabeth City and US 64 in Williamston. Within Elizabeth City, US 17 is a signalized arterial through commercial areas with a posted speed limit of 45 mph. South of Elizabeth City, US 17 is a signalized four-lane highway with a posted speed limit between 45 and 70 mph. South of Williamston, US 17 is a two-lane facility that traverses primarily rural communities, before veering to the southwest and generally following the coastline through North Carolina and states to the south.

2.1.3.2 Mainland Roadways Approaching the Washington Baum Bridge

US 64 is an east-west highway. It is primarily unsignalized with a posted speed limit ranging from 55 to 70 mph. In North Carolina, US 64 extends from Cherokee County through Rocky Mount and Plymouth as a four-lane divided highway. From Columbia to the US 264 intersection, US 64 is a two-lane highway. The roadway splits in Manns Harbor. To the north, it becomes the Manns Harbor Bridge, a two-lane highway connecting to Fort Raleigh City on Roanoke Island. To the east, it becomes the US 64 Bypass/Virginia Dare Memorial Bridge, a four-lane divided highway. The two roads merge in Manteo and US 64 continues eastward over the WBB. US 64 provides direct access to the Outer Banks from I-95.

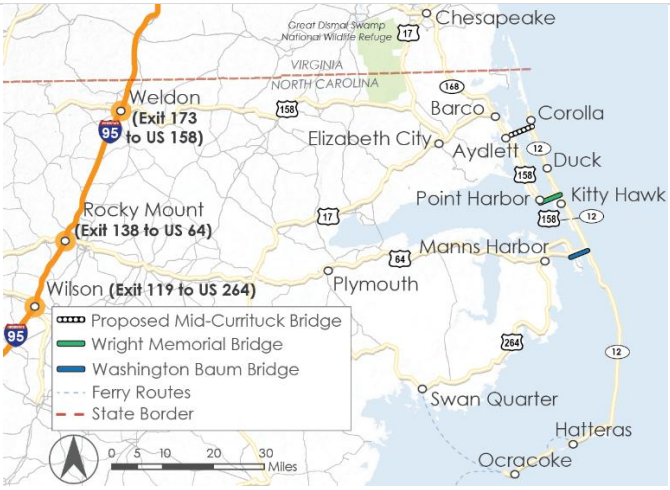


East of Washington, North Carolina, **US 264** is a two-lane roadway with limited signals east of Washington, North Carolina. It runs east-west from Raleigh through Greenville, Washington, and Swan Quarter before terminating at US 64 in Manns Harbor. Like US 64, US 264 provides direct access to I-95.



2.1.3.3 Mainland Roadways Facilitating Interstate Movements

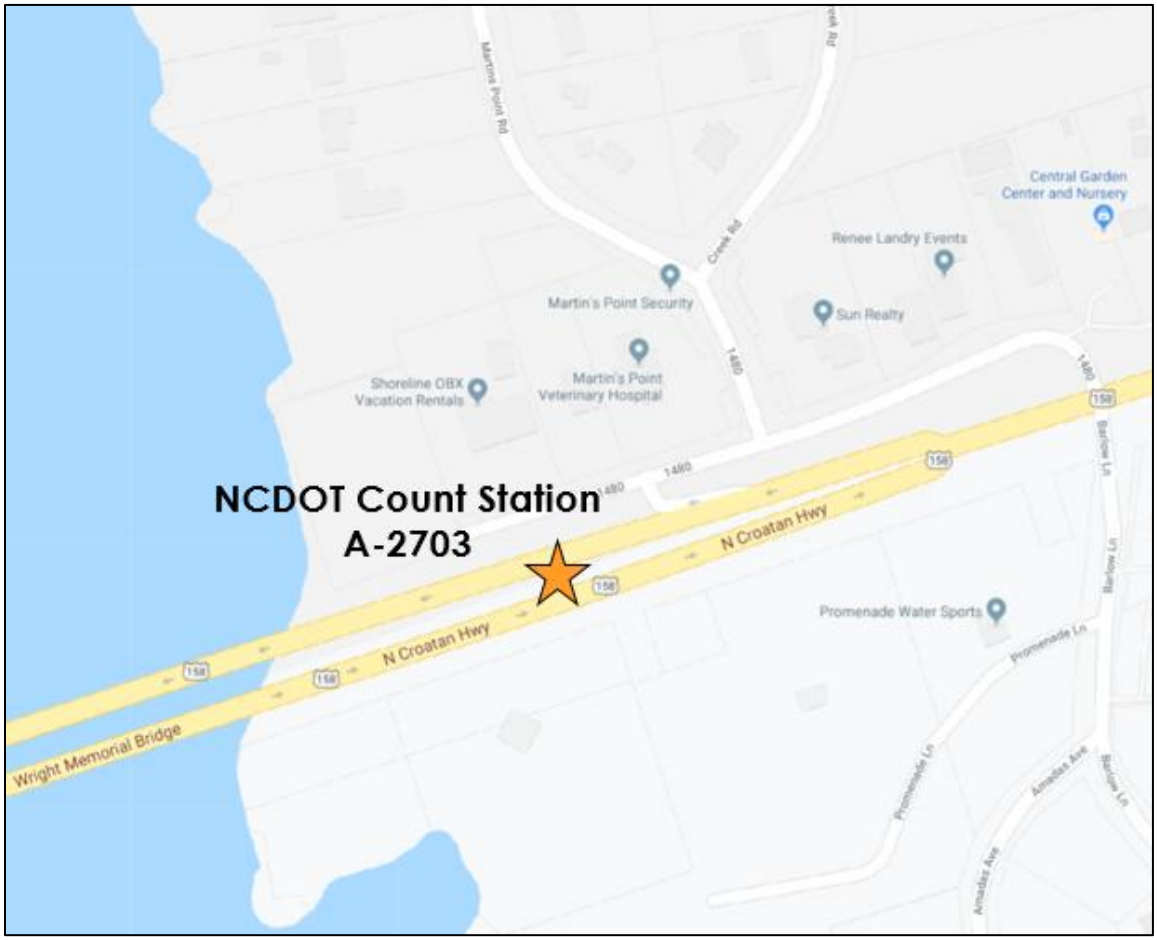
I-95 is a north-south divided interstate highway. It extends along the eastern United States from Maine to Florida, traversing both North Carolina and Virginia. The posted speed limit is 70 mph in this region. I-95 connects to US 158 (at Exit 173), US 64 (at Exit 138) and US 264 (at Exit 119); these three principal roadways lead to the WMB and WBB. As such, it provides access for long distance interstate travel to the Outer Banks.



2.2 HISTORICAL TRAFFIC ON THE WRIGHT MEMORIAL BRIDGE (WMB)

Historical count data from NCDOT's permanent count location A-2703 were analyzed to determine traffic volumes and yearly growth, and to establish the seasonality of the traffic volumes in the study area. NCDOT permanent count location A-2703 is located on US 158 at the east end of the WMB, approximately 0.2 miles west of Barlow Lane as shown in **Figure 2.2**.

Figure 2.2: NCDOT Permanent Count Station A-2703 Location



Map Data: Google, 2019.

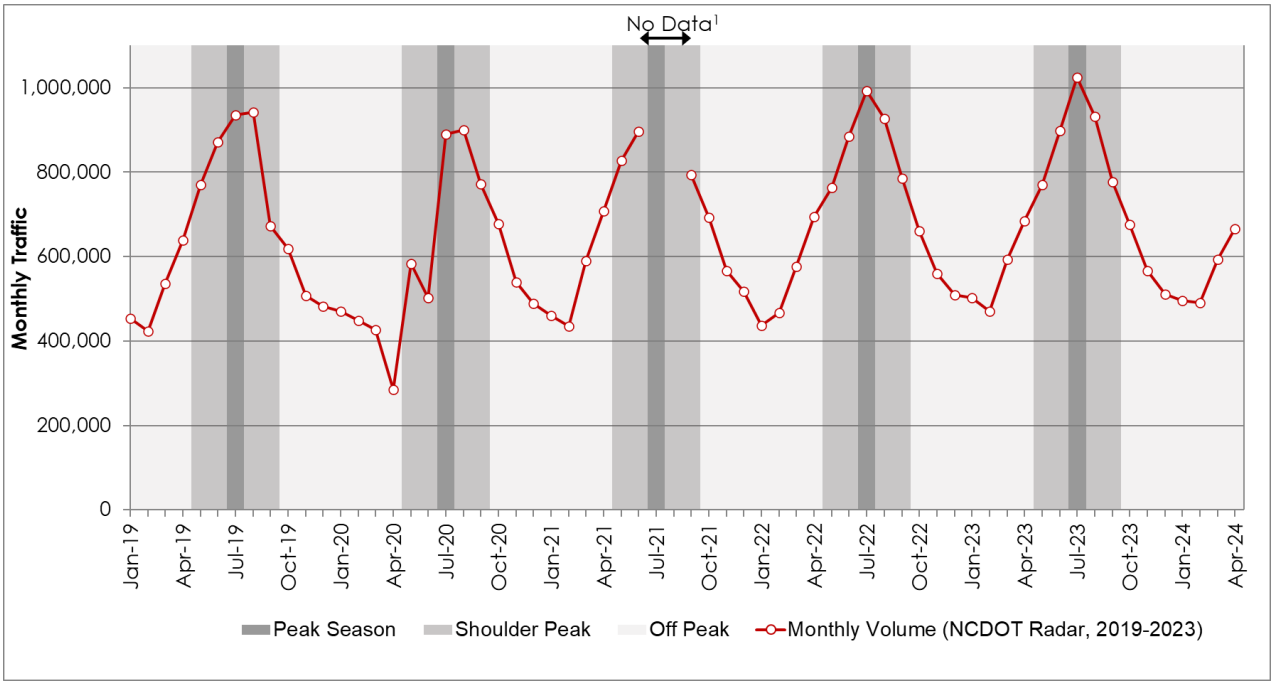
2.2.1 Seasonal Traffic Patterns by Month

As shown in **Figure 2.3**, the monthly historical traffic data between January 2019 and April 2024 indicate that traffic volumes on the WMB generally trended upwards. Volumes decreased in 2020 due to the pandemic but quickly recovered by 2021.

Historically, the crossing volumes have significant seasonal variation. Monthly traffic volumes in April are about 250,000 - 300,000 vehicles fewer than the 900,000 or more vehicles crossing in July. (The exception was in 2020 when COVID-19 impacted travel patterns in the area.) The significant seasonality of traffic volumes in the study area was a key factor, along with rental occupancy rates, in dividing the data collection program into three distinct seasons. The Peak season was identified as the eight full weeks between about June 16th and August 15th. The Shoulder season envelops the Peak season and consists of six full weeks before and six full weeks after the Peak season. The Off-Peak season encompasses the rest of the year, generally from the beginning of October to the end of April. Since 2022, traffic crossing the WMB has recovered to pre-COVID

levels. In July 2023, the WMB recorded a new historic peak with more than 1,000,000 vehicle crossings.

Figure 2.3: Total Historical Monthly Traffic Volumes on the WMB

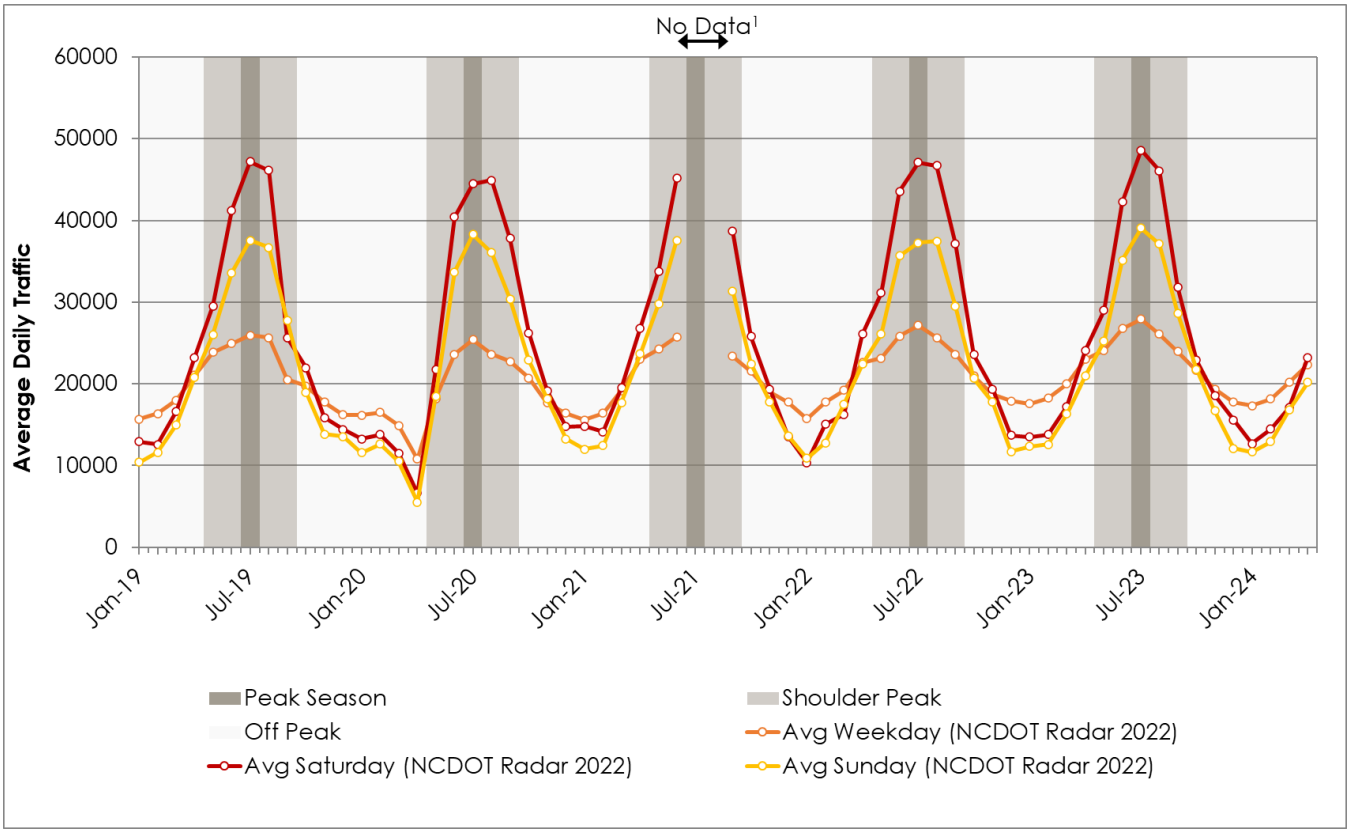


[1] Volumes for July 2021 – August 2021 not available due to construction. Note that crossing data from March 2020 to December 2020 are atypical due to COVID-19 pandemic's impact.

2.2.2 Seasonal Traffic Patterns by Day

The historical data from the NCDOT permanent count location indicate that traffic volumes on the WMB differ significantly by day of the week, and that these variations are different by season. During the Peak and Shoulder seasons, Saturdays are the most traveled day of the week. Historically, 60 to 70 percent of the Peak and Shoulder housing rental contracts are weekly and begin and end on a Saturday. During the Peak season, about two times more vehicles (about 20,000 vehicles) cross the WMB on a Saturday as compared to an average Peak season weekday. During the Shoulder season, the difference between Saturday and weekday average volumes ranges from about 5,000 to 15,000 vehicles. During the Off-Peak season, when tourism is at its lowest levels and local residents make up most vehicular traffic, the highest volumes over the WMB occur on an average weekday. On a seasonal basis, three to four times more vehicles cross the WMB on a Saturday in the Peak season compared to a Saturday during the Off-Peak season. Since COVID, there has been an effort to encourage vacation homeowners to consider changing these start/end rental days to Fridays and Sundays as work-from-homes policies are more common and these days have seen higher traffic volumes than pre-COVID. The differences in travel by season and by day of week are shown in **Figure 2.4.**

Figure 2.4: Historical Average Daily Total Traffic Volumes on the WMB by Day Type



[1] Volumes for July 2021 – August 2021 not available due to construction.

2.3 DATA COLLECTION PROGRAM

Existing traffic data were collected via field surveys designed specifically for this project in 2016, 2017, 2018, 2022, and 2023. Field surveys were conducted to collect traffic volume, classification, turning movement, and travel speed data in all three distinct travel seasons: Off-Peak, Shoulder, and Peak. A full traffic data collection program was completed in 2016 in all three seasons; traffic volumes were collected again during the Peak season in 2017 to supplement the 2016 data. Traffic and speed data were collected for all three seasons in 2018 for additional analysis and to determine whether any significant changes to traffic conditions had occurred over the two-year period. The 2017 and 2018 Peak and Shoulder season data collection dates were chosen to coincide with the 2016 data collection periods. Traffic and speed data were collected for the Peak season in 2022 and the Shoulder season in 2023. The exact dates of the field surveys are summarized in **Table 2.1**.

The following subsections of this chapter discuss the trends from 2022-2023, the most recent data available, unless otherwise noted. Off-Peak volumes for 2023 are estimated herein based on trends and relationships between Peak and Off-Peak volumes crossing the WMB in previous years.

Table 2.1: Seasonal Traffic Data Collection Field Survey Dates by Year

Data Collection Dates by Year					
Season	**2016**	**2017**	**2018**	**2022**	**2023**
Peak	July 11th – 17th	July 14th – 23rd	July 16th – 22nd	July 15th – 24th	N/A
Shoulder	June 6th – 12th	N/A	June 3rd – 9th	N/A	June 5th – 11th
Off-Peak	April 18th – 24th	N/A	Oct 19th – 25th	N/A	N/A

2.3.1 Traffic Volume, Classification, Turning Movement and Transponder Surveys

Traffic volumes in the study area were collected using automatic traffic recorders (ATRs) at the locations shown in **Figure 2.5**. Data was collected 24 hours per day for a 7-day period during the Shoulder season and a 10-day period during the Peak season. Generally, the locations were divided into four sub-sets: counts on the bridge facilities (2 locations); counts on the mainland approach roads (five to six locations, depending on the collection year); counts on the main roads on the Outer Banks (nine to eleven locations, depending on the collection year); and counts on the backroads to capture traffic avoiding NC 12 congestion (up to nine locations, depending on the collection year). A detailed description of each of the ATR count locations and collection periods is shown in **Table 2.2**. Total volume data were collected at each ATR location; classification counts were also collected via ATR at the WMB (ATR 15), just north of the WMB on NC 12 (ATR 16), and south of the WMB on US 158 (ATR 9).

Vehicular movements on NC 12 and US 158, the main Outer Banks roadways, were also identified by collecting turning movement counts at two key signalized intersections. Most vehicles crossing the WMB and heading to locations north of the bridge use NC 12. At the intersection of US 158 (Croatan Highway) and NC 12, vehicles arriving via the WMB and destined for Southern Shores and points further north must turn left. They then travel straight through the next intersection, NC 12 at Virginia Dare Trail. In 2016, the turning movements were video-recorded from 7 AM through 7 PM, Friday through Monday, in each season. Seven hours of volume and classification data from the 12 hours of recorded data for each day were reviewed and summarized. In 2017, 2018 , and 2023 the collection program summarized 15 hours of turning movement counts from 6 AM to 9 PM.

Figure 2.5: ATR and Turning Movement Count Locations

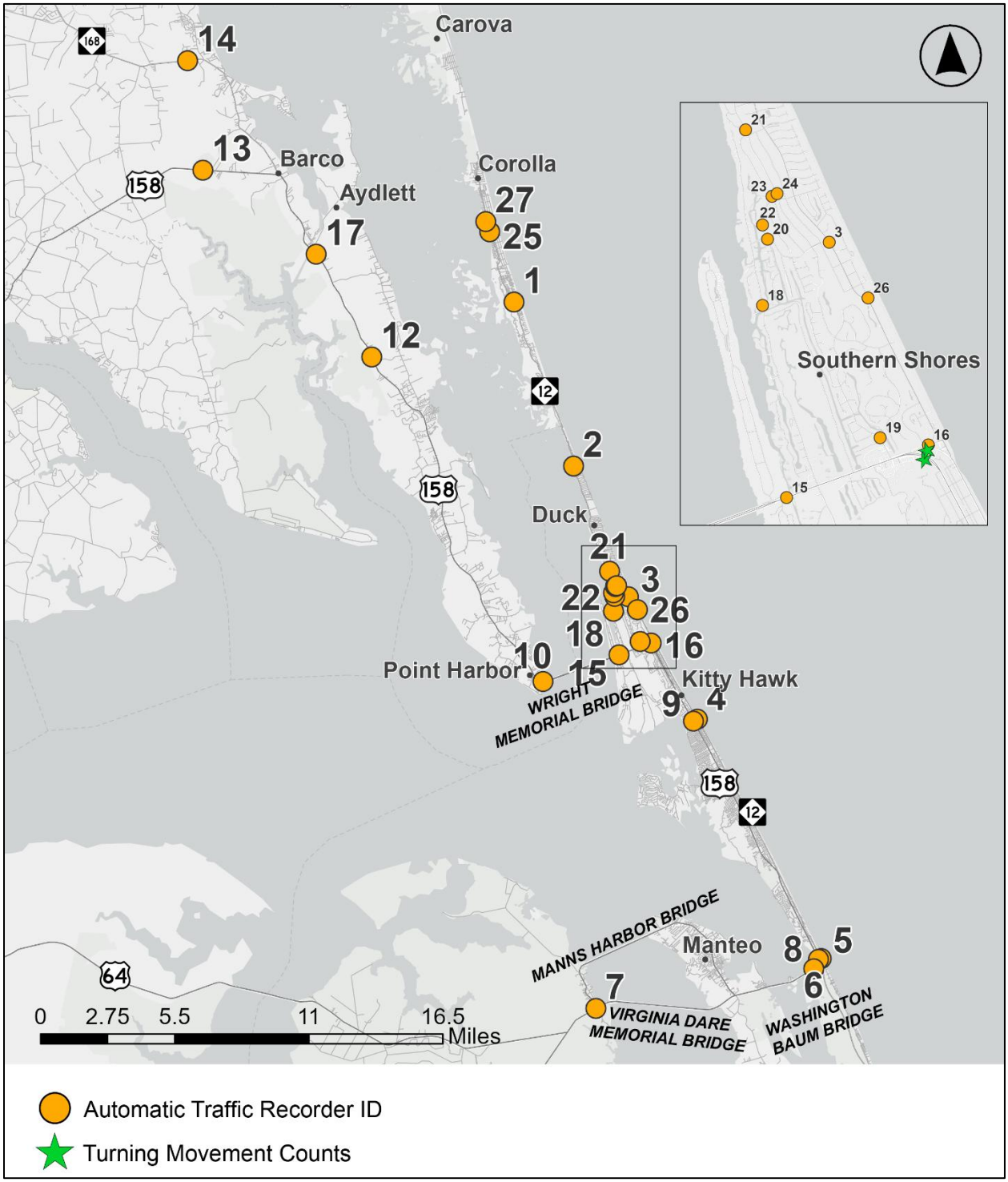


Table 2.2: ATR Locations for the Traffic Data Collection Field Surveys

Location	ATR Number	Count Description	Count Location		
			2018 (all seasons)	2022 Peak	2023 Shoulder
OBX North	1	NC 12 N of Sandfiddler Trl	x	x	x
	2	NC 12 N of Oyster Catcher Ln	x	x	x
	3	NC 12 S of E. Dogwood Trl (between Dogwood Trl and Dolphin Run)	x	x	x
	15	US 158 E of Barlow Ln (US 158 E of Martins Point Rd)	x	x	x
	16	NC 12 N of Virginia Dare Trl	x	x	x
	27	NC 12 S of Herring St			x
OBX South	4	NC 12 N of Arch St	x	x	x
	5	NC 12 S of Gray Eagle St	x	x	x
	6	US 158 S of Gray Eagle St	x	x	x
	7	US 64 W of Shipyard Rd	x	x	x
	8	US 64 W of Whalebone Junction (W of Oceans East Bait and Tackle)	x	x	x
	9	US 158 N of Arch St	x	x	x
Mainland	10	US 158 E of Albtuck Rd	x	x	x
	12	US 158 N of Marshall Grandy Lane	x	x	x
	13	US 158 W of Currituck County Airport	x	x	x
	14	NC 168 E of Dozier Rd	x	x	x
	17	US 158 N of Waterlily Rd	x	x	x
Backroads	18	S Dogwood Trl N of Tall Pine Ln	x	x	x
	19	Juniper Trl N of Palmetto Ln		x	x
	20	Dogwood Trl Between Hickory Trl and Woodland Dr		x	x
	21	Sea Oats Trl N of Hillcrest Dr		x	x
	22	Hickory Trl N of Dogwood Trl		x	x
	23	Hillcrest Dr N of Hickory Trl		x	x
	24	Sea Oats Trl N of Hickory Trl		x	x
	25	NC 12 N of Harbor View		x	
	26	Ocean Blvd N of NC 12		x	

Note: Classification counts were also collected at the WMB (ATR 15), just north of the WMB on NC 12 (ATR 16), and south of the WMB on US 158 (ATR 9).

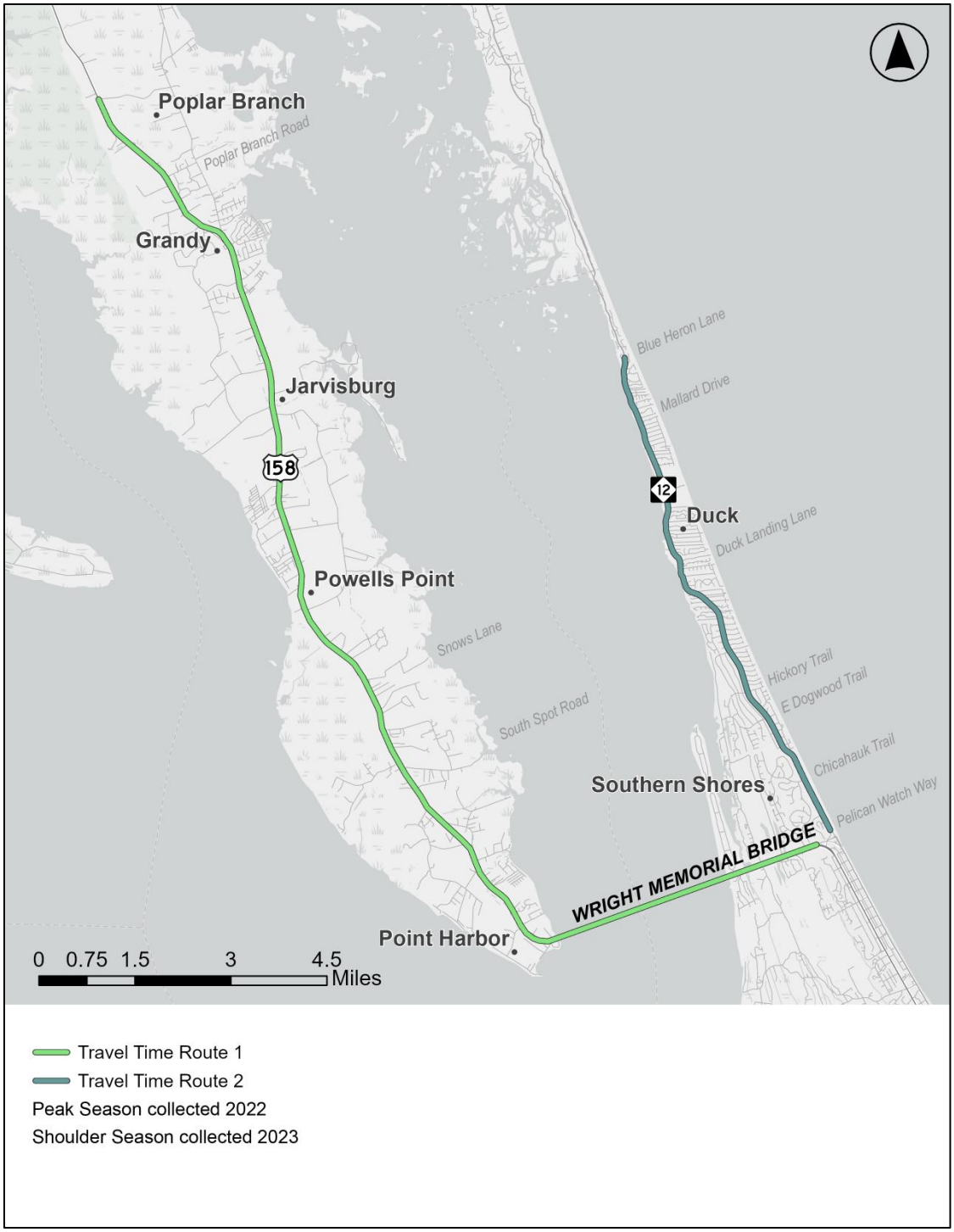
2.3.2 Travel Time and Speed Surveys

Travel times and speeds were collected along two different routes in the study area during the Peak season in July 2022 and the Shoulder season in June 2023. Vehicles with GPS-based equipment were driven in the normal flow of traffic. The GPS equipment recorded the latitude and longitude coordinates for every one to five seconds of the trip. The coordinates were then post-processed; segment lengths were used to determine average travel times and speeds for each route. Information was collected on four days during the AM peak, MD, and PM peak periods. The two routes, as depicted in **Figure 2.6**, are:

- **Route 1** (Collected in 2022 Peak season and 2023 Shoulder season): US 158 on the mainland between NC 136 near Poplar Branch, (crossing the WMB) and the NC 12 / US 158 intersection, near the east end of the WMB.

- **Route 2** (Collected in 2022 Peak season and 2023 Shoulder season): NC 12 between Pelican Watch Way in Kitty Hawk and Blue Heron Lane in Duck.

Figure 2.6: 2022-2023 Travel Time and Speed Survey Routes



2.3.3 Origin and Destination Data

Origins and destinations for trips crossing the WMB and WBB were analyzed using information received from StreetLight Data, a company that provides large sets of travel movement records. Over seven billion location records are processed each month to develop a series of travel metrics sourced from connected vehicle data, aggregated GPS data, commercial vehicle GPS data and location-based services mobility data.

For this 2023 study, travel records encompassing the period from June 2021 to April 2022 were obtained from StreetLight Data. These were the most recent data available from StreetLight Data. These data are from during the COVID-19 pandemic and while the number of trips may have been affected by the pandemic, Stantec does not anticipate the distribution of the origins and destinations would be affected. Stantec identified twenty-three separate zones as possible origins or destinations, with 19 on the Outer Banks and 4 zones outside the study area. The data were aggregated into three seasons:

- Peak season: July 2021
- Shoulder season: June 2021
- Off-Peak season: October 2021 through April 2022

Each dataset was separated out by day type (Weekday, Saturday and Sunday) and by time period (the AM Peak, 6 AM to 9 AM; the Midday, 9 AM to 3 PM; the PM Peak, 3 PM to 6 PM; and the Night, 6 PM to 6 AM). Stantec vetted and summarized the data, which are provided in a relative index format, and then expanded the data to the actual volumes in the study area.

2.4 FIELD OBSERVATIONS

Visual observations of weekend congestion levels were made during each of the survey weeks in 2016, 2017, 2018, 2022 and 2023.

- During the Off-Peak season surveys, weekend traffic across the WMB was free flow at all times. Normal traffic queues at the signalized intersections of US 158 (Croatan Highway) at NC 12 and NC 12 at Virginia Dare Trail were observed. Minimal delays were recorded on NC 12 south of Duck town center.

- NC 12 features a curve that is signed with warning notices and a speed limit decrease from 35 mph to 25 mph at the southern approach to Duck. This causes a reduction in travel speed at this location, even in the Off-Peak season.

- During Shoulder season Saturday traffic surveys, normal traffic queues were observed at the signalized intersections of US 158 (Croatan Highway) at NC 12 and NC 12 at Virginia Dare Trail. Some congestion was noted south of the Duck town center due to the higher traffic volumes, increased pedestrian activity, and higher left-turning volumes onto NC 12 from the side streets, as compared to the Off-Peak season. The additional traffic volumes

caused congestion, slowing travel speeds in the area south of Duck town center. Traffic was generally lower on Sunday as compared to Saturday, however 2023 volumes show that Sunday traffic is higher than in pre-COVID times, as more rental contracts have switched to Sunday arrival/departures.

- On Saturday during the Peak season surveys in 2016 and 2017, congestion was observed on the mainland approaching the Outer Banks, crossing the WMB, and along NC 12 north of the WMB, particularly in the northbound direction. Queues began to build along NC 12 south of Duck town center (Area C in **Figure 2.7**) due to the high traffic volumes, pedestrian activity, and high left-turning volumes onto NC 12 from the side streets. This section of roadway is only one lane per direction. There are frequent pedestrian crossings and left- and right-turning vehicles to/from side streets and driveways lining the route that substantially affect travel speeds in this area. Many vehicles headed to the northern Outer Banks try to avoid NC 12 congestion and use the "neighborhood" streets such as South Dogwood Trail that are parallel to NC 12 and then turn onto NC 12 farther downstream. These vehicles cause queues on the neighborhood streets and reduce speeds south of Duck as they merge back into NC 12 traffic. Northbound NC 12 queues in this area (between Areas B and C, as noted in **Figure 2.7**) extended the entire length of NC 12 from the Duck town center south to the intersection of NC 12 and Virginia Dare Trail (Area B) starting around 8AM on Saturday. During the Saturday surveys, police were directing traffic at the intersection between US 158 and NC 12 (Area A) from 8 AM to 4 PM, overriding the left-turn signal to allow more vehicles to travel through the intersection than the signal alone would allow. The queues from the left-turning vehicles could not be cleared for most of the day between 8 AM and 4 PM due to downstream congestion on northbound NC 12. These left-turning queues continued to build along US 158 west of the intersection with NC 12, over the WMB, and onto the mainland through Area D. The longest queues on US 158 were experienced during the morning and midday periods.

- On Saturday in the 2022 Peak season and 2023 Shoulder season, there was generally no congestion observed on the mainland, other than short back-ups at traffic lights. Some queueing was observed at the intersection on the east side of the WMB, at South Dogwood Trail, also generally due to the traffic light and vehicles turning left onto South Dogwood Trail to try to bypass NC 12 congestion. Local police have set up variable message signs to deter people from turning left onto South Dogwood Trail. The volume turning left was less than in previous years, however there still were vehicles that used this route and turned left onto NC 12 south of the Duck town center, contributing to the congestion along NC 12.

- During all Peak season data collection years, Saturday southbound traffic on NC 12 heading toward the WMB was observed to be heavier than on a weekday or Sunday. Since this roadway has only one lane per direction, a slow-moving vehicle can quickly cause queues to form upstream as there is no opportunity for passing due to heavy northbound congestion. In 2022, there was more Sunday, southbound congestion on NC

12 than in 2017 and 2018, as more rental contracts occur on Sundays than in the pre-COVID years.

- The abnormal heavy rain during the week of the 2018 Peak season data collection program resulted in atypical Saturday travel patterns. On a typical Saturday, people checking into rental properties often arrive early and spend time on the Outer Banks shopping, eating, or on the beach before the property check-in can occur. Similarly, the people checking out of rental properties often spend time at the beach after check-out. The heavy rain caused visitors to arrive later and leave earlier than a typical Peak season Saturday. Also, as many outdoor activities were canceled, day-trippers and people employed as part of these activities did not travel over the bridge. As such, queuing was not observed at the two signalized intersections (Areas A and B in **Figure 2.7**) for most of the day. There were still very congested conditions observed in the area south of Duck for most of the day.

Figure 2.7: Field-observed Congestion Areas During a Peak Season Saturday

2.5 2022-2023 TRAFFIC VOLUMES

2.5.1 Traffic Volumes on Key Mainland Travel Routes US 158 and NC 168

The primary mainland route to the WMB is US 158. Similarly, US 158 would serve as the primary route to the proposed MCB. Average 2022-2023 mainland daily traffic volumes in the Shoulder and Peak seasons, as collected during the respective data collection programs, are shown in **Figure 2.8** for weekdays and **Figure 2.9** for Saturdays. As shown:

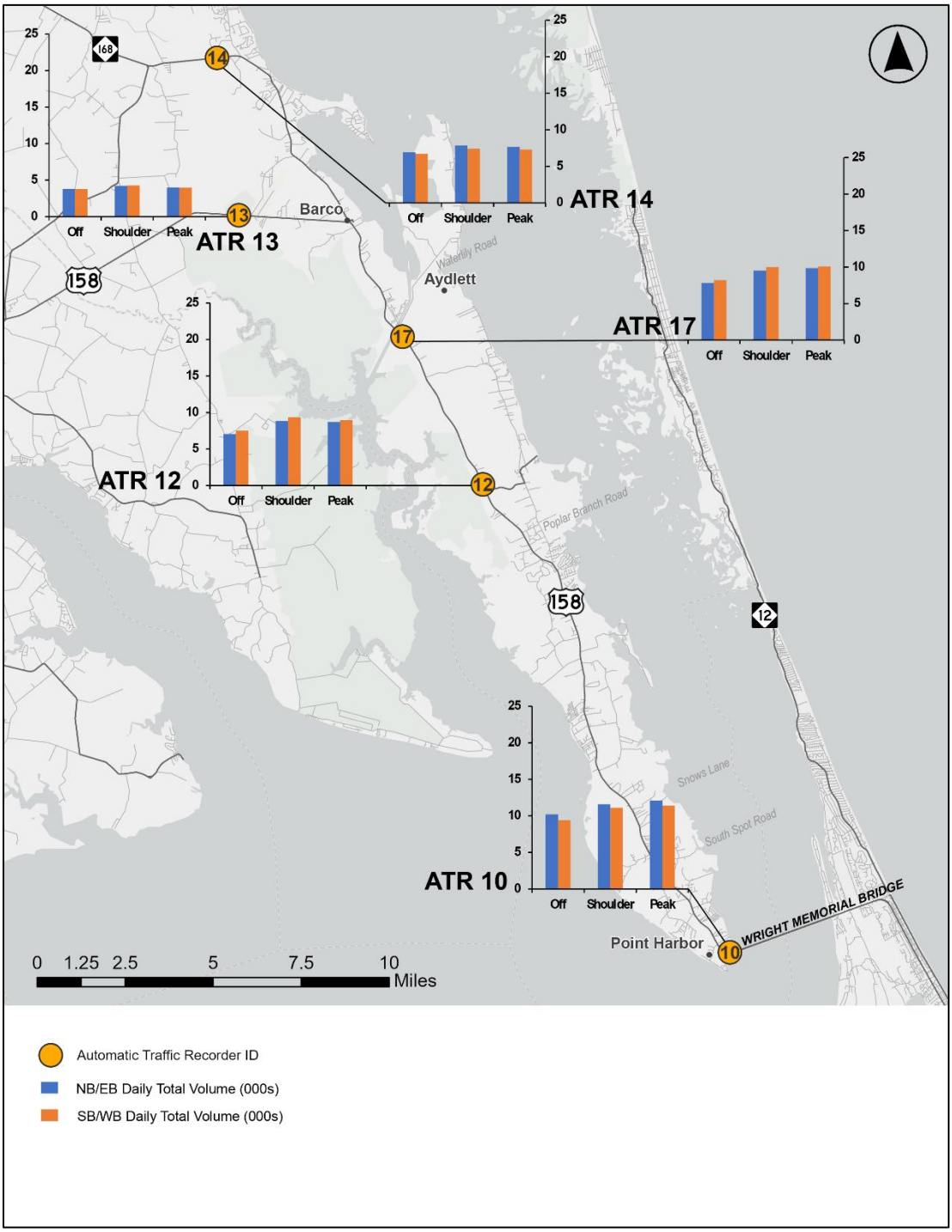
- Near Barco, weekday volumes on US 158 to the west (ATR 13) are much lower than volumes on NC 168 to the north (ATR 14). Volumes on US 158 west of Barco (ATR 13) show less variation by day (average weekday vs. average Saturday) or by season.

- Weekday volumes on NC 168 north of Barco (ATR 14) show slight increases in the Shoulder and Peak seasons. The highest weekday volume occurs during the Shoulder season.

- Average Saturday volumes on NC 168 north of Barco (ATR 14) are much higher than on an average weekday and vary significantly by season. Peak season Saturday volumes are more than twice the average Off-Peak Saturday volume. The higher Peak season Saturday volumes reflect the addition of recreational travel. The higher variability on NC 168 (ATR 14) compared to US 158 (ATR 13) indicates that more of the recreational travel originates from the north than the west.

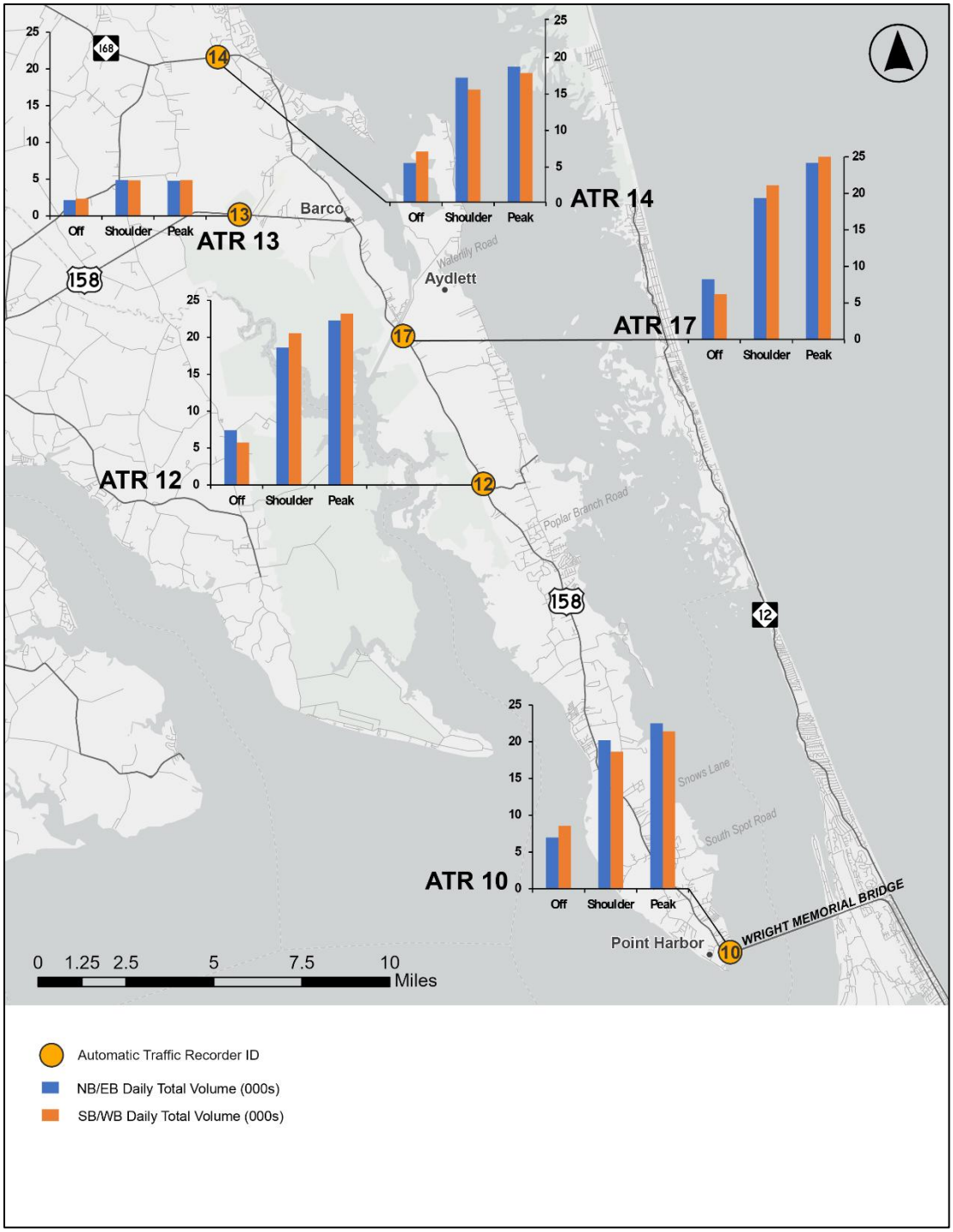
- On US 158 south of Coinjock (ATR 17, ATR 12 and ATR 10), similar patterns exist as on NC 168 north of Barco. Average weekday volumes show slight increases with the seasons. Peak season volumes are generally the highest. Average Saturday volumes are significantly higher than the average weekday volumes and are more pronounced in the Shoulder and Peak seasons.

Figure 2.8: 2022-2023 Average Weekday Mainland Traffic Volumes on US 158 and NC 168



Note: Data collected during 2022-2023 field surveys. Traffic volumes not counted during Off-Peak season. Off-Peak traffic volumes developed from 2018 Off-Peak volumes based on WMB growth since 2018.

Figure 2.9: 2022-2023 Average Saturday Mainland Traffic Volumes on US 158 and NC 168



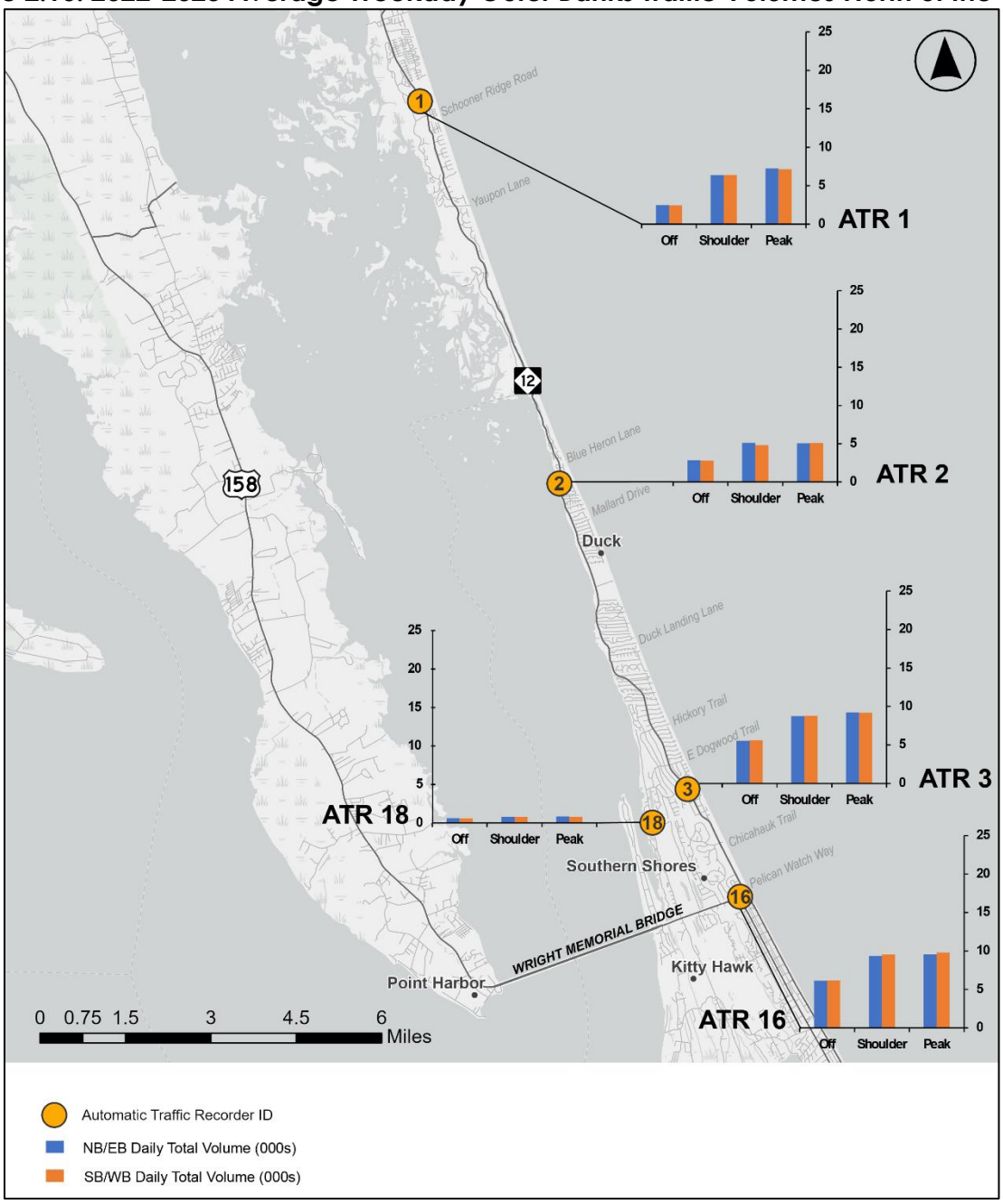
Note: Data collected during 2022-2023 field surveys. Traffic volumes not counted during Off-Peak season. Off-Peak traffic volumes developed from 2018 Off-Peak volumes based on WMB growth since 2018.

2.5.2 Traffic Volumes on Key Outer Banks Travel Routes

Figure 2.10 and **Figure 2.11** show the average weekday and Saturday volumes, respectively, on NC 12 north of the WMB (ATR's 1, 2, 3 and 16) and on S. Dogwood Trail (ATR 18) for each season. Traffic volumes generally decrease going north, further from the WMB, although volumes at ATR 1 are somewhat higher than ATR 2, due to traffic movements in the Corolla town center. At most locations, the Peak season has the highest volumes. The exception is at ATR 3 and ATR 16 on Saturdays in the northbound direction; Shoulder counts are slightly higher than the Peak season as some visitors may be trying to avoid severe Saturday congestion on NC 12 and take local routes through this area instead.

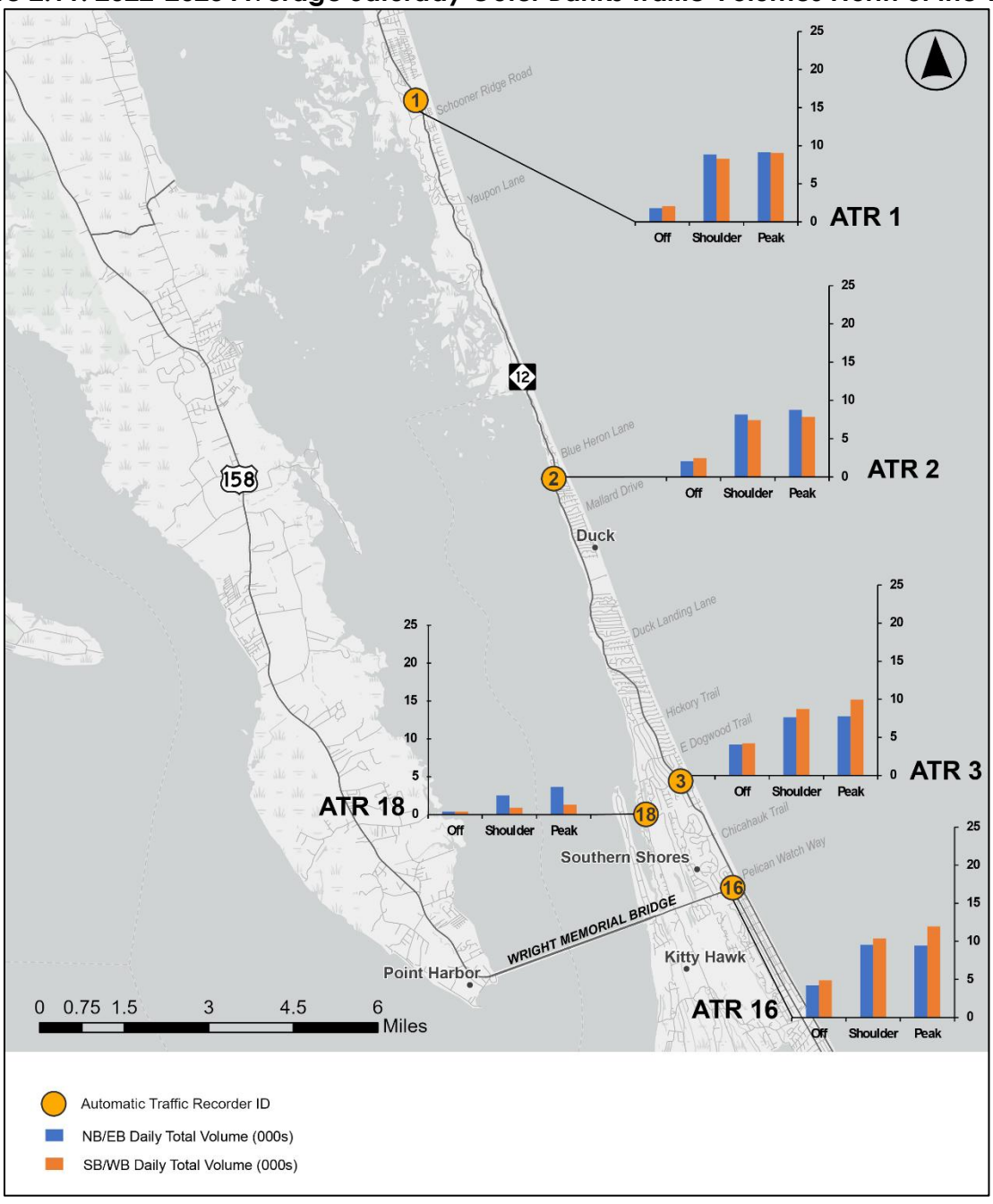
During the data collection and field studies, it was noted that during the Peak and Shoulder seasons, travelers will use the narrow, winding residential streets on the Outer Banks as an alternative to the congested NC 12. The main alternative route is South Dogwood Trail, which runs parallel to NC 12 to the west, from the WMB approach to as far north as Sea Oats Trail, a distance of about 3.75 miles. Vehicles turning on to NC 12 from one of the South Dogwood Trail outlets are a significant contributor to the congestion on NC 12. **Figure 2.12** shows the South Dogwood Trail route using Sea Oats Trail to cross over to NC 12.

Figure 2.10: 2022-2023 Average Weekday Outer Banks Traffic Volumes North of the WMB



Note: Data collected during 2022-2023 field surveys. Traffic volumes not counted during Off-Peak season. Off-Peak traffic volumes developed from 2018 Off-Peak volumes based on WMB growth since 2018.

Figure 2.11: 2022-2023 Average Saturday Outer Banks Traffic Volumes North of the WMB



Note: Data collected during 2022-2023 field surveys. Traffic volumes not counted during Off-Peak season. Off-Peak traffic volumes developed from 2018 Off-Peak volumes based on WMB growth since 2018.

Figure 2.12: Location of South Dogwood Trail Alternative Route to Avoid US 158 / NC 12 Congestion

Use of this alternative route is most pronounced on Peak and Shoulder season Saturdays, when congestion on NC 12 is the greatest, making travel times on South Dogwood Trail comparable to NC 12. **Figure 2.13** shows the variation in traffic volumes on South Dogwood Trail across days of the

week and for the Peak and Shoulder seasons. Northbound traffic reaches a high of over 3,500 vehicles on Saturdays in the Peak season. Traffic volumes on South Dogwood Trail are lower on weekdays and weekends during the Shoulder season. Stantec noted that smartphone guidance apps direct vehicles to this alternative route when there is even a minute time differential. Also, in 2023, it was noted that local authorities have tried to discourage use of South Dogwood Trail via signage but field observations indicated that some vehicles were not deterred and were still using this route. It should be noted that when travel time runs along the back roads were completed on a Shoulder Saturday in 2023, the estimated travel time was considerably understated in the Google Maps app, indicating that the route's travel time benefit over NC-12 was overstated.

Figure 2.13: 2022-2023 Average Daily Vehicular Traffic Volumes on South Dogwood Trail

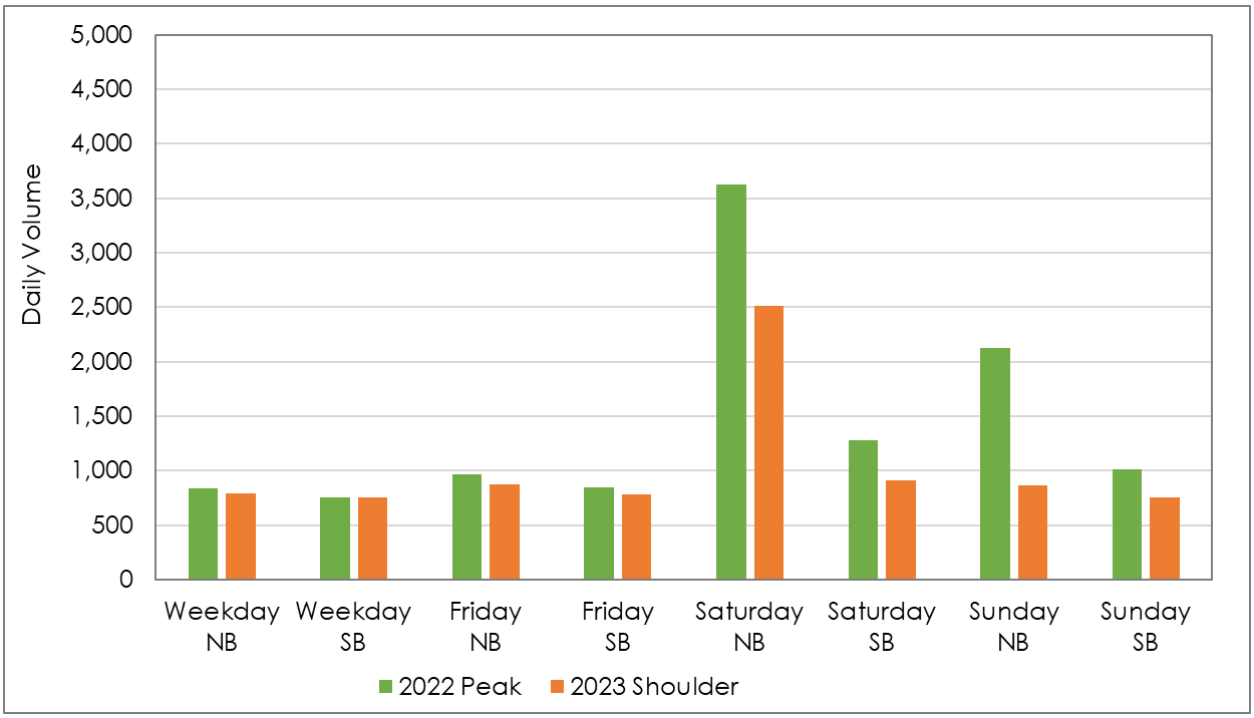
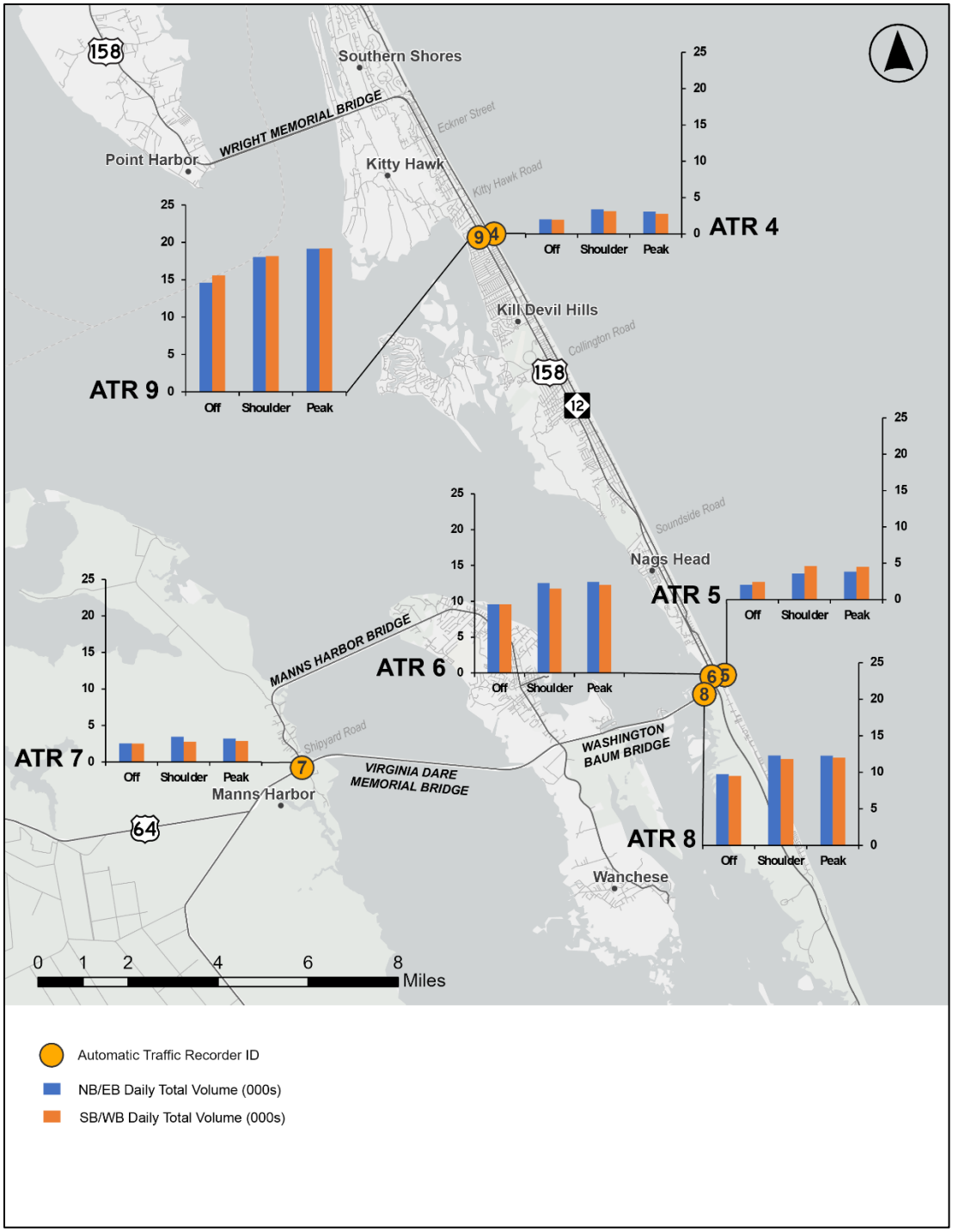


Figure 2.14 and **Figure 2.15** show the average weekday and Saturday volumes, respectively, on the major arterials south of the WMB for each season. The following trends are noted:

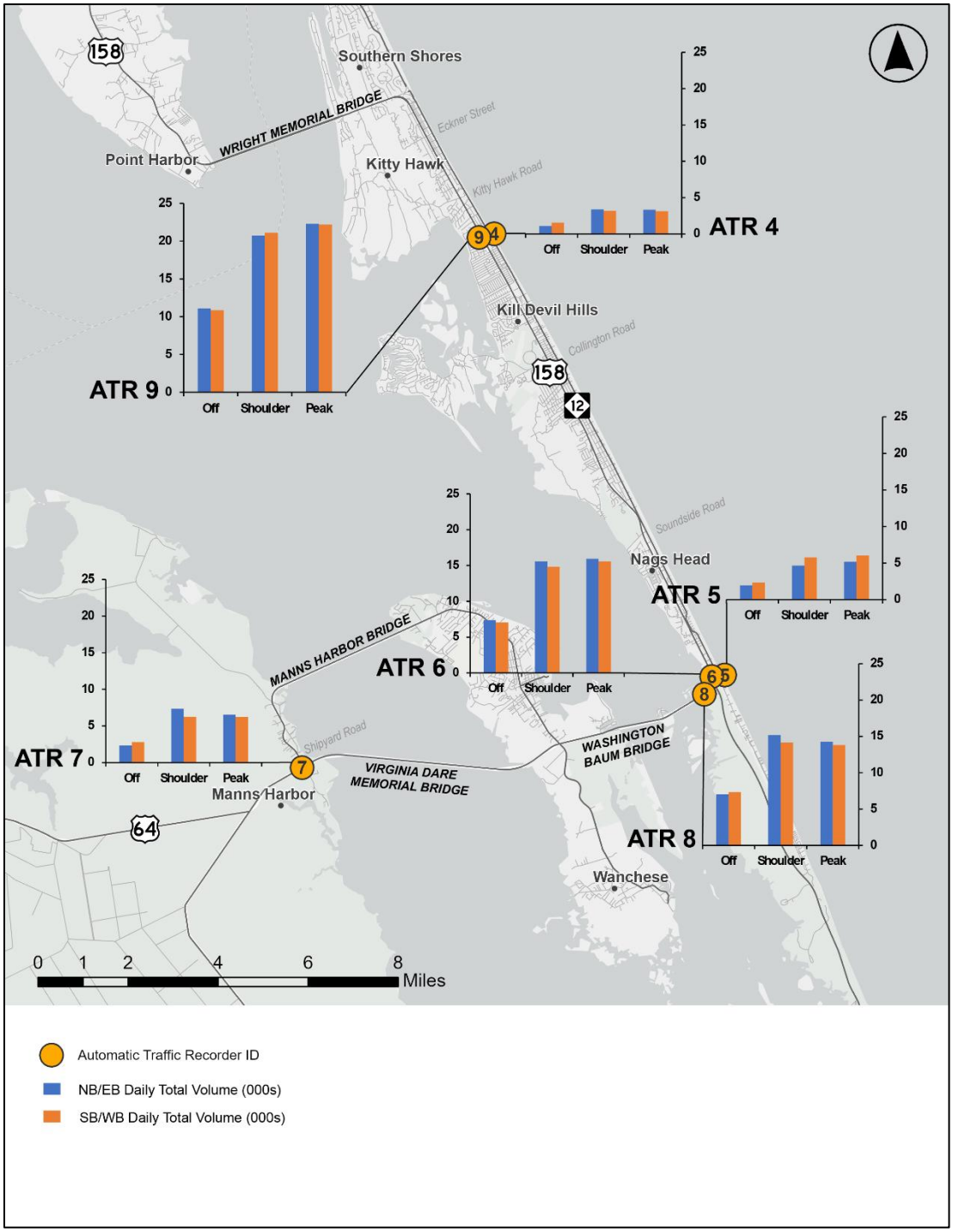
- Higher traffic volumes were observed on US 158 (ATR 6 and ATR 9) than NC 12 (ATR 4 and ATR 5) in the area between the WMB and the WBB. This pattern occurs in all seasons and on all days.
- WBB (ATR 8) traffic is less seasonal than the WMB.
- On an average weekday, traffic crossing the WBB from the mainland is very low. The majority of the traffic originates from Roanoke Island. This is illustrated by comparing the volumes at ATR 7 and ATR 8 in **Figure 2.14**.

Figure 2.14: 2022-2023 Average Weekday Outer Banks Traffic Volumes South of the WMB



Note: Data collected during 2022-2023 field surveys. Traffic volumes not counted during Off-Peak season. Off-Peak traffic volumes developed from 2018 Off-Peak volumes based on WMB growth since 2018.

Figure 2.15: 2022-2023 Average Saturday Outer Banks Traffic Volumes South of the WMB



Note: Data collected during 2022-2023 field surveys. Traffic volumes not counted during Off-Peak season. Off-Peak traffic volumes developed from 2018 Off-Peak volumes based on WMB growth since 2018.

2.5.3 2022-2023 Bridge Crossing Traffic Volumes

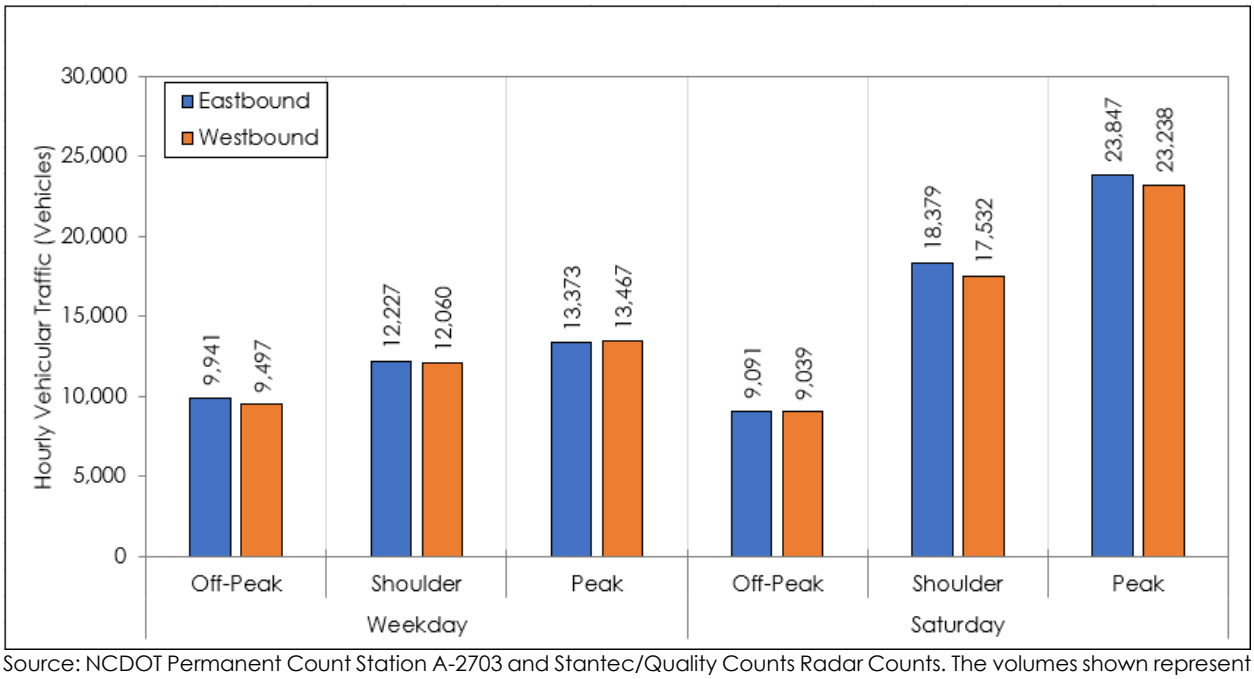
As noted previously, because of the topographic conditions and the available access routes to the bridges on the mainland, most of the existing trips that would potentially divert to the proposed MCB currently use the WMB. As such, the discussion herein focuses on the WMB.

Total daily volumes crossing the WMB and the WBB vary both by day and by season. As previously discussed, the year was divided into three seasons based on traffic volumes and rental occupancy rates in the Outer Banks. The Peak season was defined as the eight-week period between June 16th and August 15th; the Shoulder season was defined as the 6 weeks preceding and the 6 weeks following the Peak season (a total of 12 weeks) approximately from the beginning of May to June 15th and from August 16th to the end of September; the Off-Peak season was defined as the remaining seven months of the year.

Figure 2.16 compares the volumes crossing the WMB by weekday versus Saturday by season. NCDOT Permanent Count Station A-2703 and Stantec radar count data were used to show typical conditions, averaged over 365 days from Jun 2022 to Jun 2023. (Refer to **Figure 2.2** for a map.) The figure shows that:

- Average weekday volumes crossing the WMB are highest in the Peak season and lowest in the Off-Peak season.
- Saturday Off-Peak volumes are comparable to but slightly lower than weekday Off-Peak volumes.
- Shoulder and Peak season Saturday volumes are much higher than their respective weekday volumes: 48 and 75 percent higher, respectively.

Figure 2.16: Average Weekday and Saturday Traffic Volumes on the WMB, 2022-2023



Source: NCDOT Permanent Count Station A-2703 and Stantec/Quality Counts Radar Counts. The volumes shown represent data collected over a one–year period, from Jun 2022 – Jun 2023.

Table 2.3 summarizes the daily variation in traffic on the WMB by season. As shown:

- Friday has the highest volumes crossing in the Off-Peak season. Saturday has the highest volumes crossing in the Shoulder and Peak seasons.
- In the Peak season, Sunday has 20 percent less crossing than Saturday but has the second highest crossings of the week.
- Friday is the busiest weekday in all seasons and is busier than Sunday in the Off-Peak season.
- Weekday volumes in the Shoulder and Peak seasons are higher than both weekday and weekend volumes in the Off-Peak season.

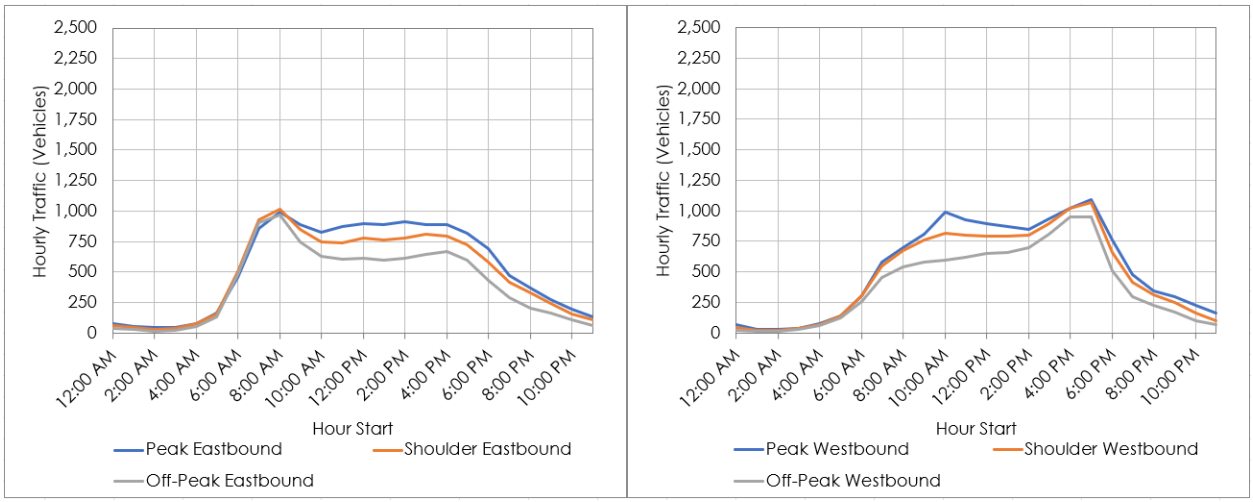
Table 2.3: 2022-2023 Average Daily Total Traffic Volumes Crossing the WMB, Both Directions

Day of Week	Off-Peak WMB Volumes		Shoulder WMB Volumes		Peak WMB Volumes	
	Avg Daily Traffic (veh)	% of Week	Avg Daily Traffic (veh)	% of Week	Avg Daily Traffic (veh)	% of Week
Monday	16,244	14%	21,559	12%	23,506	11%
Tuesday	16,282	14%	19,833	11%	22,588	11%
Wednesday	16,590	14%	20,721	12%	23,901	11%
Thursday	17,006	15%	22,255	13%	25,348	12%
Friday	19,169	17%	27,420	16%	32,031	15%
Saturday	16,252	14%	34,189	20%	45,409	22%
Sunday	14,170	12%	28,439	16%	36,924	18%
Total	115,714	100%	174,415	100%	209,707	100%

Note: Data sourced from NCDOT Permanent Count Station A-2703 and Stantec/Quality Counts Radar Counts. The volumes shown represent data collected over one-year period, from Jun 2022 – Jun 2023. The sum of all percentages may not be exactly 100% due to rounding.

Figure 2.17 shows the hourly distribution of vehicles crossing the WMB on an average weekday in each season. The traffic shows a pattern consistent with commuter behavior, with a peak in the eastbound direction to the Outer Banks in the AM and a peak in the westbound direction from the Outer Banks in the PM. This trend indicates that many bridge users live on the mainland, commute to work on the Outer Banks, and return home in the evening. Off-Peak season volumes are lowest and Peak season volumes are generally highest during all hours of the day.

Figure 2.17: Average Weekday Hourly Traffic Volumes on the WMB (2022-2023)

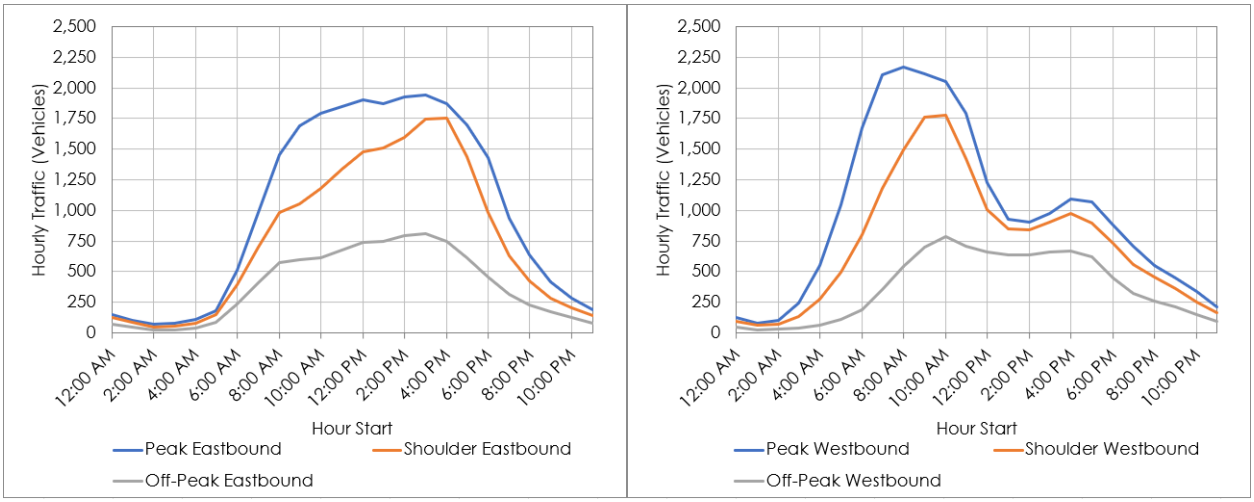


Note: Data sourced from NCDOT Permanent Count Station A-2703 and Stantec/Quality Counts Radar Counts. The hourly volumes represent data collected over one-year period, from Jun 2022 – Jun 2023.

Figure 2.18 shows the hourly distribution of vehicles crossing the WMB on an average Saturday in each season. Saturday carries the highest weekend volumes across the bridge in each season.

The Saturday traffic patterns reflect the rental lease schedule that generally requires renters to checkout by 10 AM and allows check-in starting at 3 PM. As such, traffic in the westbound direction generally peaks earlier in the day than the eastbound direction. The eastbound direction peaks in the late morning/early afternoon time as workers come to prepare for new guests and guests begin to arrive. Congestion impacts Saturday arrival patterns in the Peak season. The eastbound volume peak starts earlier, perhaps to avoid congestion.

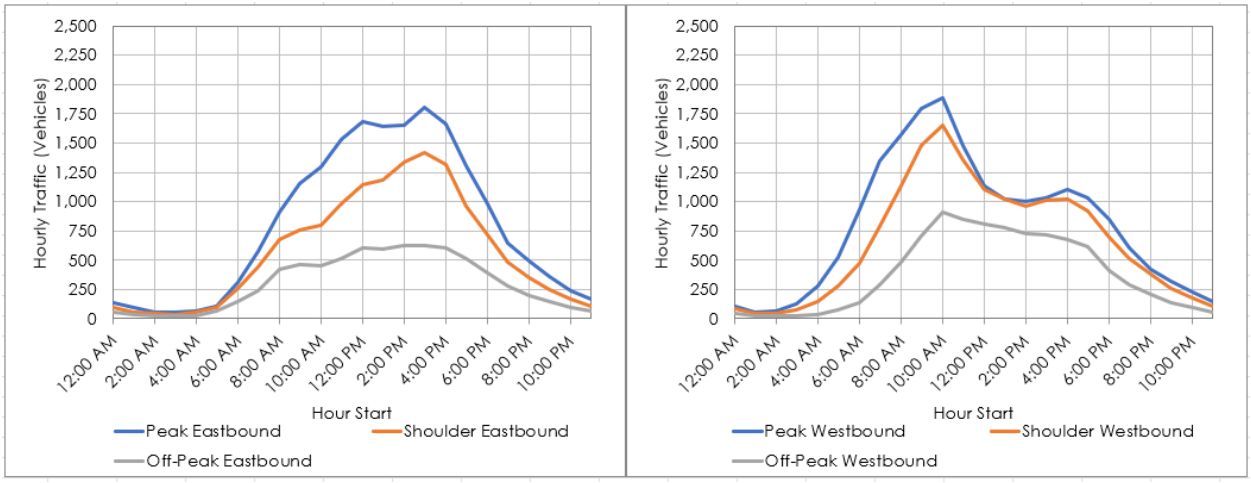
Figure 2.18: Average Saturday Hourly Volumes on the WMB (2022-2023)



Note: Data sourced from NCDOT Permanent Count Station A-2703 and Stantec/Quality Counts Radar Counts. The hourly volumes represent data collected over one-year period, from Jun 2022 – Jun 2023.

Figure 2.19 shows the hourly distribution of vehicles crossing the WMB on an average Sunday in each season. Sunday traffic has lower volumes but resembles Saturday's travel patterns. This reflects the post-COVID shift in arrivals; as more rental contracts now start on Fridays and Sundays compared to pre-COVID operations. Eastbound volume gradually increases during the morning and peaks in the early afternoon.

Figure 2.19: Average Sunday Volumes on the WMB (2022-2023)



2.6 2022-2023 VEHICLE CLASSIFICATION COUNTS

The ATR traffic counts included vehicle classifications to determine the heavy vehicle share of the overall traffic stream. A heavy vehicle is defined as any vehicle with four or more axles. Heavy vehicle volumes on the Outer Banks vary throughout the week and by season. The percentage of heavy vehicles is highest on an average weekday for most seasons, as shown in **Table 2.4**. Towns to the north of the WMB (Southern Shores, Duck, Corolla) see similar heavy vehicle percentages between Shoulder and Peak seasons. Weekend heavy vehicle percentages are typically lower than weekday percentages. **Table 2.5** shows that the heavy vehicle volume trends are similar to the percentage trends.

Table 2.4: 2022-2023 Heavy Vehicle Share of Total Traffic Volumes by Season and Day Type

Daily Heavy Vehicle Percentages		
Day Type	Shoulder	Peak
North of WMB (ATR 3: NC 12 S of E. Dogwood Trl)		
Avg Wkday	1.3%	1.1%
Saturday	0.6%	0.6%
Sunday	0.6%	0.5%

Source: Stantec 2022-2023 Data Collection Program

Table 2.5: 2022-2023 Average Daily Heavy Vehicle Volume by Season and Day Type

Daily Heavy Vehicle Volumes (vehs)		
Day Type	**Shoulder**	**Peak**
North of WMB (ATR 3: NC 12 S of E. Dogwood Trl)		
Avg Wkday	232	206
Saturday	92	115
Sunday	111	93

Source: Stantec 2022-2023 Data Collection Program

2.7 2022-2023 TRAVEL TIME AND SPEED SURVEYS

Travel time and speed measurements were taken in the 2022 Peak season and the 2023 Shoulder season. The collection method is discussed in Section 2.3.2.

2.7.1 Travel Speeds on Mainland Roadways to the Outer Banks

The surveyed segment of US 158 on the mainland (Travel Time Route 1) starts at NC 136 near Poplar Branch and extends south to NC 12 to Kitty Hawk, shown in **Figure 2.20**. Peak season speeds are generally higher than the speeds in the Shoulder season during the AM and MD weekday periods. Peak season speeds leaving the Outer Banks over the WMB are higher on the weekdays in all time periods, except during the PM period, when Saturday speeds are higher than Weekday speeds. **Figure 2.21** compares the northbound/westbound travel speeds collected during Stantec's 2022-2023 travel speed surveys.

Figure 2.22 compares the southbound/eastbound travel speeds collected during Stantec's 2022-2023 travel speed surveys. During most periods, travel speeds are similar in each season.

Figure 2.20: Travel Time Route, Aydlett Road to NC 12 on US 158

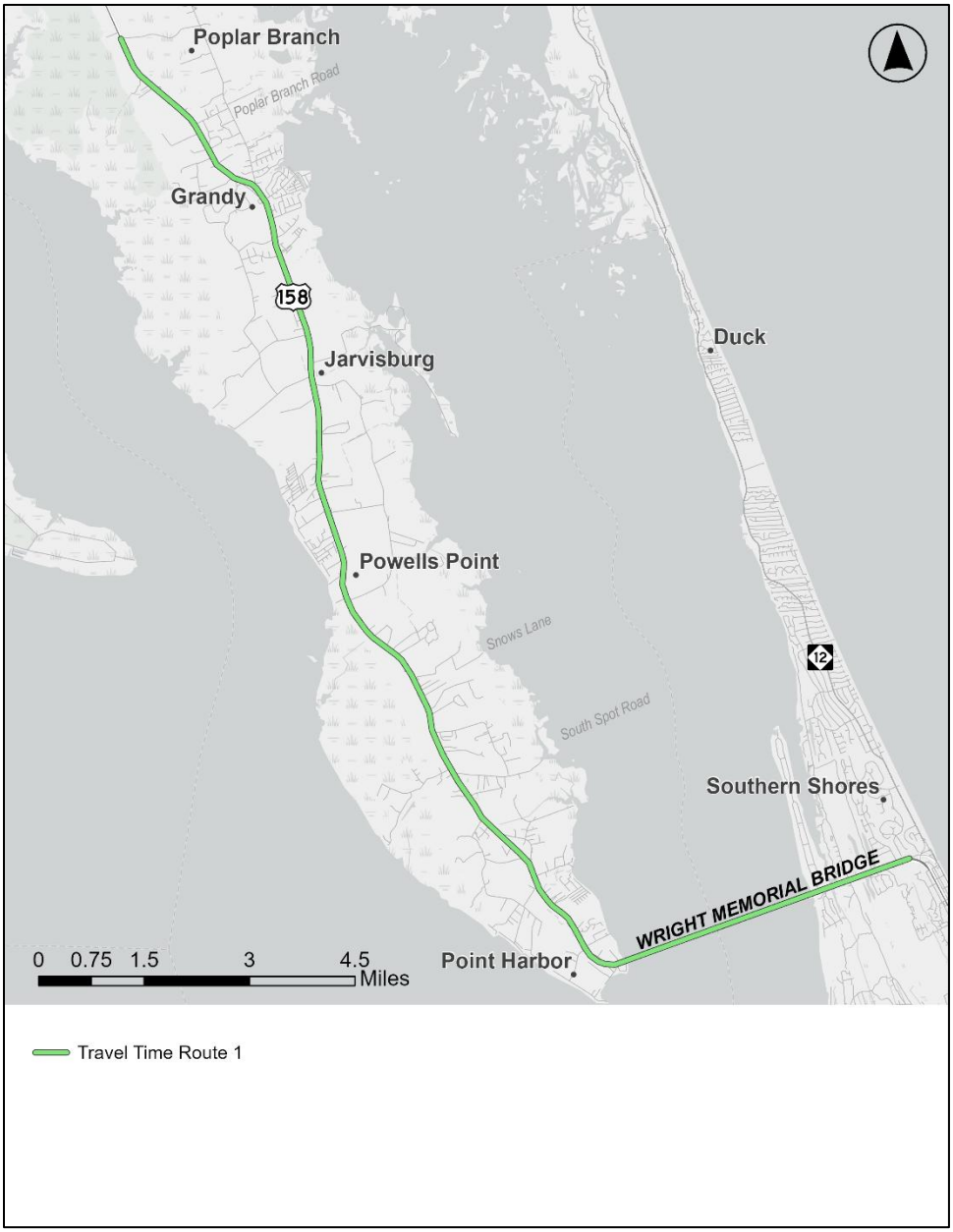
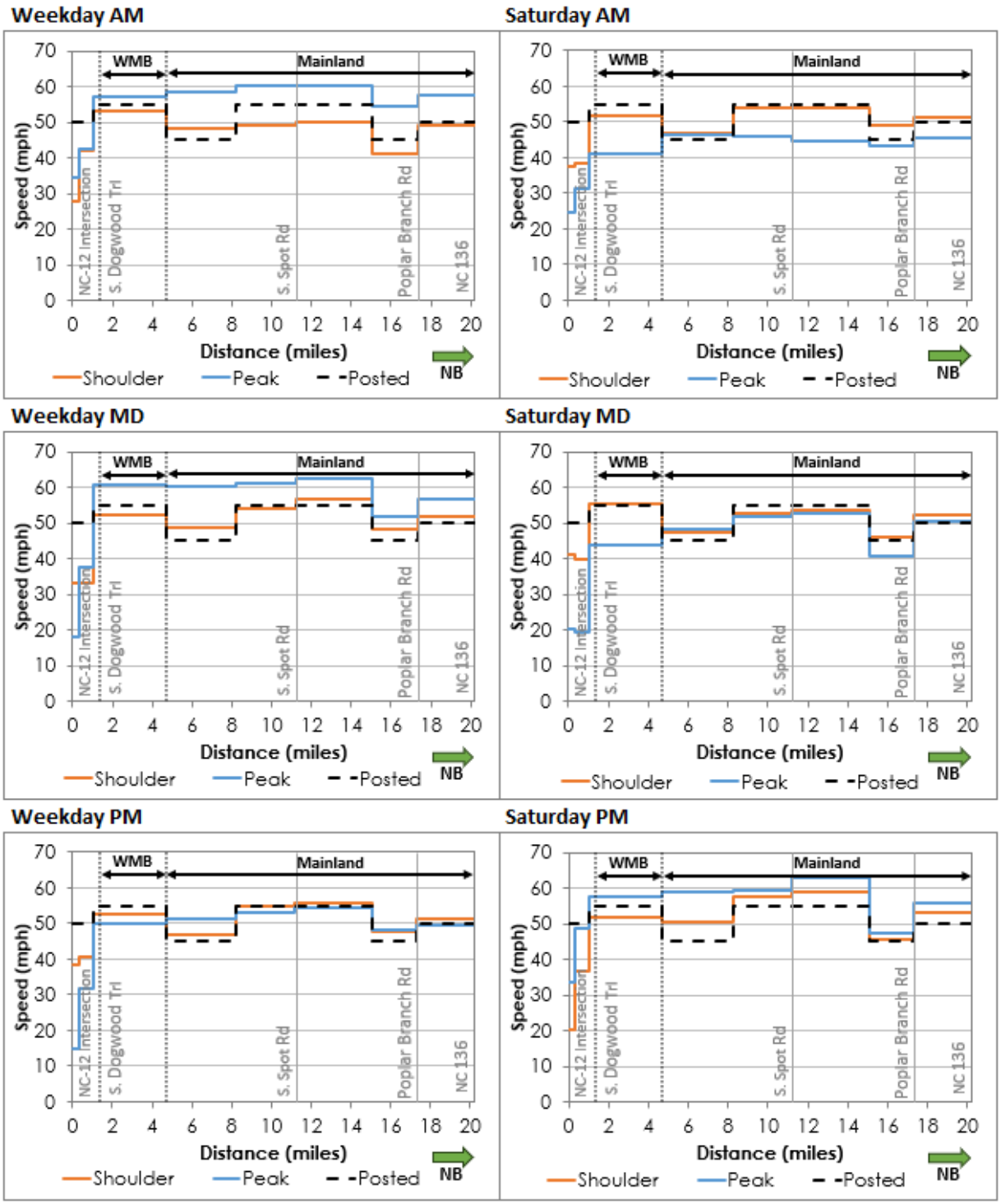
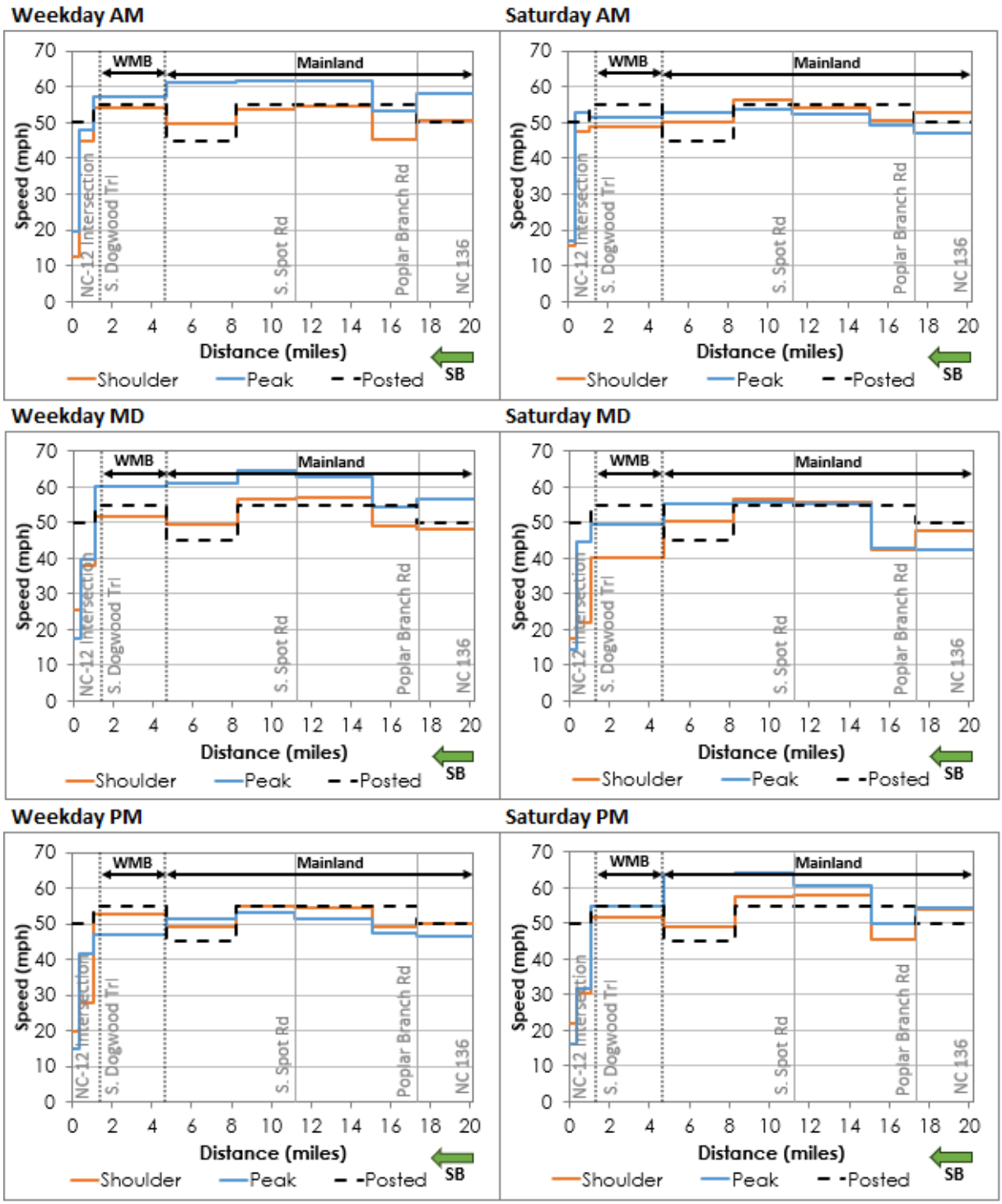


Figure 2.21: 2022-2023 NB/WB Travel Speeds on US 158 from Southern Shores to Poplar Branch



Note: Travel time survey data collected 6/5/23, 6/9/18 – 6/11/23 (Shoulder); 7/15/22 – 7/18/22 (Peak).

Figure 2.22: 2022-2023 SB/EB Travel Speeds on US 158 from Poplar Branch to Southern Shores



Note: Travel time survey data collected 6/5/23, 6/9/18 – 6/11/23 (Shoulder); 7/15/22 – 7/18/22 (Peak).

2.7.2 Travel Speeds on Roadways on the Outer Banks

The surveyed segment of NC 12 (Travel Time Route 2) starts at Pelican Watch Way in Southern Shores and extends north to Blue Heron Lane, three miles north of Duck town center, as shown in **Figure 2.23**.

Figure 2.24 compares the northbound travel speeds on NC 12 north of the WMB on an average weekday and Saturday collected during Stantec's 2022-2023 travel speed surveys. The Saturday Peak season speeds are typically slower than the speeds in the Shoulder seasons. Northbound speeds on NC 12 are less than 15 mph for most of the stretch of roadway between Chicahauk Trail (Southern Shores) and Schooner Ridge (Duck) in the MD and PM Saturday Peak periods. Travelers arriving in the AM Saturday period encounter less congestion and higher travel speeds.

Figure 2.25 compares the southbound travel speeds on NC 12 north of the WMB, from Blue Heron Lane (north of Duck) to Pelican Watch Way (Southern Shores), on an average weekday and an average Saturday. As shown, speeds in the Peak season are typically slower than the speeds in the Shoulder season in the AM and MD periods. The slowest speeds in all periods occur near Schooner Ridge in Duck during the Peak period.

Figure 2.23: Travel Time Route, Pelican Watch Way to Blue Heron Drive on NC 12

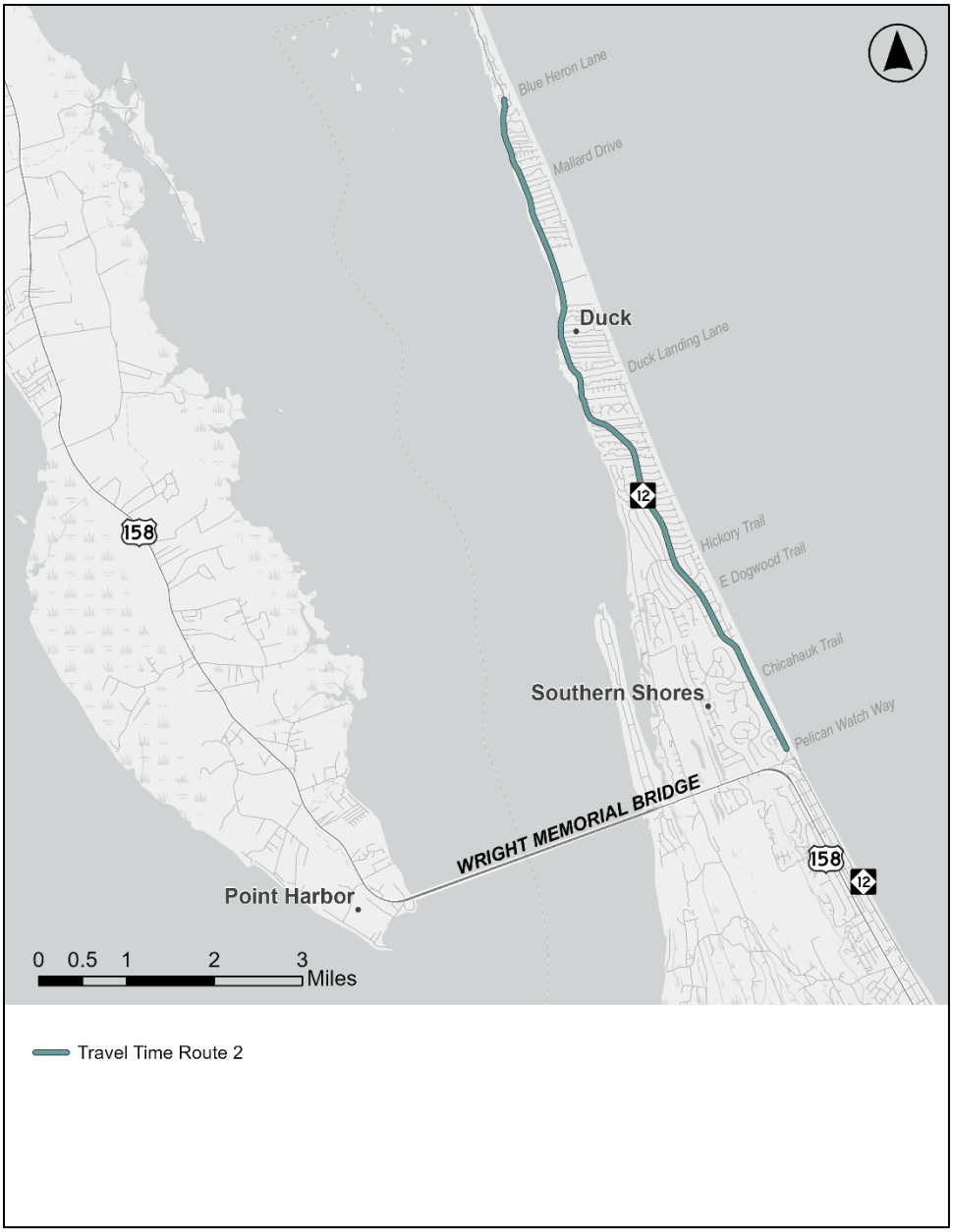
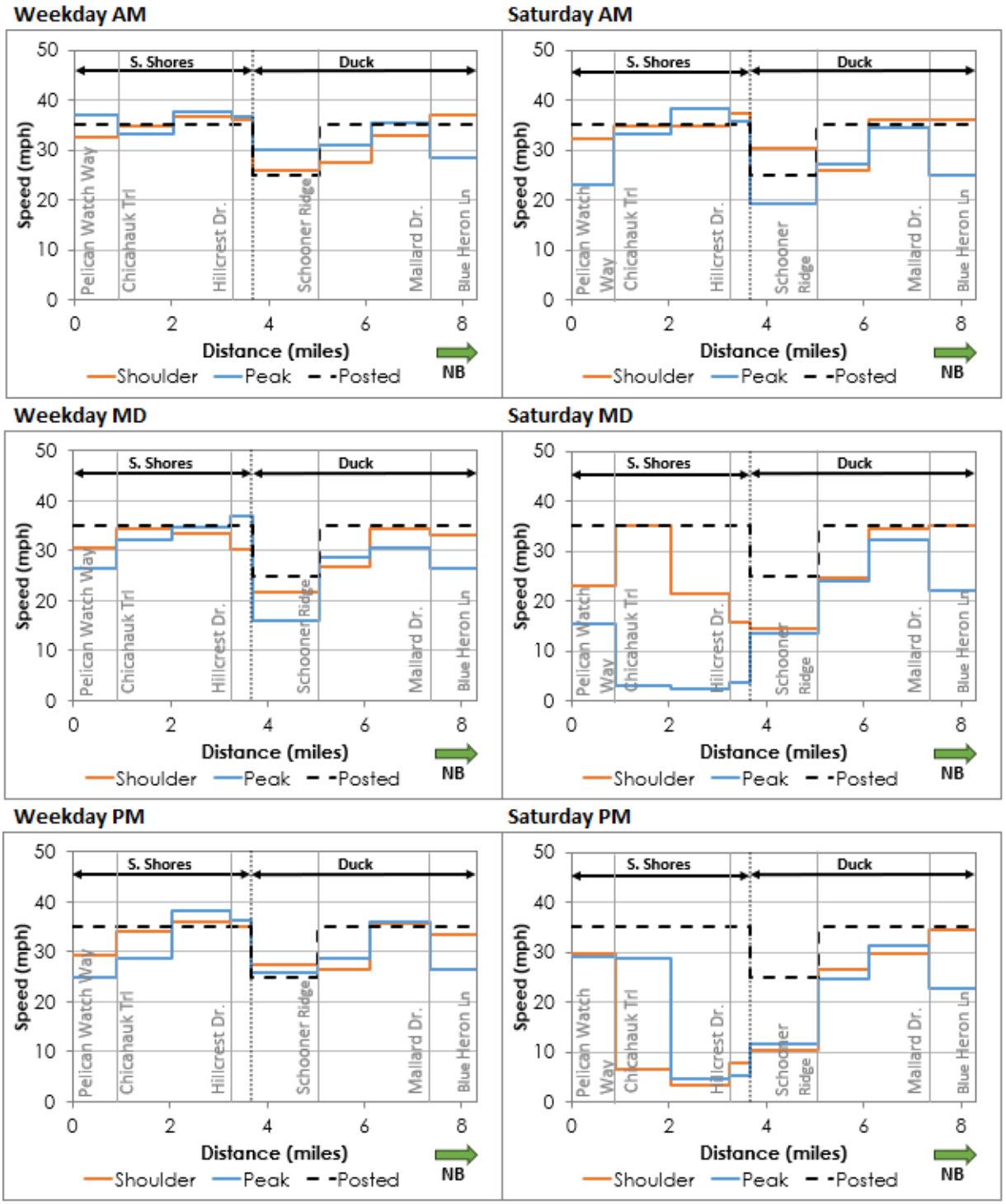
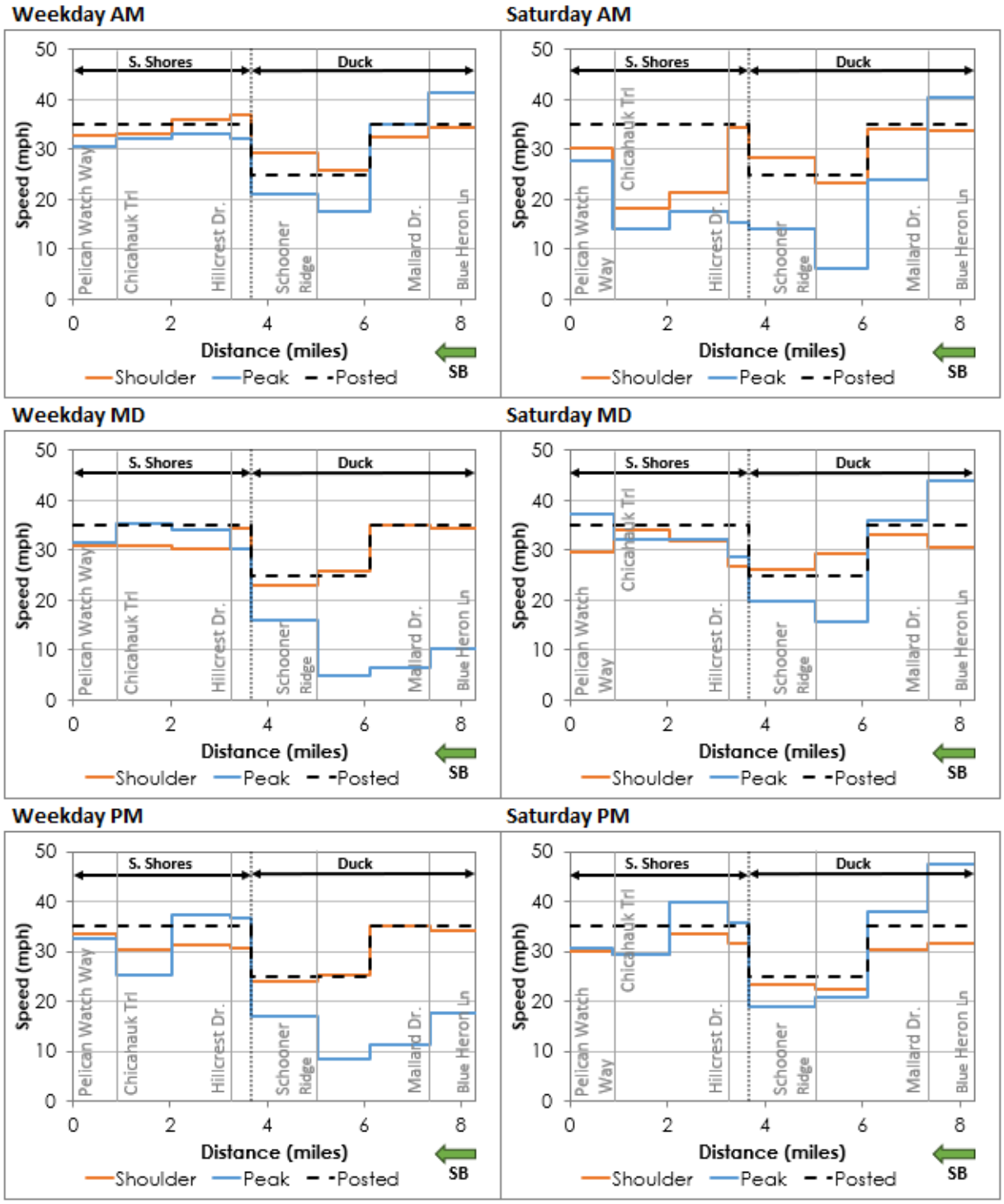


Figure 2.24: 2022-2023 NB Travel Speeds on NC 12 from Southern Shores to Duck



Note: Travel time survey data collected 6/5/23, 6/9/18 – 6/11/23 (Shoulder); 7/15/22 – 7/18/22 (Peak).

Figure 2.25: 2022-2023 SB Travel Speeds on NC 12 from Duck to Southern Shores

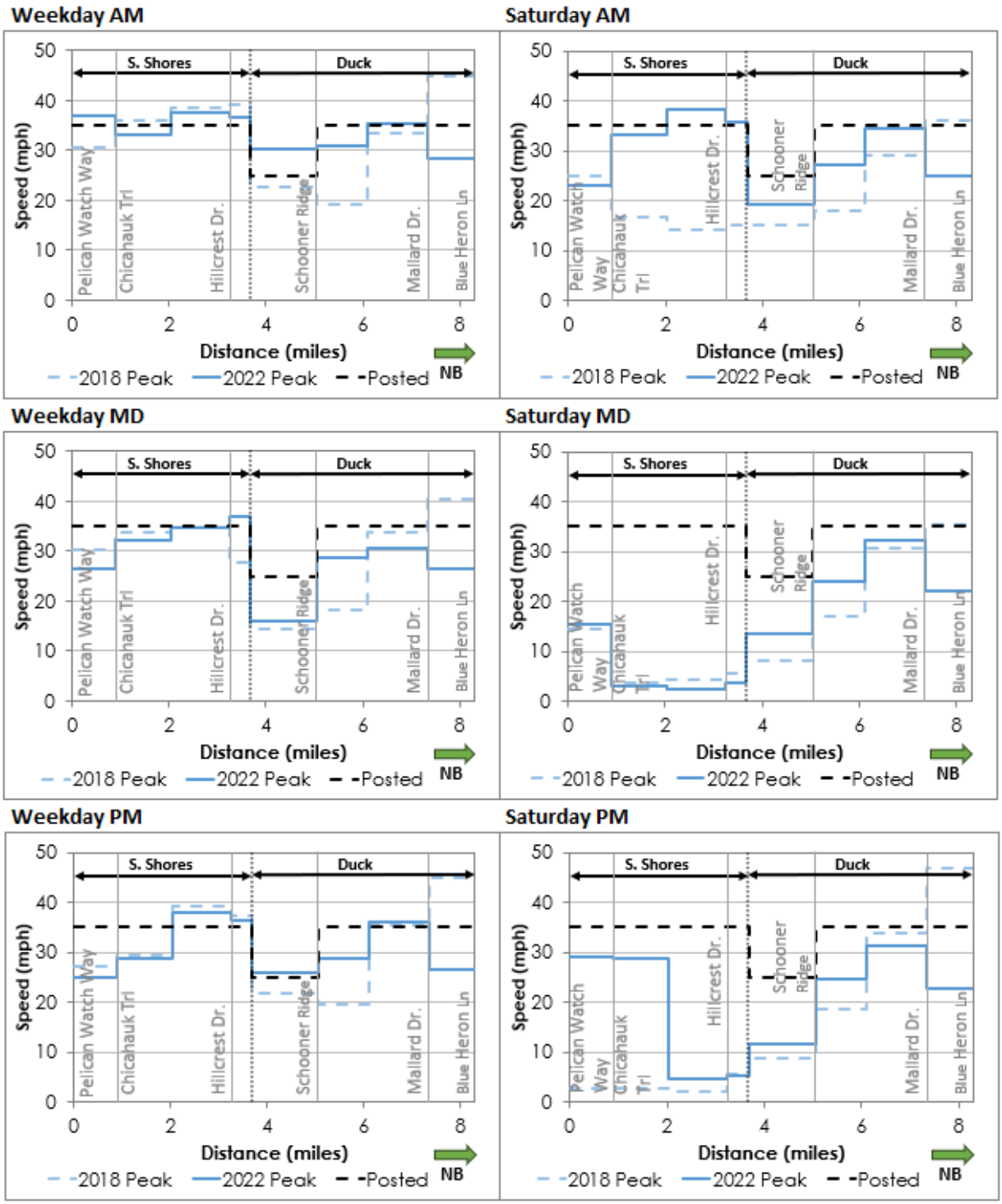


Note: Travel time survey data collected 6/5/23, 6/9/18 – 6/11/23 (Shoulder); 7/15/22 – 7/18/22 (Peak).

2.7.3 Comparing 2022 and 2018 Peak Travel Speeds

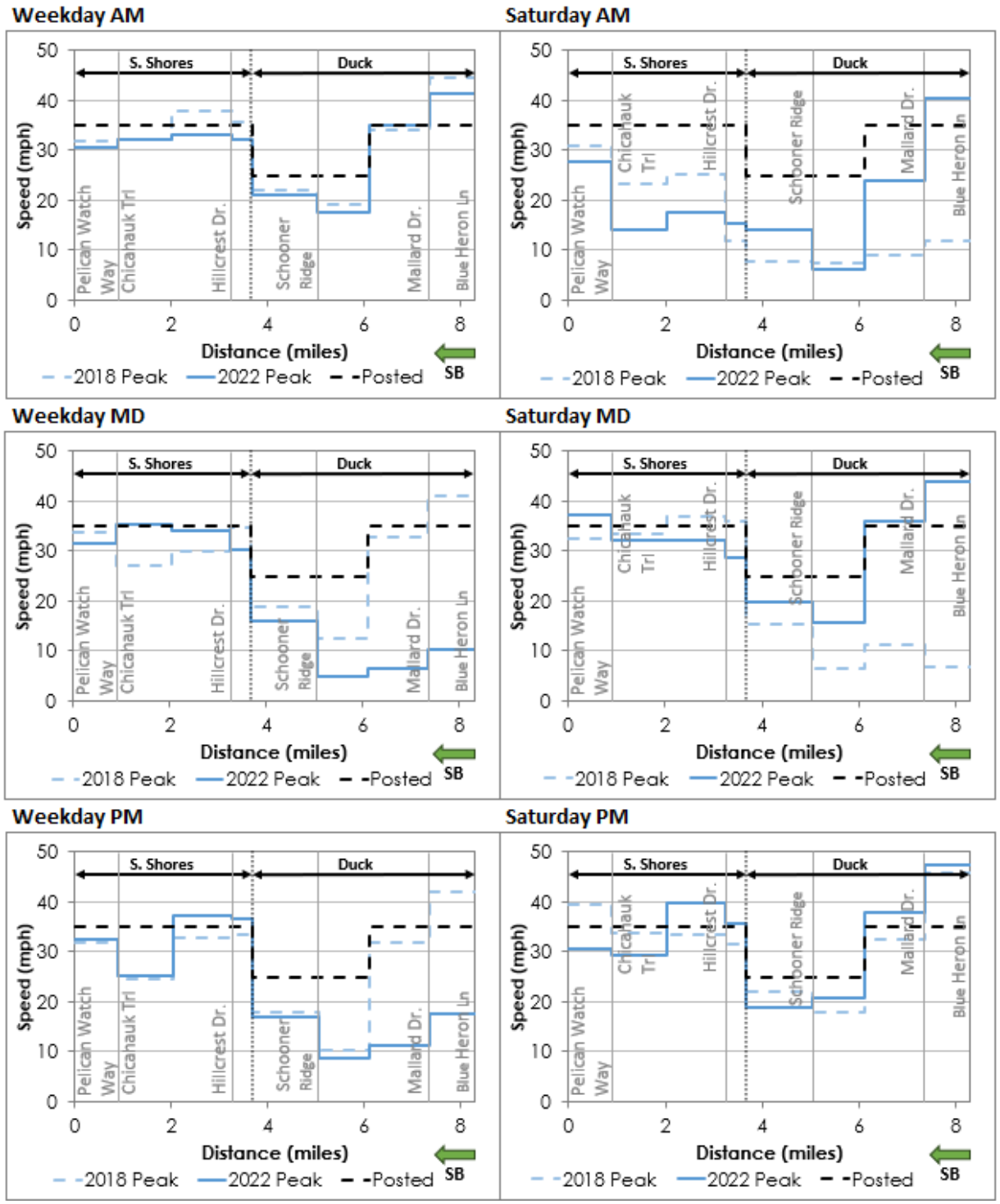
Figure 2.26 and **Figure 2.27** compare Peak season travel speeds in 2022 to Peak season travel speeds in 2018 for northbound and southbound traffic, respectively. The 2022 travel speed measurements were taken during a period of clear weather and are therefore representative of a typical Peak season week. While the traffic volumes during the 2018 Peak season were adjusted to account for the effects of inclement weather, the travel speeds were not adjusted. The extremely rainy weather in July 2018 is likely to have deterred discretionary travel during the count program, reducing congestion in the study area and therefore allowing vehicles to travel more quickly than a typical Peak Saturday in the peak direction. In the northbound direction, it appears that travel speeds are generally higher in 2022 than in 2018. Saturday AM and PM travel speeds are significantly higher in the Southern Shores area. In the southbound direction, the 2022 and 2018 travel speeds were similar for most periods. There are exceptions in the Duck area; speeds were higher during the Saturday AM and MD periods in 2022 and during the Weekday MD and PM periods in 2018.

Figure 2.26: 2018 vs. 2022 NB Peak Season Travel Speeds on NC 12



Note: Travel time survey data collected 7/15/22 – 7/18/22 (2022 Peak); 7/16/18, 7/20/18 – 7/22/18 (2018 Peak).

Figure 2.27: 2018 vs. 2022 SB Peak Season Travel Speeds on NC 12

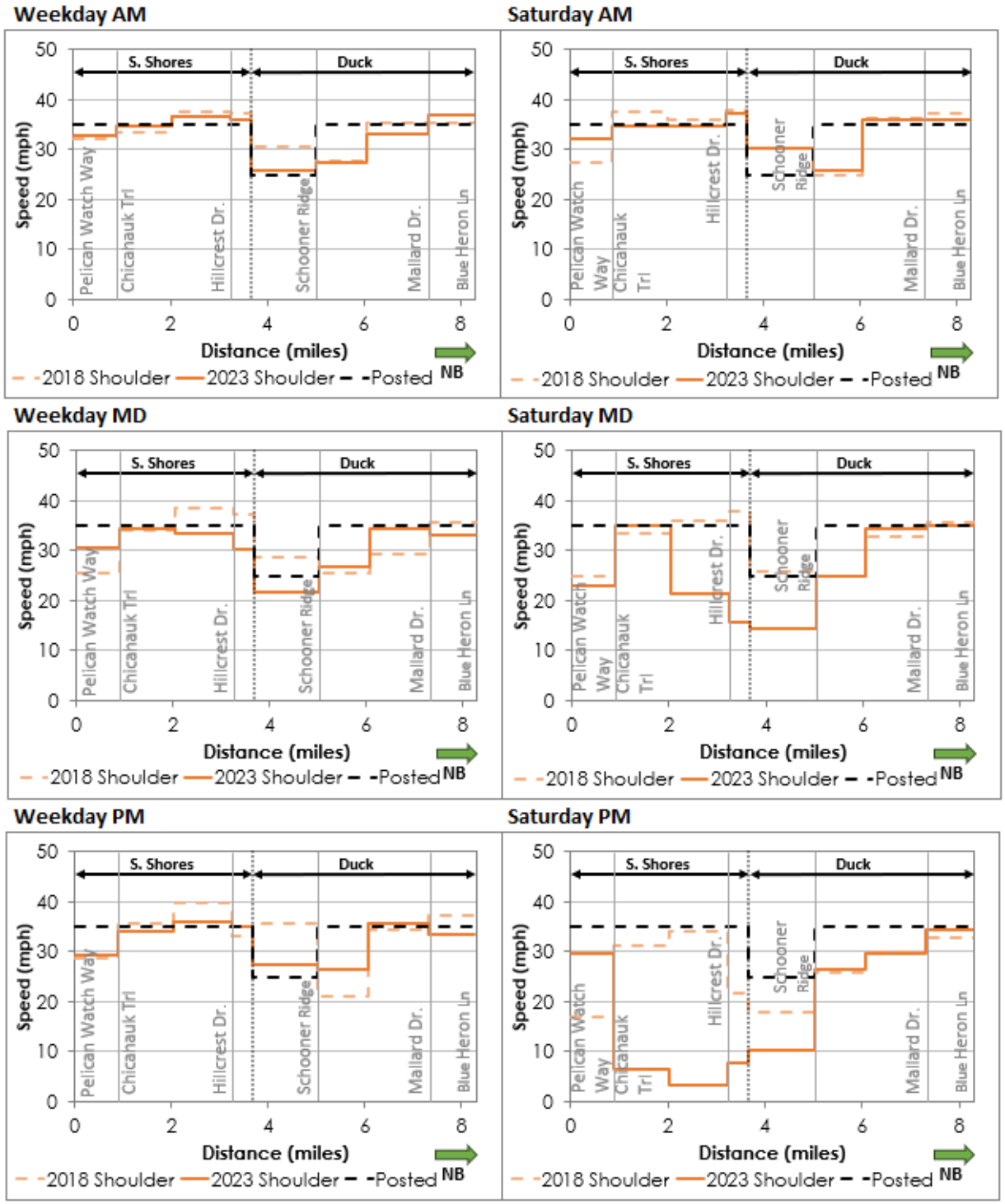


Note: Travel time survey data collected 7/15/22 – 7/18/22 (2022 Peak); 7/16/18, 7/20/18 – 7/22/18 (2018 Peak).

2.7.4 Comparing 2023 and 2018 Shoulder Travel Speeds

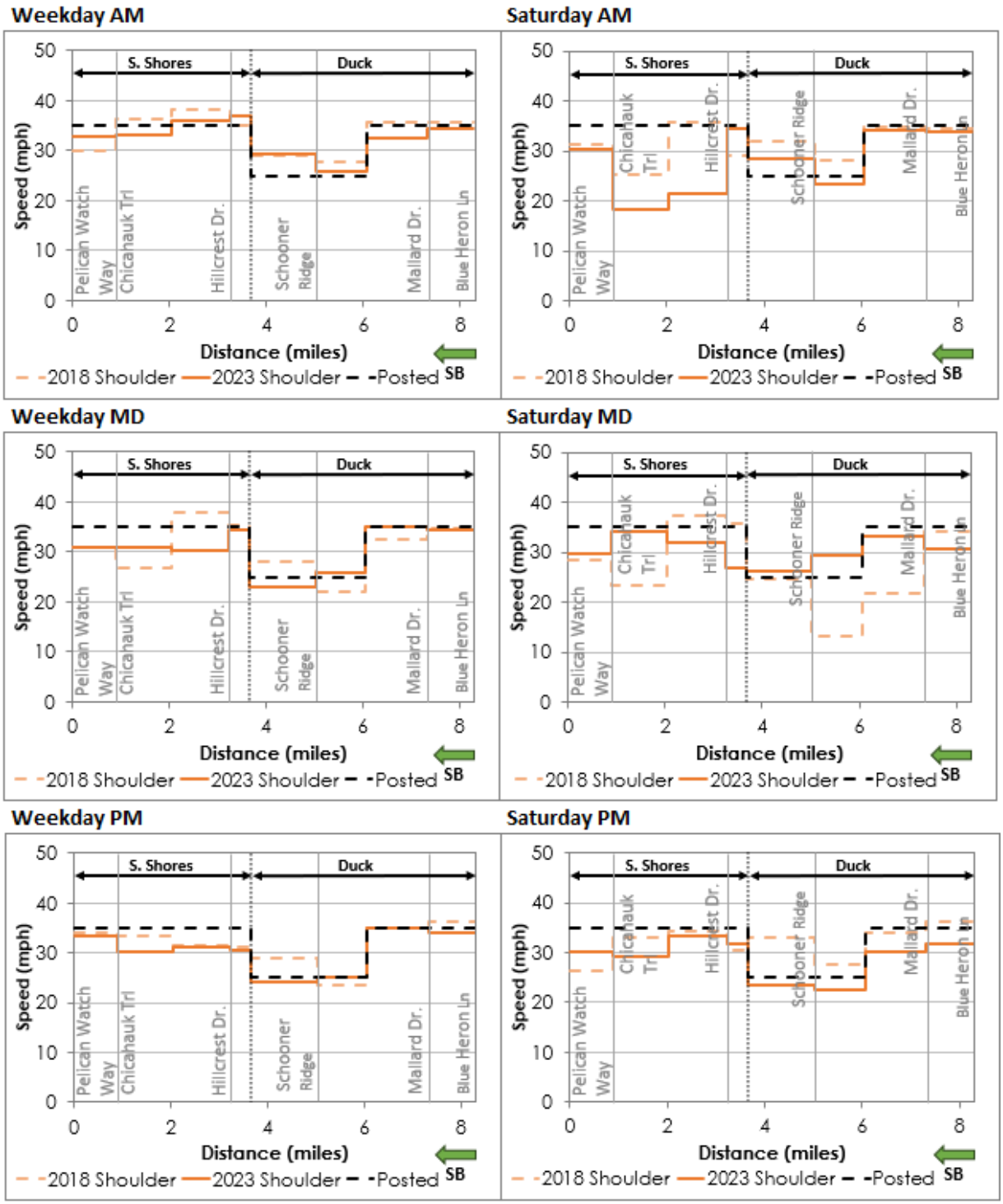
Figure 2.28 and **Figure 2.29** compare Shoulder season travel speeds in 2023 to Shoulder season travel speeds in 2018. The 2018 and 2023 travel speed measurements were taken during a period of clear weather and are therefore representative of a typical Shoulder season week. In the northbound direction, it appears that travel speeds in 2023 are generally similar to or lower than those in 2018. Saturday MD and PM 2023 travel speeds are significantly lower than 2018 travel speeds in the Southern Shores area. In the southbound direction, the 2023 and 2018 travel speeds were similar for most periods. The lower speeds in 2023 during the Saturday AM indicate some minor congestion.

Figure 2.28: 2018 vs. 2023 NB Shoulder Season Travel Speeds on NC 12



Note: Travel time survey data collected 6/5/23 – 6/11/23 (2023 Shoulder); 6/3/18 – 6/9/18 (2018 Shoulder).

Figure 2.29: 2018 vs. 2023 SB Shoulder Season Travel Speeds on NC 12



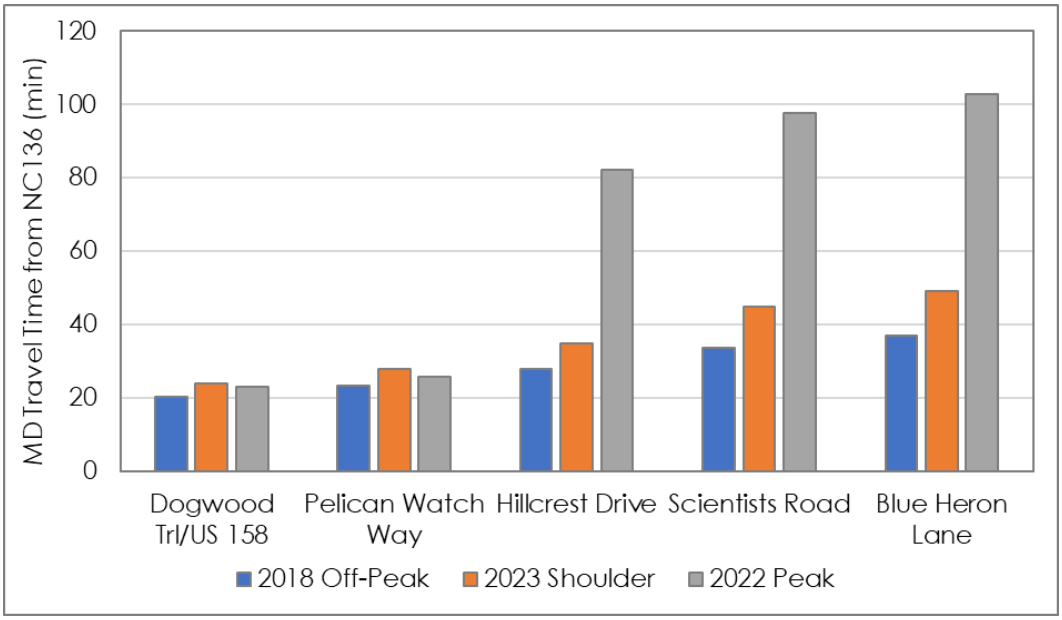
Note: Travel time survey data collected 6/5/23 – 6/11/23 (2023 Shoulder); 6/3/18 – 6/9/18 (2018 Shoulder).

2.7.5 Travel Times

Travel times were collected for the 2022 Peak and 2023 Shoulder seasons. The collection method is discussed in Section 2.3.2. For the Off-Peak, travel times were assumed to be similar to the data collected for the 2018 Off-Peak. Average vehicle travel times from NC 136 (on US 158 near Poplar Branch) to the Pelican Watch Way (NC 12) were generally similar in all seasons. Saturday MD travel time from NC 136 to the WMB ranged from 20 to 24 minutes in the Off-Peak and Shoulder seasons. Travel time from NC 136 to Scientists Road ranged from 34 to 45 minutes in the same period, as shown in **Figure 2.30**.

During the Peak season, travel times from NC 136 to Hillcrest Drive (Southern Shores), Scientists Road (Duck), and Blue Heron Lane (north of Duck) were significantly longer than in the Shoulder and Off-Peak seasons. The Peak Saturday MD travel time from NC 136 to Blue Heron Lane was 103 minutes (over one and one-half hours) compared to 37 minutes in the Off-Peak and 49 minutes in the Shoulder seasons.

Figure 2.30: Saturday MD Eastbound Travel Times from NC136 to the Outer Banks via WMB



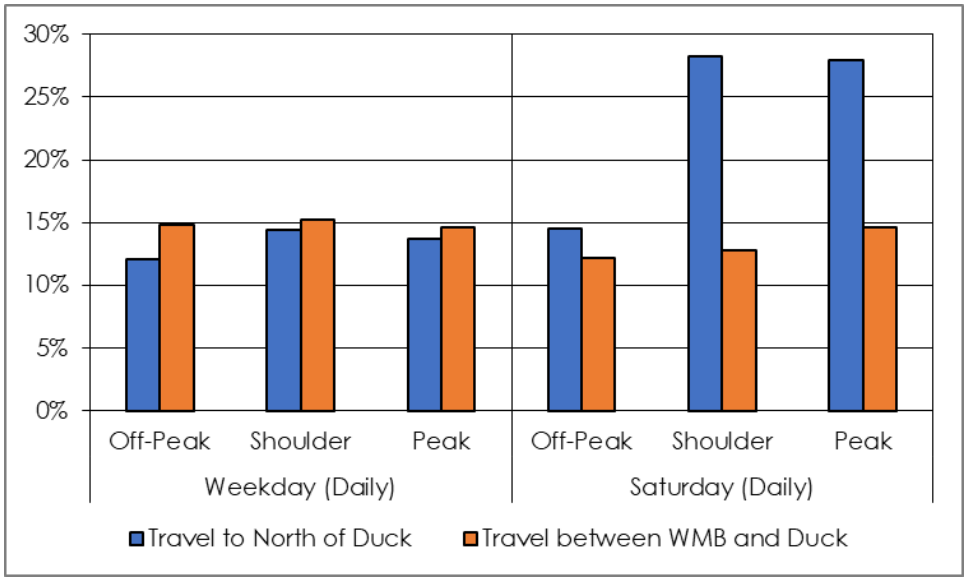
Source: Stantec 2018 and 2022-2023 travel time surveys.

2.8 2022-2023 ORIGIN-DESTINATION PATTERNS

Origin-destination data were analyzed to determine the portion of trips that could potentially divert from the WMB to the proposed MCB. The location of the new bridge will provide a shorter route in terms of both time and distance for those travelers accessing locations north of Duck. The

new bridge may also provide shorter travel times for those accessing locations between Duck and the WMB, depending on season and day of travel. **Figure 2.31** summarizes the destination locations for 2022--2023 trips crossing the WMB by period. On an average weekday, between 12 and 14 percent of vehicles crossing the WMB are destined to locations north of Duck. On Saturdays, between 14 and 28 percent of vehicles crossing the WMB are destined for locations north of Duck. On weekdays, a larger portion of trips crossing the WMB are destined for locations south of Duck and north of the WMB (Southern Shores or Kitty Hawk) than north of Duck. The reverse is true on Saturdays, particularly during the Peak and Shoulder seasons.

Figure 2.31: Average Daily Eastbound Traffic Destination Share from the WMB, 2022-2023



Source: StreetLight Data origin-destination metrics, June 2022 – Jun 2023.

3.0 SOCIOECONOMIC REVIEW AND FORECASTS

In 2023, nearly 70,000 permanent residents lived in Currituck and Dare counties, the two North Carolina counties in the project study area. In addition to its permanent residents, millions of visitors from around the world travel to the Outer Banks every year, from day trippers making short trips from mainland North Carolina and Virginia to those traveling from farther distances and staying for extended periods of time. Occupancy tax revenue generated by these visitors reached an all-time high in 2023. Some of this growth is the result of an extended Shoulder season as more vacationers arrive in the spring and fall months. A continued growth in large rental homes also contributes to the growth in the number of visitors to the Outer Banks, which is expected to continue to increase over the forecast years.

Despite the relatively low number of permanent residents, most of the Outer Banks is perceived to be nearing build-out, with most of the existing development accommodating the large seasonal population. Visitors to the Outer Banks typically stay in a vacation home or hotel room, with the demand for the former growing despite local opposition. Coupled with the deregulation of the number of bedrooms in vacation homes, some local stakeholders estimate that large rental or "event" homes, which operate like small hotels, will make up most new units on the Outer Banks in the coming years.

Tourism is the dominant industry in Currituck and Dare counties, with much of the workforce employed in hospitality-related industries. As seen in **Table 3.1**, 53 percent of the local employment works in tourism -related service jobs and construction, from working in restaurants to building and maintaining tourist accommodations. Conversely, tourism-related employment totals in North Carolina and the nation are 28 and 25 percent, respectively.

Table 3.1: Share of Hospitality-Related Industry Employment (2022)

Industry	United States	North Carolina	Currituck and Dare Counties
Accommodation and food service	9%	7%	14%
Retail trade	10%	10%	14%
Real estate and rental and leasing	2%	5%	15%
Construction	5%	6%	10%
Share of Total Employment	25%	28%	53%

Source: Bureau of Economic Analysis, Total full-time and part-time employment by NAICS industry
Note: Industry-specific shares may not sum to total shares due to rounding.

Many permanent residents of the Outer Banks commute to mainland communities for employment. According to the 2022 American Community Survey (ACS), 23 percent of Currituck and Dare County residents work outside their state of residence, compared to less than 5 percent in North Carolina and in the United States as a whole, as shown in **Table 3.2**. There is also substantial commuting within and between Currituck County, Dare County, and the neighboring counties of Camden and Pasquotank. Unlike most areas where total employment stays relatively constant

throughout the year, the Currituck and Dare County employment totals increase during the Shoulder and Peak seasons to meet the increased demand of the visiting population. The employment totals in the mainland counties of Camden and Pasquotank are largely unaffected during the tourism season.

Table 3.2: Place of Work (2022)

Place of Employment	United States	North Carolina	Currituck and Dare Counties
Worked in state of residence	97%	98%	77%
Worked in county of residence	75%	73%	65%
Worked outside county of residence	22%	24%	12%
Worked outside state of residence	3%	2%	23%

Source: ACS 2022 5-year Estimates, Sex of Workers by Place of Work – State and County Level

As noted previously, roadway access to the Outer Banks is limited to two existing bridge crossings: the WMB that links the northern portion of Dare County to the Currituck mainland and the WBB. The WMB provides access from the north via US 158 and serves as the gateway to Virginia, Camden, and Pasquotank counties. The WBB is the US 64 access route to Roanoke Island and eventually to other parts of eastern and central North Carolina.

Roadway access also exists from the northern Outer Banks to Hatteras Island in the southern part of Dare County. This access is via the Marc Basnight Bridge (formerly known as the Herbert C. Bonner Bridge) over the Oregon Inlet. Out-of-area visitors to Hatteras Island and its tourism-related economy are generally required to travel over the WMB or WBB. There is no other road servicing the island, but there is a ferry service to-and-from Ocracoke Island in Hyde County. Ocracoke Island is accessible by one of three ferries (from Hatteras, Swan Quarter, and Cedar Island). During the Peak season, heavy demand on the WMB (going to and from the most northern beaches of Currituck County and south to all parts of Dare County) has historically caused traffic congestion across the WMB, along mainland access roadways and on the main roadways on the Outer Banks.

The number of rental units is expected to increase over the next 30 years to accommodate the growing visitor population, which will exacerbate traffic congestion. The proposed MCB is expected to provide significant distance and time savings to residents and visitors, particularly to those that travel to the most northern portion of Dare County and the Currituck County portion of the Outer Banks. The MCB will reduce Peak season congestion for trips to the south, facilitate planned growth north of the WMB, and improve emergency evacuation for those residing on all parts of the Outer Banks.

Understanding exactly how the proposed MCB will influence future travel patterns depends on a reasonable estimation of future development patterns, including where people live and work, their incomes, the number and size of available rental units, and how many visitors travel to and from the region. All these factors help determine the number of trips that residents and visitors will make, where they will travel to and from, and the paths they will choose to get there.

In 2016, Delta Associates (Delta), in cooperation with Dr. James Kleckley, Director of the Bureau of Business Research at East Carolina University (ECUBBR), updated the 2009 investment-grade demographic and land use forecast for the proposed MCB Project. Through Dr. Kleckley's direction, ECUBBR further refined the demographics and produced new forecasts in 2018.

In 2023, Stantec was contracted by the North Carolina Department of Transportation (NCDOT) to develop a travel demand model for Region 17, which encompasses a total of 10 counties in northeastern North Carolina, including Dare and Currituck Counties and the Outer Banks. The effort included the development of socioeconomic inputs for the region. In Dare and Currituck counties, the socioeconomic inputs were built on the earlier work completed by Dr. Kleckley and ECUBBR in 2018.

For this study, J. Scott Lane, AICP, CPTED, a 30-year veteran of planning and policy based in Raleigh, North Carolina, reviewed the county and TAZ-level inputs to the NCRTDM R17 (North Carolina Regional Travel Demand Model Region 17), model and proposed refinements based on the latest available socioeconomic data, a review of local area plans and tax data, as well as interviews with planning officials, rental property companies, and hotels. Mr. Lane's forecast report is provided in Appendix A. The forecasts revised by Mr. Lane were reviewed by Stantec and further adjustments were made to reflect a slightly more conservative outlook appropriate for this Level 2 study. This chapter describes the methodology for reviewing and revising the existing socioeconomic inputs and presents recent demographic and economic trends and projections of future levels of activity in the area. The future estimates herein assume that the MCB project will be built.

3.1 METHODOLOGY

The following section provides a brief overview of the methodology and primary data sources used to develop the socioeconomic forecasts for this study.

The travel demand model utilized for this study includes demographic inputs for the base year (2023) and three forecast years (2030, 2040, and 2050). Base year estimates and future year forecasts were developed for the following variables:

- Permanent Population
- Permanent Employment
- Seasonal Employment
- Number of Rental Bedrooms
- Number of Hotel Rooms
- Rental Housing Occupancy
- Hotel Occupancy

Seasonality patterns were analyzed, and season-specific inputs were developed for three of the variables. These variables included:

- Seasonal Employment

- Rental Housing Occupancy
- Hotel Occupancy

Three periods of activity were considered: the Peak season, the Shoulder season, and the Off-Peak season.

3.1.1 Study Area

The NCRTDM R17 model covers the 10-county area shown in **Figure 3.1**. The model area includes Camden, Chowan, Currituck, Gates, Pasquotank, Perquimans, Dare, Hyde, Tyrrell, and Washington counties.

Figure 3.2 shows the study area for this Level 2 study, which includes the Outer Banks and mainland Currituck County. A focus area was identified for the socioeconomic update, prioritizing TAZs most likely to impact traffic on the proposed MCB. The focus area includes TAZs on the Currituck mainland and Outer Banks, as well as TAZs in Dare County on the Outer Banks, north and immediately south of the WMB.

Figure 3.1: NCRTDM R17 Model Area

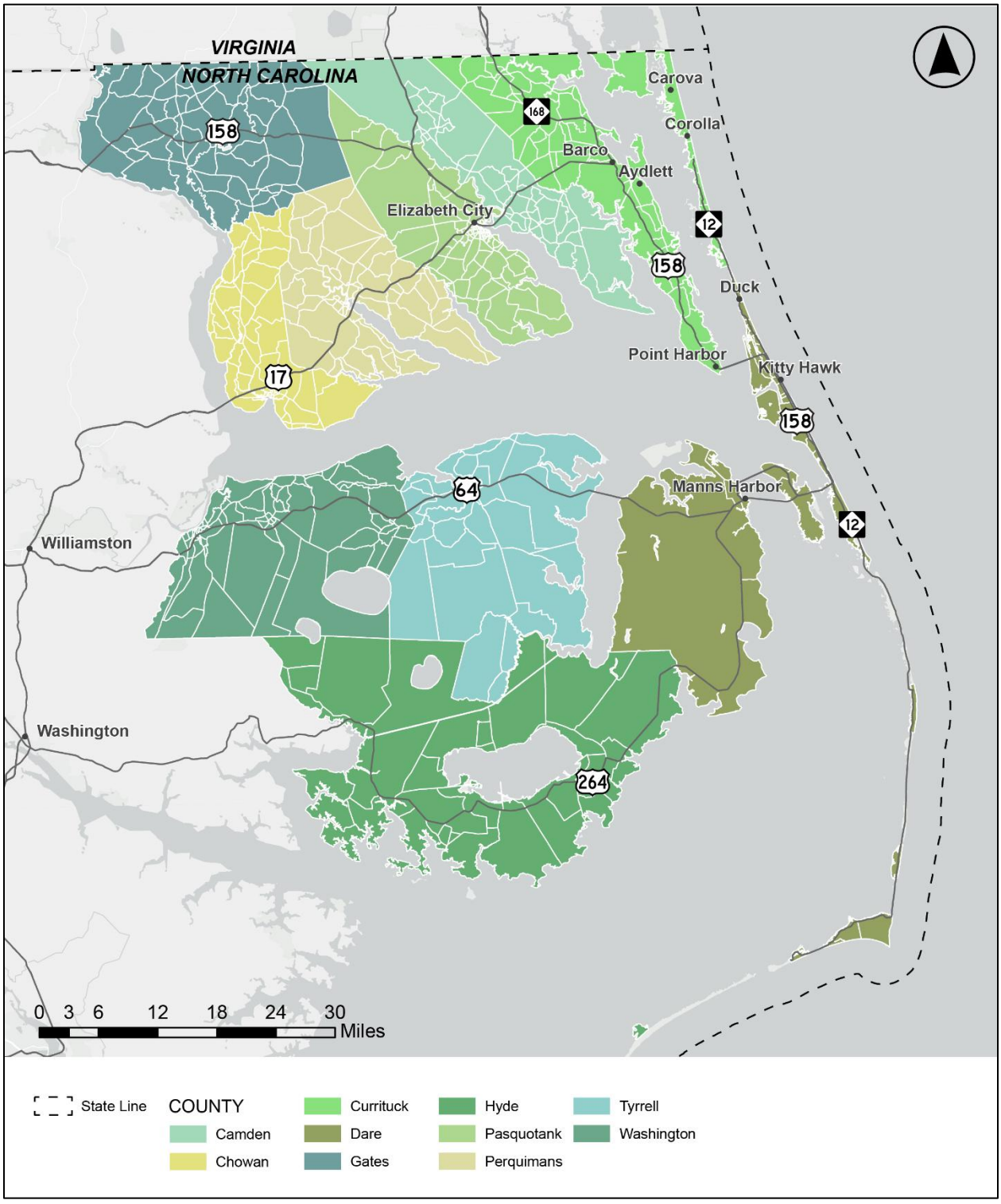
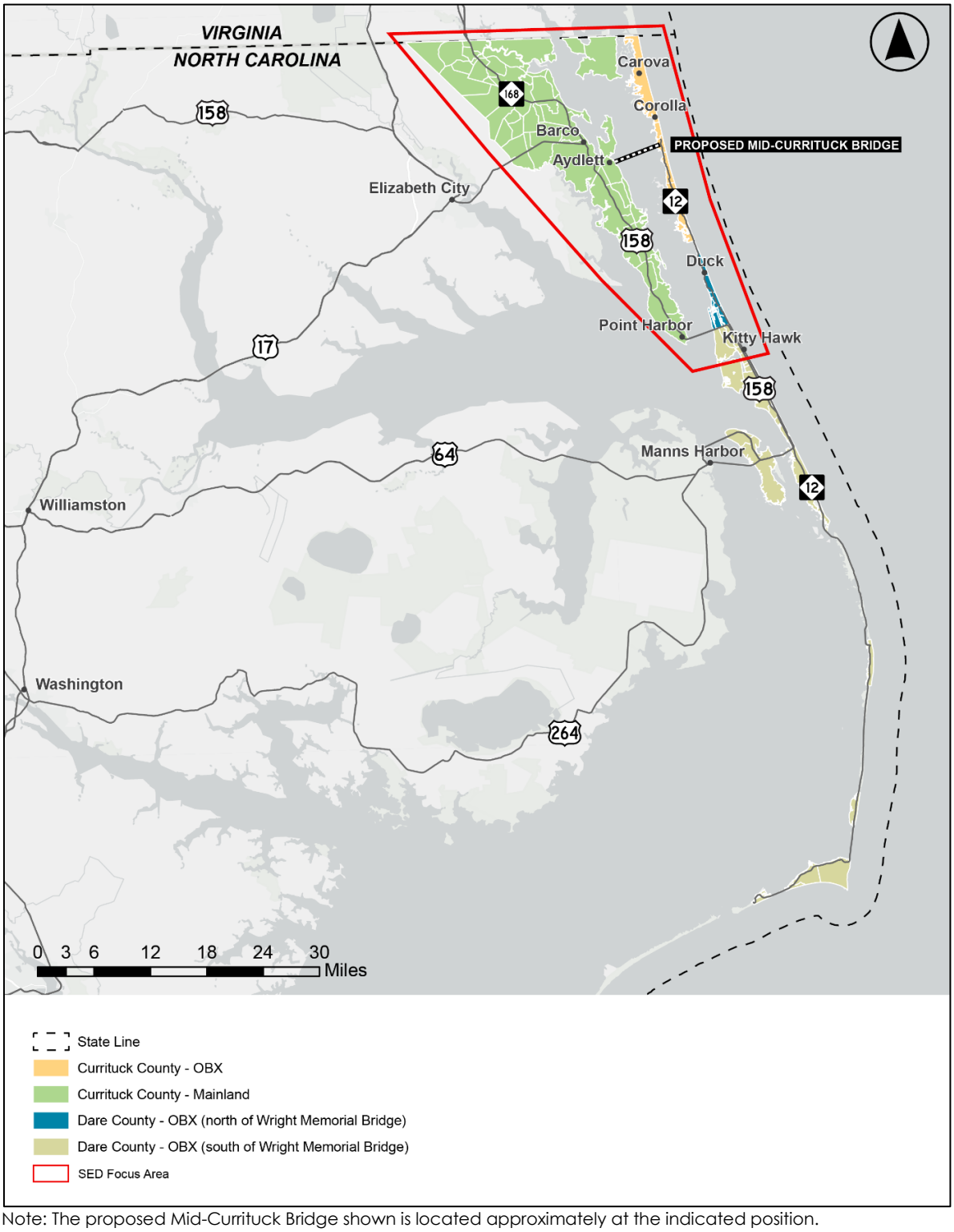


Figure 3.2: Study Area



Note: The proposed Mid-Currituck Bridge shown is located approximately at the indicated position.

3.1.2 Data Sources

The following section provides a short description of the data sources used to evaluate and update the socioeconomic inputs for this study.

U.S. Census Bureau

Census population data were accessed from the Esri Business Analyst Online (Esri BAO) data platform for counties and subareas. Major US Census counts are conducted decennially, 2010 and 2020, while annual sampling refreshes these estimates (the most-recent, available data used was from the year 2022).

Longitudinal-Employer Household Dynamic (LEHD) Origin-Destination Employment Statistics (LODES)

This employment data has annual updates from 2002 to 2020. This data relies on insurance reporting, so it typically underreports small businesses and their employees.

Woods & Poole, Inc.

Woods & Poole data were used at the county level for employment and population projections, which this dataset reports every year through the year 2060; the 2023 dataset was used in this report. The Woods & Poole forecasts are often fairly aggressive, straight-line projections with the unique aspect that control totals exist at the national and state level, and lower levels of geography are rebalanced to ensure that these state and national controls never vary (e.g., if a county in one part of the country has a population increase in a new update of the dataset, then another county or counties have to be reduced by the same amount). New datasets adjust prior years to match with US Census data as they become available.

AirDNA

AirDNA, a third-party vendor that collects information from Airbnb and VRBO platform listings was used primarily to examine relationships for occupancy and comparison to tax data on rental properties.

Collected Data

Interviews were conducted with county planning directors (four), managers of companies that platform rental homes (eight), and hotel operators (47). A second round of calls, as well as a website search, was used to generate total properties managed from those property managers that were interviewed and for those responding to calls (5) the numbers of listings on or not on VRBO or Airbnb. This information was used directly in the estimates of rental bedrooms and hotel rooms by TAZ. The data collected also informed the discussion of seasonal variability, as did data provided by the Outer Banks Visitors Bureau for monthly totals of dollars expended in Dare County for a four-year period.

Tax data were collected from the Dare and Currituck county's tax assessors' offices to generate total rental rooms; residential permit data were also collected to assess growth in housing for use in "growing" the number of rental rooms. Lastly, The Outer Banks Visitors Bureau, and their publication, "Long-Range Tourism Management Plan 2023–2033," provided local market insights.

3.2 BASE YEAR COUNTY CONTROL TOTALS

The overall reliability of a travel demand model depends upon the ability of the model to replicate existing traffic conditions. Demographic inputs to the travel demand model, like population, employment, and household income, determine how many trips are generated in the model and the paths taken to complete these trips. Therefore, developing accurate base year demographic inputs is key to calibrating a travel demand model to replicate existing traffic conditions.

Stantec recently developed the NCRTDM R17 model (June 2024) for the North Carolina Department of Transportation (NCDOT), which served as the starting point for the socioeconomic data review and base year development for this study. The County-level population control totals for the NCRTDM R17 model base year (2021) were developed using data from the U.S. Census Bureau. Base year (2021) estimates of employment in the NCRTDM R17 model were based on data from Data Axle (formerly InfoUSA), an industry leader in data, processing and data verification, as well as maintaining, validating, and categorizing millions of public records, real estate filings, and local directories. Data Axle provided point-level location data for businesses and number of employees within the NCRTDM R17 model area for 2021.

The following sections discuss the development of the county-level 2023 base year estimates of the principal drivers of traffic volume: population and employment.

3.2.1 Permanent Population

County-level control totals were developed for the ten counties in the model region. For population, historical Census data and current estimates for 2023 were reviewed. **Table 3.3** shows population from the 2010 and 2020 Censuses and the adopted 2023 base year for this study. From 2010 to 2020, several counties in the model region lost population, including Chowan, Gates, Hyde, Perquimans, Tyrrell and Washington counties. Currituck and Dare counties had the strongest growth during this period, at 1.8 percent and 0.8 percent annually. For the period from 2020 to 2023, Currituck and Camden counties had the strongest compound annual growth, at 2.9 percent and 2.7 percent respectively. Dare County grew by a compound annual growth of 1.2 percent. Collectively, Currituck and Dare counties added nearly 4,000 new residents from 2020 to 2023.

Table 3.3: Population County Control Totals (2023)

County	Population			CAGR	
	2010 Census	2020 Census	2023 MCB Study	2010-20	2020-23
Camden	9,980	10,355	11,219	0.4%	2.7%
Chowan	14,793	13,708	13,769	-0.8%	0.1%
Currituck	23,547	28,100	30,590	1.8%	2.9%
Dare	33,920	36,915	38,239	0.8%	1.2%
Gates	12,197	10,478	10,714	-1.5%	0.7%
Hyde	5,810	4,589	4,554	-2.3%	-0.3%
Pasquotank	40,661	40,568	41,045	0.0%	0.4%
Perquimans	13,453	13,005	13,557	-0.3%	1.4%
Tyrrell	4,407	3,245	3,406	-3.0%	1.6%
Washington	13,228	11,003	10,809	-1.8%	-0.6%
Total	171,996	171,966	177,902	0.0%	1.1%

Source: U.S. Census, J.S. Lane Company, & Stantec
Note: Due to rounding, the sums may not equal the totals.

Table 3.4 shows a comparison of the adopted base year population control totals and 2023 estimates from the annual Population Estimates developed by the U.S. Census Bureau. The base year population used for this study closely aligns with those estimates.

Table 3.4: Population Compared to Census Estimates (2023)

County	2023 Census Estimates	2023 MCB Study	Difference	Percent Difference
Camden	11,137	11,219	82	1%
Chowan	13,891	13,769	-122	-1%
Currituck	31,593	30,590	-1,003	-3%
Dare	38,110	38,239	129	0%
Gates	10,343	10,714	371	4%
Hyde	4,607	4,554	-53	-1%
Pasquotank	41,444	41,045	-399	-1%
Perquimans	13,377	13,557	180	1%
Tyrrell	3,461	3,406	-55	-2%
Washington	10,713	10,809	96	1%
Total	178,676	177,902	-774	0%

Source: U.S. Census, J.S. Lane Company, & Stantec
Note: Due to rounding, the sums may not equal the totals.

3.2.2 Total Employment

County-level control totals for employment were developed by reviewing estimates from Woods & Poole, as well as data from the Quarterly Census of Employment and Wages (QCEW)[1] and the Longitudinal-Employer Household Dynamic (LEHD) Origin-Destination Employment Statistics (LODES). **Table 3.5** shows historical employment trends in the model region from the QCEW over the past ten years. Employment totals for the region are relatively low, at just 60,000 jobs across ten counties. Nearly half of the regional employment is located in Currituck and Dare counties, with Dare County being the most common county of employment in the model region (34 percent). From 2013 to 2023, Currituck County grew by 1.9 percent annually, adding approximately 1,300 jobs, and Dare County grew by 0.7 percent annually, adding approximately 1,400 jobs. Notably, this 10-year period includes the economic recession caused by the COVID-19 pandemic, during which the region lost 5 percent in employment. Employment in both Currituck and Dare counties in 2023 exceeds the pre-pandemic levels observed in 2019.

[1] QCEW data excludes certain national security agencies, proprietors, the unincorporated self-employed, unpaid family members, certain farm and domestic workers, and railroad workers covered by the railroad unemployment insurance system. Excluded as well are workers who earned no wages during the entire applicable pay period because of work stoppages, temporary layoffs, illness, or unpaid vacations. For a complete list of exclusions, see https://www.bls.gov/cew/overview.htm

Table 3.5: Historical Employment in the Model Region (2013 – 2023)

County	Employment										
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023*
Camden	1,528	1,471	1,407	1,367	1,313	1,208	1,223	1,167	1,148	1,153	1,236
Chowan	4,521	4,595	4,563	4,539	4,589	4,637	4,604	4,496	4,691	4,957	5,123
Currituck	6,271	6,482	6,662	6,463	6,728	7,136	7,279	6,743	7,297	7,414	7,538
Dare	18,749	18,970	19,375	19,138	19,266	19,303	19,527	18,048	19,237	19,582	20,198
Gates	1,366	1,409	1,424	1,460	1,480	1,473	1,519	1,553	1,510	1,400	1,405
Hyde	2,212	2,205	2,160	1,941	1,971	1,895	1,818	1,684	1,734	1,718	1,742
Pasquotank	15,458	15,321	15,720	15,773	15,856	15,583	15,181	14,740	15,045	15,425	15,882
Perquimans	1,927	1,921	1,976	2,050	2,052	2,122	2,126	2,082	2,241	2,348	2,405
Tyrrell	1,211	1,170	1,146	1,139	1,188	1,120	1,062	994	970	977	945
Washington	3,660	3,536	3,497	3,465	3,403	3,290	3,160	3,080	3,065	3,119	3,104
Total	56,903	57,080	57,930	57,335	57,846	57,767	57,499	54,587	56,938	58,093	59,578

County	Employment CAGR									
		2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Camden	--	-3.7%	-4.4%	-2.8%	-4.0%	-8.0%	1.2%	-4.6%	-1.6%	0.4%	7.2%
Chowan	--	1.6%	-0.7%	-0.5%	1.1%	1.0%	-0.7%	-2.3%	4.3%	5.7%	3.3%
Currituck	--	3.4%	2.8%	-3.0%	4.1%	6.1%	2.0%	-7.4%	8.2%	1.6%	1.7%
Dare	--	1.2%	2.1%	-1.2%	0.7%	0.2%	1.2%	-7.6%	6.6%	1.8%	3.1%
Gates	--	3.1%	1.1%	2.5%	1.4%	-0.5%	3.1%	2.2%	-2.8%	-7.3%	0.4%
Hyde	--	-0.3%	-2.0%	-10.1%	1.5%	-3.9%	-4.1%	-7.4%	3.0%	-0.9%	1.4%
Pasquotank	--	-0.9%	2.6%	0.3%	0.5%	-1.7%	-2.6%	-2.9%	2.1%	2.5%	3.0%
Perquimans	--	-0.3%	2.9%	3.7%	0.1%	3.4%	0.2%	-2.1%	7.6%	4.8%	2.4%
Tyrrell	--	-3.4%	-2.1%	-0.6%	4.3%	-5.7%	-5.2%	-6.4%	-2.4%	0.7%	-3.3%
Washington	--	-3.4%	-1.1%	-0.9%	-1.8%	-3.3%	-4.0%	-2.5%	-0.5%	1.8%	-0.5%
Total	--	0.3%	1.5%	-1.0%	0.9%	-0.1%	-0.5%	-5.1%	4.3%	2.0%	2.6%

Source: Bureau of Labor Statistics, Quarterly Census of Employment and Wages (QCEW)
Note: QCEW data represent annual averages that are based on employment levels throughout the year. Due to rounding, the sums may not equal the totals.
*Preliminary estimates

Table 3.6 shows a comparison of the adopted base year total employment (includes seasonal employment) control totals and estimates from Woods & Poole. The total, ten-county employment is similar between the two datasets with this study having higher employment estimates than Woods and Poole for Dare and Washington Counties and lower employment estimates for all other counties. Several employment datasets were compared, and Stantec decided to largely retain the employment forecasts from the Region 17 model which were developed with a more regional focus than the estimates provided by Woods & Poole which employ a similar methodology across all counties in the United States.

Table 3.6: Employment Compared to Woods & Poole Estimates (2023)

County	W&P Estimates	MCB Study	W&P Difference	W&P Percent Difference
Camden	2,707	1,963	-744	-27%
Chowan	6,947	6,659	-288	-4%
Currituck	12,671	11,323	-1,348	-11%
Dare	32,006	38,265	6,259	20%
Gates	3,033	2,519	-514	-17%
Hyde	3,266	3,249	-17	-1%
Pasquotank	22,614	20,140	-2,474	-11%
Perquimans	4,225	2,982	-1,243	-29%
Tyrrell	1,645	1,312	-333	-20%
Washington	4,294	5,157	863	20%
Total	93,408	93,569	161	0%

Source: J.S. Lane Company & Stantec, Woods & Poole
Note: MCB Study estimates include seasonal employment to allow for comparison with W&P estimates. Due to rounding, the sums may not equal the totals.

3.3 BASE YEAR SOCIOECONOMIC ESTIMATES IN THE STUDY AREA

The following sections discuss the development of the TAZ-level 2023 base year estimates of the principal drivers of traffic volume: population (permanent and seasonal), employment (permanent and seasonal), rental bedrooms and hotel rooms, occupancy rates, and median household income.

For discussion purposes, the study area has been divided into four geographic areas as follows: Currituck County on the Outer Banks, Currituck County on the mainland, Dare County on the Outer Banks north of the WMB, and Dare County on the Outer Banks south of the WMB. These geographic areas were presented earlier in **Figure 3.2**.

3.3.1 Permanent Population

Permanent population on the Outer Banks is relatively low. Most of the permanent population is situated between the two existing bridges: the WMB and the WBB. Much of the northern portion of the Outer Banks near Corolla and the Carova 4-WD area is underdeveloped compared to the rest of the island. This is due to both utility and access constraints. While the northern portion of Currituck County is less developed, these zones still see large influxes of visitors during the Shoulder and Peak seasons.

The study area, as defined in **Figure 3.2**, is home to nearly 70,000 residents. Approximately 84 percent of the residents on the Outer Banks are located in Dare County south of the WMB, with

just over 6,000 residents located north of the WMB. Nearly half of the residents in the study area (43 percent) are located on the mainland in Currituck County, as shown in **Table 3.7**. The areas that would include potential trips on the MCB, referred to as the total market, include Currituck County (both the mainland and the Outer Banks portions) and Dare County, north of the WMB. The permanent population in the total market for the MCB is 35,207 persons or 52 percent of the permanent population in the study area.

Table 3.7: Permanent Population in the Study Area (2023)

Subarea	Population
Currituck County - OBX	1,538
Currituck County - Mainland	29,052
Dare County - OBX (north of Wright Memorial Bridge)	4,617
Total Market for Mid-Currituck Bridge	35,207
Dare County - OBX (south of Wright Memorial Bridge)	32,371
Total	67,578

Source: J.S. Lane Company & Stantec
Note: Due to rounding, the sums may not equal the totals.

3.3.2 Seasonal Population

The visitor model component of the travel demand model uses estimates of bedrooms from rental units and hotel rooms, as well as occupancy data, to generate visitor trips. **Table 3.8** shows the number of hotel rooms and rental bedrooms in the study area in 2023. Most of the existing hotel rooms are located south of the WMB. The number of rental bedrooms north and south of the WMB is more equally distributed, with a slight majority (53 percent) located south of the WMB. Note that rental bedrooms were not estimated for the mainland portion of Currituck County, since this area does not provide significant tourism-related housing for seasonal visitors to the Outer Banks.

Table 3.8: Rental Accommodations (2023)

Subarea	Hotel Rooms	Rental Bedrooms
Currituck County - OBX	386	17,109
Currituck County - Mainland	--	--
Dare County - OBX (north of Wright Memorial Bridge)	139	8,945
Total Market for Mid-Currituck Bridge	525	26,054
Dare County - OBX (south of Wright Memorial Bridge)	3,089	29,319
Total	3,614	55,373

Source: J.S. Lane Company & Stantec
Note: Due to rounding, the sums may not equal the totals.

Table 3.9 shows the occupancy rates for each month/season by rental type. On the Outer Banks, approximately 15 percent of rental units and 42 percent of hotel rooms are occupied during the

Off-Peak season. During the Peak season, however, virtually all of the rental units (95 percent) and most of the hotel rooms (90 percent) are occupied, indicating practical saturation. Occupancy rates were based on interviews with local rental property management companies and hotels conducted in 2023 for this study, as well as data collected as part of the previous studies in 2009 and 2016.

Table 3.9: Occupancy Rates by Month and Rental Type

Month	Season	Rental Units	Hotels
January	Off Peak	15%	42%
February	Off Peak	15%	42%
March	Off Peak	15%	42%
April	Off Peak	15%	65%
May	Shoulder	70%	65%
June	Shoulder / Peak	83%	78%
July	Peak	95%	90%
August	Shoulder / Peak	83%	78%
September	Shoulder	70%	78%
October	Off Peak	15%	65%
November	Off Peak	15%	42%
December	Off Peak	15%	42%

Source: J.S. Lane Company & Stantec

3.3.3 Permanent Employment

Tourism is the primary industry on the Outer Banks. As shown earlier in **Table 3.1**, the share of employment in the major hospitality-related industries is nearly double the share for the nation and for North Carolina. These jobs and careers include real estate, vacation rentals, restaurants, hotel operations, and beach services. Unlike other areas where employment levels remain fairly constant throughout the year, employment on the Outer Banks fluctuates with the tourism season, although not nearly as drastically as the visitor population. Construction, geared toward the building and maintenance of tourist-related structures, is also more than double the relative share of total employment than either the state or national average.

Permanent employment on the Outer Banks is relatively low. Like population, most of the permanent employment is situated between the two bridges: the WMB and the WBB. Additionally, many permanent residents commute to nearby cities on the mainland for employment. According to the latest ACS, nearly 23 percent of Currituck and Dare County residents with jobs commute outside the state to work, mostly to areas in southeastern Virginia. Total permanent employment in the study area is more than 38,000 jobs, the majority (63 percent) of which are located on the Outer Banks, south of the WMB. The remaining 37 percent are located north of the WMB or on the mainland in Currituck County. **Table 3.10** provides a detailed breakdown of permanent employment in the study area in 2023.

Table 3.10: Permanent Employment in the Study Area (2023)

Subarea	Employment
Currituck County - OBX	1,981
Currituck County - Mainland	8,747
Dare County - OBX (north of Wright Memorial Bridge)	3,447
Total Market for Mid-Currituck Bridge	14,175
Dare County - OBX (south of Wright Memorial Bridge)	24,193
Total	38,368

Source: J.S. Lane Company & Stantec
Note: Due to rounding, the sums may not equal the totals.

3.3.4 Seasonal Employment

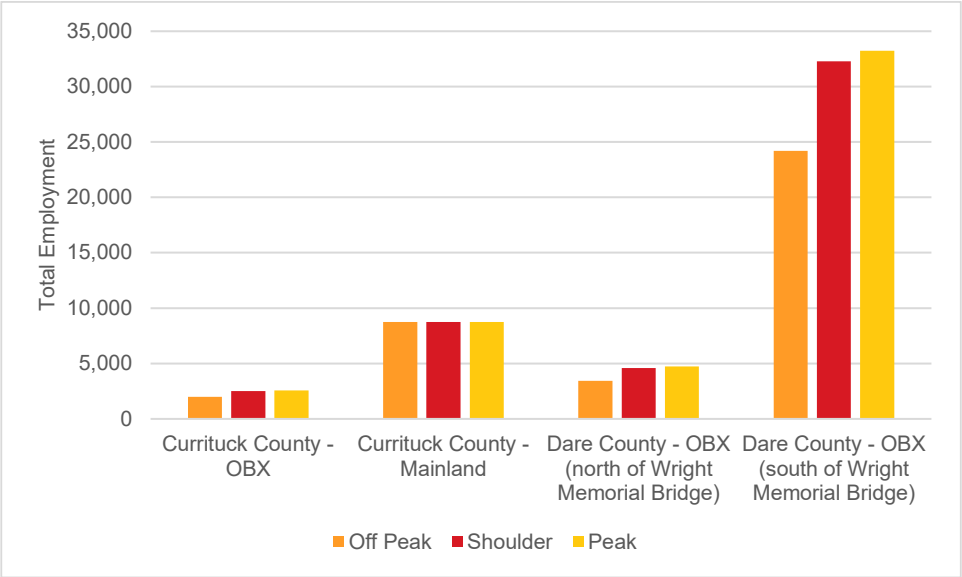
Table 3.11 summarizes total employment by season for 2023, as well as growth rates between seasons. Overall, total employment in the study area increases from approximately 38,400 jobs in the Off-Peak season to over 48,000 jobs in the Shoulder season, and to approximately 49,300 jobs in the Peak season. These constitute increases of 25 percent and 28 percent, respectively. However, if the Currituck County mainland is omitted, employment on the Outer Banks increases by 33 percent in the Shoulder season and 37 percent in the Peak season. While there is likely some seasonal employment on the Currituck mainland, the number is much smaller in comparison to the areas on the Outer Banks. Seasonal employment on the mainland may increase in response to the construction of the Mid-Currituck Bridge. However, Stantec adopted a conservative approach that assumed no seasonal employment on the Currituck mainland over the forecast period. **Figure 3.3** shows the seasonal differences in employment for the study area.

Table 3.11: Total Employment by Season (2023)

Subarea	Total Employment			Percent Increase over Off Peak	
	Off Peak	Shoulder	Peak	Shoulder	Peak
Currituck County - OBX	1,981	2,517	2,576	27%	30%
Currituck County - Mainland	8,747	8,747	8,747	0%	0%
Dare County - OBX (north of Wright Memorial Bridge)	3,447	4,604	4,734	34%	37%
Total Market for Mid-Currituck Bridge	14,175	15,868	16,057	12%	13%
Dare County - OBX (south of Wright Memorial Bridge)	24,193	32,282	33,198	33%	37%
Total	38,368	48,150	49,255	25%	28%

Source: J.S. Lane Company & Stantec
Note: Due to rounding, the sums may not equal the totals.

Figure 3.3: Total Employment by Season (2023)



3.4 FUTURE YEAR COUNTY CONTROL TOTALS

The following sections describe the methodology for developing future year forecasts of population and employment for the ten counties included in the model area. The process included a review of forecasts from other sources and historical growth trends, as well as interviews with planning officials in the region.

3.4.1 Permanent Population

Future year county-level control totals were developed for the ten counties in the model region for the years 2030, 2040, and 2050. Population forecasts from the North Carolina State Demographer and Woods & Poole were reviewed.

Table 3.12 shows population from the three sources and their associated compound annual growth rates (CAGRs). The adopted population forecasts closely align with estimates from the NC State Demographer. The highest growth in the model region over the forecast period is in Currituck County, which is forecasted to grow between 2.2 and 3.6 percent annually from 2023 to 2050. Currituck County is where land is available for housing development. Growth in Dare County is projected to be approximately 1 percent per year over the forecast period, due primarily to the fact that the county is largely built out.

Table 3.12: Comparison of Adopted Population Forecasts to Other Sources

County	Adopted Population Forecasts				CAGR		
	2023	2030	2040	2050	2023-30	2030-40	2040-50
Camden	11,219	12,802	13,544	13,825	1.9%	0.6%	0.2%
Chowan	13,769	13,776	13,798	13,817	0.0%	0.0%	0.0%
Currituck	30,590	39,257	51,642	64,012	3.6%	2.8%	2.2%
Dare	38,239	41,416	45,954	50,497	1.1%	1.0%	0.9%
Gates	10,714	10,504	10,455	10,451	-0.3%	0.0%	0.0%
Hyde	4,554	4,173	3,666	3,201	-1.2%	-1.3%	-1.3%
Pasquotank	41,045	41,482	41,620	41,643	0.2%	0.0%	0.0%
Perquimans	13,557	14,022	14,117	14,124	0.5%	0.1%	0.0%
Tyrrell	3,406	3,169	2,865	2,595	-1.0%	-1.0%	-1.0%
Washington	10,809	9,678	8,527	7,878	-1.6%	-1.3%	-0.8%
Total	177,902	190,279	206,188	222,043	1.0%	0.8%	0.7%
County	**NC Demographer Population Forecasts**				**CAGR**		
	2023	2030	2040	2050	2023-30	2030-40	2040-50
Camden	11,144	12,252	12,963	13,232	1.4%	0.6%	0.2%
Chowan	13,722	13,735	13,754	13,771	0.0%	0.0%	0.0%
Currituck	32,208	41,335	54,369	67,404	3.6%	2.8%	2.2%
Dare	38,392	41,583	46,142	50,700	1.1%	1.0%	0.9%
Gates	10,247	10,047	10,003	9,999	-0.3%	0.0%	0.0%
Hyde	4,495	4,120	3,617	3,156	-1.2%	-1.3%	-1.4%
Pasquotank	40,887	41,324	41,460	41,479	0.2%	0.0%	0.0%
Perquimans	13,598	14,064	14,162	14,174	0.5%	0.1%	0.0%
Tyrrell	3,161	2,942	2,661	2,409	-1.0%	-1.0%	-1.0%
Washington	10,425	9,332	8,228	7,598	-1.6%	-1.3%	-0.8%
Total	178,279	190,734	207,359	223,922	1.0%	0.8%	0.8%
County	**Woods & Poole Population Forecasts**				**CAGR**		
	2023	2030	2040	2050	2023-30	2030-40	2040-50
Camden	11,174	11,789	12,729	13,744	0.8%	0.8%	0.8%
Chowan	13,934	13,888	13,822	13,756	0.0%	0.0%	0.0%
Currituck	31,435	34,539	39,514	45,206	1.4%	1.4%	1.4%
Dare	38,287	40,686	44,376	48,401	0.9%	0.9%	0.9%
Gates	10,416	10,650	10,992	11,346	0.3%	0.3%	0.3%
Hyde	4,553	4,396	4,180	3,975	-0.5%	-0.5%	-0.5%
Pasquotank	41,120	42,414	44,334	46,340	0.4%	0.4%	0.4%
Perquimans	13,283	13,805	14,586	15,412	0.6%	0.6%	0.6%
Tyrrell	3,361	3,337	3,302	3,268	-0.1%	-0.1%	-0.1%
Washington	10,791	10,539	10,190	9,851	-0.3%	-0.3%	-0.3%
Total	178,354	186,043	198,025	211,299	0.6%	0.6%	0.7%

Source: J.S. Lane Company & Stantec, NC State Demographer, Woods & Poole
Note: Due to rounding, the sums may not equal the totals.

3.4.2 Total Employment

County-level control totals for total employment (including seasonal employment) were developed by reviewing forecasts from Woods & Poole. **Table 3.13** shows a comparison of the adopted employment control totals for 2030, 2040, and 2050 compared to forecasts from Woods & Poole. Growth rates for the adopted employment forecasts closely align with those from Woods & Poole. Over the forecast period, Currituck and Dare counties show the strongest growth. Currituck County is projected to grow by approximately 2 percent annually over the forecast period, adding nearly 8,000 new jobs (including seasonal jobs). Dare County is projected to grow at a slightly lower rate of approximately 1.5 percent annually over the forecast period, adding nearly 19,000 new jobs (including seasonal jobs).

Table 3.13: Comparison of Adopted Employment Forecasts to Other Sources

County	Adopted Employment Forecasts				CAGR		
	2023	2030	2040	2050	2023-30	2030-40	2040-50
Camden	1,963	2,081	2,250	2,411	0.8%	0.8%	0.7%
Chowan	6,659	6,870	7,080	7,247	0.4%	0.3%	0.2%
Currituck	11,323	13,072	15,883	19,196	2.1%	2.0%	1.9%
Dare	38,265	43,121	50,000	57,204	1.7%	1.5%	1.4%
Gates	2,519	2,651	2,792	2,911	0.7%	0.5%	0.4%
Hyde	3,249	3,432	3,624	3,825	0.8%	0.5%	0.5%
Pasquotank	20,140	21,523	23,280	24,923	1.0%	0.8%	0.7%
Perquimans	2,982	3,166	3,408	3,634	0.9%	0.7%	0.6%
Tyrrell	1,312	1,377	1,453	1,507	0.7%	0.5%	0.4%
Washington	5,157	5,314	5,485	5,647	0.4%	0.3%	0.3%
Total	93,569	102,607	115,255	128,505	1.3%	1.2%	1.1%
County	**Woods & Poole Employment Forecasts**				**CAGR**		
	2023	2030	2040	2050	2023-30	2030-40	2040-50
Camden	2,707	2,881	3,114	3,335	0.9%	0.8%	0.7%
Chowan	6,947	7,153	7,373	7,537	0.4%	0.3%	0.2%
Currituck	12,671	14,688	17,925	21,771	2.1%	2.0%	2.0%
Dare	32,006	36,064	41,815	47,846	1.7%	1.5%	1.4%
Gates	3,033	3,165	3,327	3,476	0.6%	0.5%	0.4%
Hyde	3,266	3,438	3,633	3,829	0.7%	0.6%	0.5%
Pasquotank	22,614	24,101	26,092	27,942	0.9%	0.8%	0.7%
Perquimans	4,225	4,448	4,789	5,104	0.7%	0.7%	0.6%
Tyrrell	1,645	1,732	1,815	1,892	0.7%	0.5%	0.4%
Washington	4,294	4,433	4,585	4,725	0.5%	0.3%	0.3%
Total	93,408	102,103	114,468	127,457	1.3%	1.1%	1.1%

Source: J.S. Lane Company & Stantec, Woods & Poole
Note: MCB Study include seasonal employment for comparison purposes. Due to rounding, the sums may not equal the totals.

3.5 BASE CASE FORECASTS

Key trends in the study area over the forecast years include a stable but growing permanent population (1.9 percent per year), inventory of rental bedrooms (0.6 percent per year), and permanent employment (1.7 percent per year). Highlights for the entire study area, which includes the Outer Banks and mainland Currituck County, reflect the following major changes:

- Total permanent population increases from 67,600 in 2023 to 113,000 in 2050. Most of the growth (31,300) is on the Currituck County mainland where there is more developable land. The largest percent population increase is in the Currituck County portion of the Outer Banks, which more than doubles from 1,500 in 2023 to nearly 3,700 in 2050.
- Total number of rental bedrooms increases from 55,400 in 2023 to 65,500 in 2050. More than 60 percent of the growth in rental bedrooms is in the Currituck County portion of the Outer Banks, due to land availability and improved access provided by the proposed MCB. The growth in rental bedrooms accounts for both new construction, as well as expansions and rebuilds of existing structures into larger units.
- Total permanent employment increases from 38,400 in 2023 to nearly 60,000 in 2050. The Currituck County mainland is projected to have the highest percent increase at over 2 percent per year. However, the majority of new jobs (13,000) are in Dare County, south of the WMB.
- Total Peak Season Employment (including permanent employment) increases to 75,900 in 2050 from a base of 49,300 in 2023. The majority of these seasonal jobs are located in Dare County, south of the WMB.

3.5.1 Permanent Population

TAZ-level estimates in the study area were developed by Mr. Lane based on a review of existing land uses and build out potential, as well as information gathered from local planning staff. The TAZ-level forecasts were reviewed by Stantec and further adjusted to reflect information on development patterns gathered during the development of the NCRTDM R17 model. The base year and forecasted permanent population and associated growth is shown in **Table 3.14**.

Growth rates are highest in areas with more development potential, particularly in Currituck County on the mainland and Outer Banks, as much of Dare County has approached build-out. Currituck County is part of the large metropolitan statistical area found in southeastern Virginia (which includes Norfolk, Virginia Beach, and Newport News). The mainland portion of Currituck County will see population growth that benefits from the relationship. With the addition of the MCB, the beach portion of the county (Outer Banks) should benefit similarly. Without the bridge, the growth in the latter area would be only modest, as increased congestion elsewhere would discourage rapid expansion.

Table 3.14: Base Year and Forecasted Permanent Population

Subarea	Population				CAGR		
	2023	2030	2040	2050	2023-30	2030-40	2040-50
Currituck County - OBX	1,538	2,265	2,980	3,694	5.7%	2.8%	2.2%
Currituck County - Mainland	29,052	36,992	48,662	60,318	3.5%	2.8%	2.2%
Dare County - OBX (north of Wright Memorial Bridge)	4,617	5,171	5,738	6,305	1.6%	1.0%	0.9%
Total Market for Mid-Currituck Bridge	35,207	44,428	57,380	70,317	3.4%	2.6%	2.1%
Dare County - OBX (south of Wright Memorial Bridge)	32,371	34,965	38,795	42,630	1.1%	1.0%	0.9%
Total	67,578	79,393	96,175	112,947	2.3%	1.9%	1.6%

Source: J.S. Lane Company & Stantec
Note: Due to rounding, the sums may not equal the totals.

3.5.2 Seasonal Population

As previously mentioned, seasonal population is not a direct input to the travel demand model. Rather, the visitor model component of the travel demand model uses estimates of bedrooms from rental units and hotel rooms, as well as occupancy data, to generate visitor trips. Mr. Lane developed the initial forecasts for rental bedrooms based on a visual inspection of the potential for growth, including the amount of vacant land, land that is in conservation, and the value of residential properties (and potential for tear-down and rebuilds to homes that are larger with more bedrooms). Stantec reviewed these estimates and made further adjustments to reflect a slightly more conservative outlook appropriate for this Level 2 study.

Table 3.15 shows the base year and forecasted rental bedrooms and associated growth. Of the more than 10,000 new rental bedrooms that are anticipated in the study area over the forecast horizon, over 6,000 are forecasted to be in Currituck County on the Outer Banks. No seasonal rental development was projected on the Currituck mainland because it is not considered a feasible location for large, seasonal rentals.

Table 3.15: Base Year and Forecasted Rental Bedrooms

Subarea	Rental Bedrooms				CAGR		
	2023	2030	2040	2050	2023-30	2030-40	2040-50
Currituck County - OBX	17,109	20,078	23,016	23,247	2.3%	1.4%	0.1%
Currituck County - Mainland	--	--	--	--	--	--	--
Dare County - OBX (north of Wright Memorial Bridge)	8,945	9,476	9,571	9,667	0.8%	0.1%	0.1%
Total Market for Mid-Currituck Bridge	26,054	29,553	32,587	32,914	1.8%	1.0%	0.1%
Dare County - OBX (south of Wright Memorial Bridge)	29,319	31,280	32,309	32,634	0.9%	0.3%	0.1%
Total	55,373	60,833	64,896	65,548	1.4%	0.6%	0.1%

Source: J.S. Lane Company & Stantec
Note: Due to rounding, the sums may not equal the totals.

There are no known hotels planned for the Outer Banks. While it is possible that some hotels will be added over the forecast period, it is difficult to determine their size and location absent any existing plans. Moreover, no major hotels are anticipated in the Carova 4-WD area due to regulatory and utility constraints. Therefore, the number of hotel rooms was held constant over the forecast period.

The assumed occupancy rates by season (see **Table 3.9**) for the base year were held constant across the forecast period.

3.5.3 Permanent Employment

Similar to population, TAZ-level estimates in the study area were developed by Mr. Lane based on a review of existing land uses and build out potential, as well as information gathered from local planning staff. The TAZ-level forecasts were reviewed by Stantec and further adjusted to reflect information on development patterns gathered during the development of the NCRTDM R17 model. The base year and forecasted permanent employment and associated growth is shown in **Table 3.16**.

Growth rates are highest in Currituck County on the mainland, where an increase in residential development is likely to encourage the development of certain commercial uses, such as grocery stores, retail shopping, banks, gas stations and convenience stores, etc. Area stakeholders anticipate that the proposed MCB would also serve to attract commercial development on the mainland, particularly land intensive uses that cannot be accommodated on the Outer Banks.

Employment growth on the Outer Banks is greatest in Dare County, south of the WMB, where the majority of permanent employment is currently located. However, many northern Outer Banks stakeholders believe that the proposed MCB will spur some development and redevelopment in Corolla, including upscale commercial projects. The Currituck County portion of the Outer Banks is forecasted to grow around 1 percent per year over the forecast period, adding approximately 500 jobs.

Table 3.16: Base Year and Forecasted Permanent Employment

Subarea	Employment				CAGR		
	2023	2030	2040	2050	2023-30	2030-40	2040-50
Currituck County - OBX	1,981	2,133	2,297	2,458	1.1%	0.7%	0.7%
Currituck County - Mainland	8,747	10,292	12,889	15,992	2.4%	2.3%	2.2%
Dare County - OBX (north of Wright Memorial Bridge)	3,447	3,713	3,997	4,276	1.1%	0.7%	0.7%
Total Market for Mid-Currituck Bridge	14,175	16,138	19,183	22,726	1.9%	1.7%	1.7%
Dare County - OBX (south of Wright Memorial Bridge)	24,193	27,432	32,104	37,016	1.8%	1.6%	1.4%
Total	38,368	43,570	51,287	59,742	1.8%	1.6%	1.5%

Source: J.S. Lane Company & Stantec
Note: Due to rounding, the sums may not equal the totals.

3.5.4 Seasonal Employment

Base year seasonal employment in the study area is estimated to increase by 27 to 34 percent in the Shoulder season and by 30 to 38 percent during the Peak season, depending on the subarea (excluding the Currituck County mainland). The Shoulder and Peak season employment estimates relied on seasonal factors developed using QCEW data for the 2018 MCB Study. The relationship between permanent employment and seasonal employment was maintained across the forecast period as shown in **Table 3.17** (Shoulder season) and **Table 3.18** (Peak season).

Table 3.17: Base Year and Forecasted Shoulder Season Employment

Subarea	Shoulder Season Total Employment				Percent Increase Over Off Peak			
	2023	2030	2040	2050	2023	2030	2040	2050
Currituck County - OBX	2,517	2,714	2,924	3,129	27%	27%	27%	27%
Currituck County - Mainland	8,747	10,292	12,889	15,992	0%	0%	0%	0%
Dare County - OBX (north of Wright Memorial Bridge)	4,604	4,968	5,354	5,721	34%	34%	34%	34%
Total Market for Mid-Currituck Bridge	15,868	17,974	21,167	24,842	12%	11%	10%	9%
Dare County - OBX (south of Wright Memorial Bridge)	32,282	36,594	42,830	49,395	33%	33%	33%	33%
Total	48,150	54,569	63,997	74,237	25%	25%	25%	24%

Source: J.S. Lane Company & Stantec
Note: Due to rounding, the sums may not equal the totals.

Table 3.18: Base Year and Forecasted Peak Season Employment

Subarea	Peak Season Total Employment				Percent Increase Over Off Peak			
	2023	2030	2040	2050	2023	2030	2040	2050
Currituck County - OBX	2,576	2,782	2,997	3,207	30%	30%	30%	30%
Currituck County - Mainland	8,747	10,292	12,889	15,992	0%	0%	0%	0%
Dare County - OBX (north of Wright Memorial Bridge)	4,734	5,114	5,512	5,889	37%	38%	38%	38%
Total Market for Mid-Currituck Bridge	16,057	18,187	21,397	25,088	13%	13%	12%	10%
Dare County - OBX (south of Wright Memorial Bridge)	33,198	37,658	44,075	50,832	37%	37%	37%	37%
Total	49,255	55,845	65,472	75,920	28%	28%	28%	27%

Source: J.S. Lane Company & Stantec
Note: Due to rounding, the sums may not equal the totals.

3.6 HIGH CASE FORECASTS

A High Case SED forecast was also developed which incorporated assumptions considered to be more favorable to utilization of the proposed MCB, including higher population and employment growth in Currituck and Dare counties and more rental units on the Outer Banks, north of the WMB. Mr. Lane, the SED subconsultant, developed a methodology for forecasting values for the high case that involved creating ranges around the base case forecast values for population and employment to determine reasonable expectations of variation in growth based on observed past county trends from 2010 to 2023 using data from Woods & Poole. Confidence intervals were developed for each county to represent this range, with the result being used to create "Low" and "High" estimates for 2030, 2040, and 2050 for each county. At the TAZ-level, each TAZ maintained its share of total county population from the Base Case. The following sections discuss the High Case forecast compared to the Base Case forecast in the study area.

3.6.1 Permanent Population

In the High Case forecast, the part of the study area considered to be the primary market for the MCB grows to approximately 76,000 by 2050 compared to just over 70,000 in the Base Case, representing an 8 percent increase in population over the Base Case. The projected population on the Outer Banks, south of the WMB, is also higher in 2050 by about 2 percent. **Table 3.19** shows a comparison of permanent population for the Base Case and High Case forecast.

Table 3.19: Base Case and High Case Permanent Population Forecasts

Subarea	Base Case Population				High Case Population			
	2023	2030	2040	2050	2023	2030	2040	2050
Currituck County - OBX	1,538	2,265	2,980	3,694	1,538	2,377	3,195	3,998
Currituck County - Mainland	29,052	36,992	48,662	60,318	29,052	38,806	52,159	65,290
Dare County - OBX (north of Wright Memorial Bridge)	4,617	5,171	5,738	6,305	4,617	5,218	5,819	6,407
Total Market for Mid-Currituck Bridge	35,207	44,428	57,380	70,317	35,207	46,401	61,173	75,695
Dare County - OBX (south of Wright Memorial Bridge)	32,371	34,965	38,795	42,630	32,371	35,289	39,347	43,322
Total	67,578	79,393	96,175	112,947	67,578	81,690	100,520	119,017
Subarea	**Base Case Population CAGR**				**High Case Population CAGR**			
		2023-30	2030-40	2040-50		2023-30	2030-40	2040-50
Currituck County - OBX	--	5.7%	2.8%	2.2%	--	6.4%	3.0%	2.3%
Currituck County - Mainland	--	3.5%	2.8%	2.2%	--	4.2%	3.0%	2.3%
Dare County - OBX (north of Wright Memorial Bridge)	--	1.6%	1.0%	0.9%	--	1.8%	1.1%	1.0%
Total Market for Mid-Currituck Bridge	--	3.4%	2.6%	2.1%	--	4.0%	2.8%	2.2%
Dare County - OBX (south of Wright Memorial Bridge)	--	1.1%	1.0%	0.9%	--	1.2%	1.1%	1.0%
Total	--	2.3%	1.9%	1.6%	--	2.7%	2.1%	1.7%

Source: J.S. Lane Company & Stantec
Note: Due to rounding, the sums may not equal the totals.

3.6.2 Seasonal Population

For the High Case, the rental bedrooms located in Currituck County on the Outer Banks were increased. The number of rental bedrooms in all other TAZs were held constant. The High Case assumes there will be more than 3,000 more rental bedrooms on the Outer Banks in Currituck County in 2050, representing an increase of 14 percent compared to the Base Case. More rental units in the Currituck County portion of the Outer Banks will attract more visitors to the time savings offered by the proposed MCB to reach their rental properties. **Table 3.20** shows a comparison of rental bedrooms for the Base Case and High Case forecast.

Table 3.20: Base Case and High Case Rental Bedroom Forecasts

Subarea	Base Case Rental Bedrooms				High Case Rental Bedrooms			
	2023	2030	2040	2050	2023	2030	2040	2050
Currituck County - OBX	17,109	20,078	23,016	23,247	17,109	21,158	25,432	26,468
Currituck County - Mainland	--	--	--	--	--	--	--	--
Dare County - OBX (north of Wright Memorial Bridge)	8,945	9,476	9,571	9,667	8,945	9,476	9,571	9,667
Total Market for Mid-Currituck Bridge	26,054	29,553	32,587	32,914	26,054	30,634	35,003	36,135
Dare County - OBX (south of Wright Memorial Bridge)	29,319	31,280	32,309	32,634	29,319	31,280	32,309	32,634
Total	55,373	60,833	64,896	65,548	55,373	61,914	67,312	68,769
Subarea	**Base Case Rental Bedrooms CAGR**				**High Case Rental Bedrooms CAGR**			
		2023-30	2030-40	2040-50		2023-30	2030-40	2040-50
Currituck County - OBX	--	2.3%	1.4%	0.1%	--	3.1%	1.9%	0.4%
Currituck County - Mainland	--	--	--	--	--	--	--	--
Dare County - OBX (north of Wright Memorial Bridge)	--	0.8%	0.1%	0.1%	--	0.8%	0.1%	0.1%
Total Market for Mid-Currituck Bridge	--	1.8%	1.0%	0.1%	--	2.3%	1.3%	0.3%
Dare County - OBX (south of Wright Memorial Bridge)	--	0.9%	0.3%	0.1%	--	0.9%	0.3%	0.1%
Total	--	1.4%	0.6%	0.1%	--	1.6%	0.8%	0.2%

Source: J.S. Lane Company & Stantec
Note: Due to rounding, the sums may not equal the totals.

3.6.3 Permanent Employment

Similar to population, employment throughout the study area was increased for the High Case. The part of the study area considered to be the primary market for the MCB grows to more than 26,000 jobs by 2050 compared to nearly 23,000 jobs in the Base Case, representing a 17 percent increase in employment over the Base Case. The projected employment located on the Outer Banks south of the WMB is also higher in 2050 by approximately 13 percent. **Table 3.21** shows a comparison of permanent employment for the Base Case and High Case forecasts.

Table 3.21: Base Case and High Case Permanent Employment Forecasts

Subarea	Base Case Employment				High Case Employment			
	2023	2030	2040	2050	2023	2030	2040	2050
Currituck County - OBX	1,981	2,133	2,297	2,458	1,981	2,327	2,616	2,881
Currituck County - Mainland	8,747	10,292	12,889	15,992	8,747	11,219	14,687	18,752
Dare County - OBX (north of Wright Memorial Bridge)	3,447	3,713	3,997	4,276	3,447	3,995	4,449	4,843
Total Market for Mid-Currituck Bridge	14,175	16,138	19,183	22,726	14,175	17,541	21,752	26,476
Dare County - OBX (south of Wright Memorial Bridge)	24,193	27,432	32,104	37,016	24,193	29,555	35,730	41,940
Total	38,368	43,570	51,287	59,742	38,368	47,096	57,482	68,416
Subarea	**Base Case Employment CAGR**				**High Case Employment CAGR**			
		2023-30	2030-40	2040-50		2023-30	2030-40	2040-50
Currituck County - OBX	--	1.1%	0.7%	0.7%	--	2.3%	1.2%	1.0%
Currituck County - Mainland	--	2.4%	2.3%	2.2%	--	3.6%	2.7%	2.5%
Dare County - OBX (north of Wright Memorial Bridge)	--	1.1%	0.7%	0.7%	--	2.1%	1.1%	0.9%
Total Market for Mid-Currituck Bridge	--	1.9%	1.7%	1.7%	--	3.1%	2.2%	2.0%
Dare County - OBX (south of Wright Memorial Bridge)	--	1.8%	1.6%	1.4%	--	2.9%	1.9%	1.6%
Total	--	1.8%	1.6%	1.5%	--	3.0%	2.0%	1.8%

Source: J.S. Lane Company & Stantec
Note: Due to rounding, the sums may not equal the totals.

3.6.4 Seasonal Employment

Table 3.22 and **Table 3.23** show the Base Case and High forecast for Shoulder and Peak season total employment (includes permanent), respectively. Shoulder season employment in the part of the study area considered to be the primary market for the MCB grows to nearly 28,000 jobs by 2050 compared to nearly 25,000 jobs in the Base Case, representing a 12 percent increase in employment over the Base Case. The projected Shoulder season employment located on the Outer Banks, south of the WMB, is also higher in 2050 by approximately 3 percent.

Peak season employment in the part of the study area considered to be the primary market for the MCB grows to more than 28,000 jobs by 2050 compared to 25,000 jobs in the High Case, representing a 12 percent increase in employment over the Base Case. The projected Peak season employment located on the Outer Banks, south of the WMB, is also higher in 2050 by approximately 4 percent.

Table 3.22: Base Case and High Case Shoulder Season Employment Forecasts

Subarea	Base Case Shoulder Season Employment				High Case Shoulder Season Employment			
	2023	2030	2040	2050	2023	2030	2040	2050
Currituck County - OBX	2,517	2,714	2,924	3,129	2,517	2,768	3,007	3,241
Currituck County - Mainland	8,747	10,292	12,889	15,992	8,747	11,219	14,687	18,752
Dare County - OBX (north of Wright Memorial Bridge)	4,604	4,968	5,354	5,721	4,604	5,060	5,507	5,909
Total Market for Mid-Currituck Bridge	15,868	17,974	21,167	24,842	15,868	19,047	23,201	27,901
Dare County - OBX (south of Wright Memorial Bridge)	32,282	36,594	42,830	49,395	32,282	37,270	44,010	50,999
Total	48,150	54,569	63,997	74,237	48,150	56,317	67,211	78,900
Subarea	**Base Case Shoulder Season Employment CAGR**				**High Case Shoulder Season Employment CAGR**			
		2023-30	2030-40	2040-50		2023-30	2030-40	2040-50
Currituck County - OBX	--	1.1%	0.7%	0.7%	--	1.4%	0.8%	0.8%
Currituck County - Mainland	--	2.4%	2.3%	2.2%	--	3.6%	2.7%	2.5%
Dare County - OBX (north of Wright Memorial Bridge)	--	1.1%	0.8%	0.7%	--	1.4%	0.9%	0.7%
Total Market for Mid-Currituck Bridge	--	1.8%	1.6%	1.6%	--	2.6%	2.0%	1.9%
Dare County - OBX (south of Wright Memorial Bridge)	--	1.8%	1.6%	1.4%	--	2.1%	1.7%	1.5%
Total	--	1.8%	1.6%	1.5%	--	2.3%	1.8%	1.6%

Source: J.S. Lane Company & Stantec
Note: Due to rounding, the sums may not equal the totals.

Table 3.23: Base Case and High Case Peak Season Employment Forecasts

Subarea	Base Case Peak Season Employment				High Case Peak Season Employment			
	2023	2030	2040	2050	2023	2030	2040	2050
Currituck County - OBX	2,576	2,782	2,997	3,207	2,576	2,842	3,089	3,332
Currituck County - Mainland	8,747	10,292	12,889	15,992	8,747	11,219	14,687	18,752
Dare County - OBX (north of Wright Memorial Bridge)	4,734	5,114	5,512	5,889	4,734	5,216	5,682	6,098
Total Market for Mid-Currituck Bridge	16,057	18,187	21,397	25,088	16,057	19,277	23,458	28,182
Dare County - OBX (south of Wright Memorial Bridge)	33,198	37,658	44,075	50,832	33,198	38,412	45,392	52,622
Total	49,255	55,845	65,472	75,920	49,255	57,689	68,850	80,804
Subarea	**Base Case Peak Season Employment CAGR**				**High Case Shoulder Season Employment CAGR**			
		2023-30	2030-40	2040-50		2023-30	2030-40	2040-50
Currituck County - OBX	--	1.1%	0.7%	0.7%	--	1.4%	0.8%	0.8%
Currituck County - Mainland	--	2.4%	2.3%	2.2%	--	3.6%	2.7%	2.5%
Dare County - OBX (north of Wright Memorial Bridge)	--	1.1%	0.8%	0.7%	--	1.4%	0.9%	0.7%
Total Market for Mid-Currituck Bridge	--	1.8%	1.6%	1.6%	--	2.6%	2.0%	1.9%
Dare County - OBX (south of Wright Memorial Bridge)	--	1.8%	1.6%	1.4%	--	2.1%	1.7%	1.5%
Total	--	1.8%	1.6%	1.5%	--	2.3%	1.8%	1.6%

Source: J.S. Lane Company & Stantec
Note: Due to rounding, the sums may not equal the totals.

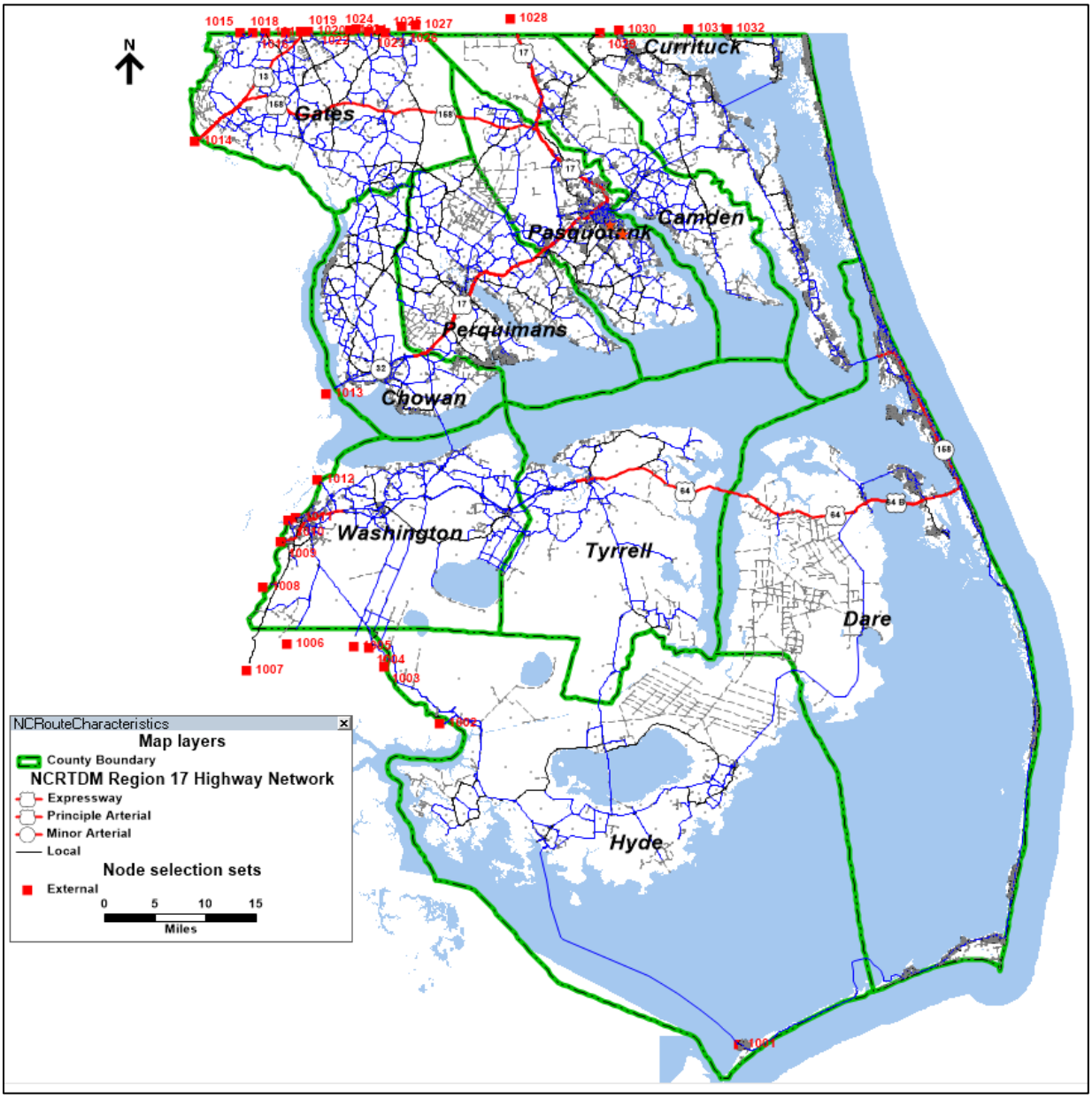
4.0 TRAVEL DEMAND AND TOLL DIVERSION MODELING

The travel demand modeling and toll diversion estimation process for the MCB T&R forecasts were developed to focus on specific characteristics of potential customers to this proposed toll facility. Unlike many other toll facilities, the proposed MCB will serve communities that are primarily recreational in nature and have a significant portion of dwelling units that are seasonally occupied second homes or rentals. Note that the prior 2019 MCB T&R study used a regional travel demand model developed by Stantec as part of the study while this current study adopted the regional travel demand estimates from the existing regional travel demand model, NCRTDM R17, which had been recently developed by Stantec in conjunction with NCDOT.

4.1 REGIONAL TRAVEL DEMAND MODEL

NCRTDM R17 is the first of a series of new regional models instituted by NCDOT which specially contains new model components dealing with Connected Autonomous Vehicles (CAVs) and a customized visitor trip model that is structured to estimate the recreational activities focused on the coastal areas of the region as this is a major generator of traffic particularly in the summer months. The model structure also provides the estimations of Average Daily Traffic (ADT) conditions for various season and day types such as Off-Peak season (April) weekday/weekend, Shoulder season (June) weekday/Saturday/Sunday, and Peak season (July) weekday/Saturday/ Sunday. The model area encompasses a total of 10 counties in northeastern North Carolina as shown in **Figure 4.1**. It includes total 727 zones with 695 internal zones and 32 external zones.

Figure 4.1: NCRTDM R17 Model Area



4.1.1 Regional Travel Demand Model Structure

The NCRTDM R17 is structured as a trip-based model that provides flexibility to estimate standard travel demand defined as AWDT traffic conditions as well as peak season demand representing vacation travel to the Outer Banks region of North Carolina. It incorporates a series of modeling steps based on traditional four-step processes as well as a series of supporting applications. It uses a TransCAD-based graphical environment that employs a flowchart interface to manage and run scenarios and to organize model data and parameters interactively. The schematic displayed in

Figure 4.2 demonstrates that the application of the model begins with two key sets of input data: the zonal socioeconomic/land use information and the transportation network database.

Figure 4.2: NCRTDM R17 Modeling Process

The first step in the main model sequence is the trip generation model, where the magnitude of trip-making from household residents within the model area is estimated at the zonal level, stratified by trip purposes (i.e., Home-Based Work, Home-Based School, Home-Based Other, etc.). Following trip generation, the internal-external/external-internal (IX) model is executed to estimate trips made by both residents and non-residents with either trip origins or destinations located

beyond the model area. In addition, the non-home-based non-resident (NHB-NR) trip generation is estimated after estimating the IX trip-ends. The commercial vehicle trip generation and distribution are performed for light trucks, single-unit trucks generally described as medium trucks, and multi-unit trucks generally described as heavy trucks.

The linking of trip origins and destinations is accomplished by the trip distribution model, while the choice among transportation modes is estimated in the mode choice component. For the non-commercial trip purposes (all Home-Based or Non-Home-Based trip purposes), trip distribution and mode choice model are implemented via applications of destination choice models and nested logit models, respectively. The next step is estimating the proportion of travel (by trip purpose) occurring in the individual time periods as determined by period specific time-of-day factors. The final component of the model system is embodied in the assignment of travel to the highway network and the transit network. In the NCRTDM R17, the estimation of CAV travel is performed via specific techniques within the resident model and the visitor model. For the resident model, CAV travel demand is estimated by partitioning households into two categories - conventional vehicles and CAVs - and executing separate trip generation, trip distribution and mode choice components for these individual household categories. The allocation of CAVs for visitor trips is largely determined by the initial assumptions of CAV usage at the external zones and mainland households.

4.1.2 Visitor Model in NCRTDM R17

The NCRTDM R17 model has a series of customized trip purposes to represent visitor travel. The normal daily travel of residents in the region is modeled with a traditional four-step modeling approach that is contained within the resident model. The visitor trip purposes represent travel to the coastal region for recreational purposes. This includes many long-distance travelers from outside the region as well as resident travel to the barrier islands. The resident portion of this recreational travel was separated into a unique trip purpose as it was not possible to adequately represent these trips as part of the resident model Home-Based Other (HBO) trip purpose. The visitor trip purposes in the model are estimated initially as person trips for internal trips and vehicle trips for external-internal trips.

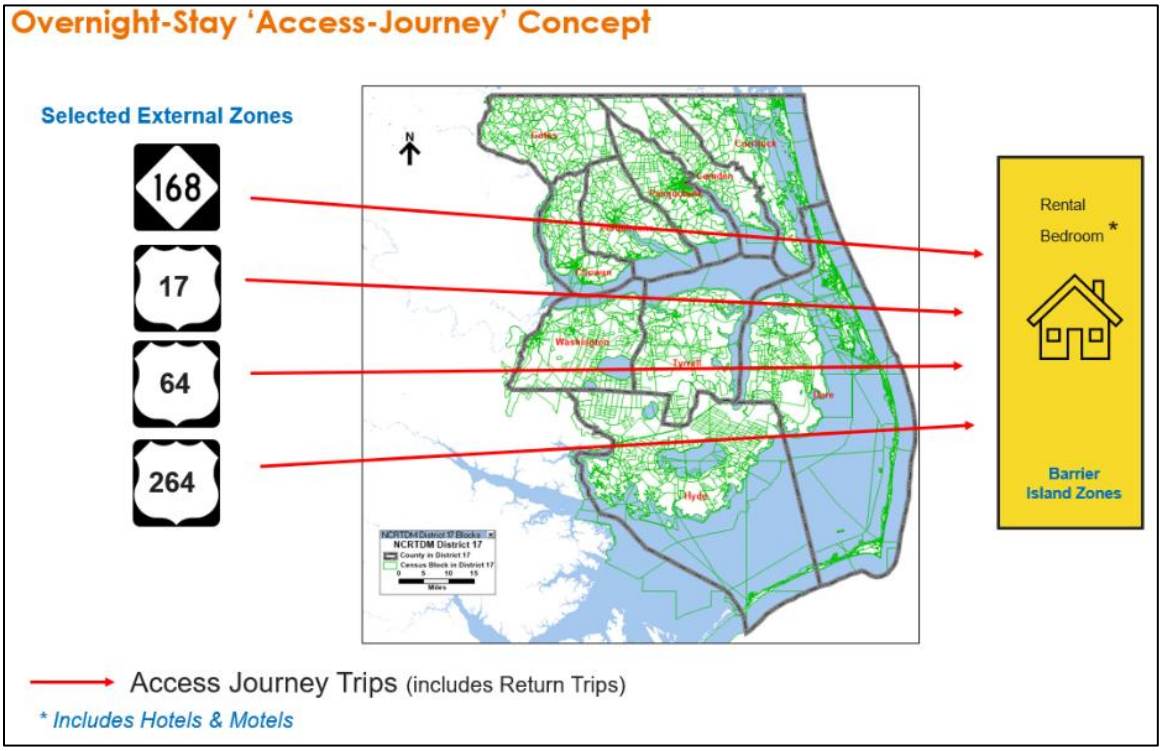
Visitor trips are segmented to capture the unique characteristics of the various trip types. Note that these trips are a mixture of vehicle trips arriving in the region as well as person trips made by vacationers within the region. These purposes also have variation in the urgency of travel as many of the long-distance access trips are traveling multiple hours to arrive at their vacation rental location. In contrast once the vacationers have reached their destination, local trips made by these vacationers are likely more leisurely in nature. It is noted that for certain markets such as the day trip visitors to the beach communities, it is necessary to implement trip chaining techniques to address any intermediate travel that the day trippers perform once they arrive on the barrier islands.

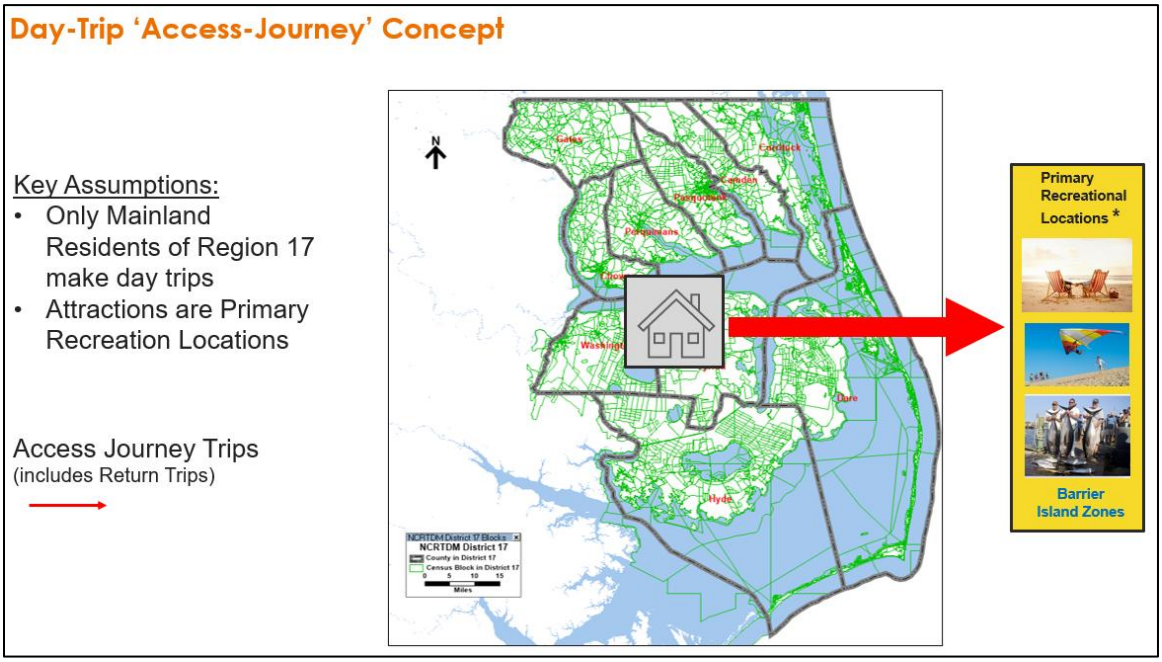
The visitor model development is controlled by the trip generation and distribution patterns observed for Dare and Currituck Counties, based on the assumption that the vast majority of

seasonal travel is destined for these counties and the worst conditions of seasonal demand are likely experienced on the roadways near the barrier island communities. It is also influenced by the existing inventory of rental facilities (hotels and rental homes) for these two counties.

The visitor model predicts two generalized trip markets. The first market is 'access journey' which represents the travelers' journey to and from the barrier island traffic analysis zones from the travelers' permanent home. This market is further sub-divided into two categories, Day Trips and Overnight Stays. By definition, day trippers complete their recreational trips within a single day, which would include trips to and from the barrier island zones and their permanent homes along with any other trips for additional recreational activities within the barrier island zones, such as eating and tourist activities. However, for the access journey, day trippers would have two trips, one onto the barrier island and the return trip from the barrier island to the permanent residence zone. In contrast, the Overnight Stays category implicitly assumes only one trip of the traveler on the scenario day (either the arrival to the barrier island, or the departure from the barrier island at the end of their vacation). **Figure 4.3** depicts the general concepts for the access journey trips for the day tripper and those overnight stay visitors.

Figure 4.3: Visitor Trip Access Journey Market Segments

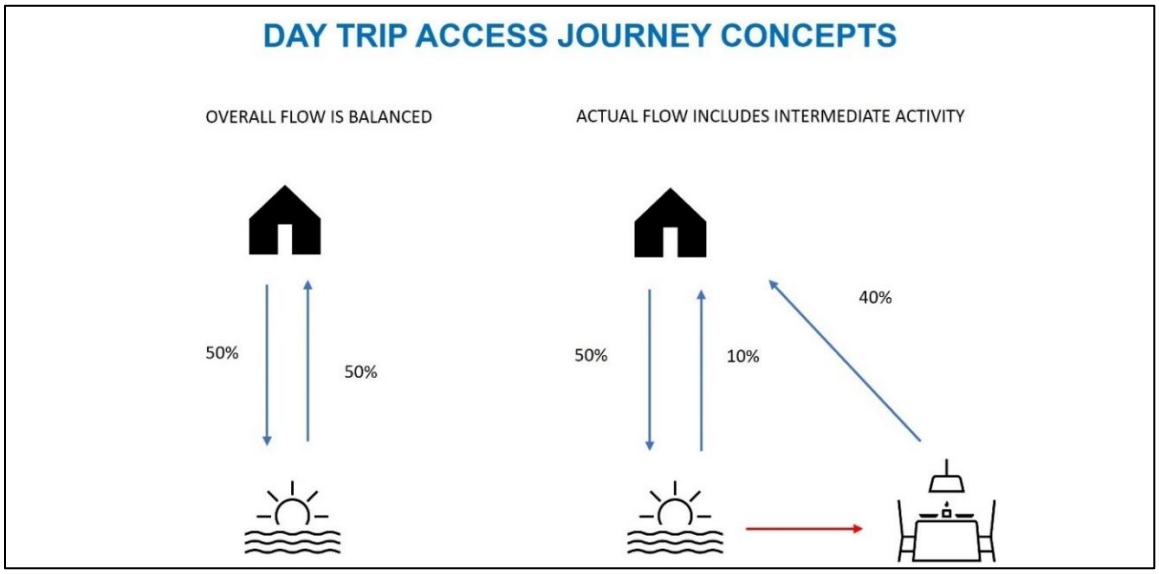




For each of these market segments once the primary movement has been made to the barrier island, additional trips described as 'At-Location' trips are assumed to occur. For the day trip market segment, it is assumed that a portion of these travelers make intermediate trips prior to

their return to their residence while other travelers simply travel to and from their primary recreational activity which is likely the beach. For this reason, it is necessary to further partition the access journey for the day trip market into two submarkets defined as direct and indirect access journeys. **Figure 4.4** depicts the general concepts for the direct and indirect access journey submarkets for the day trip market segment.

Figure 4.4: Day Trip Access Journey Submarkets



The second generalized trip market includes non-access trips made during the traveler's stay at the barrier island communities. These trips are referred to as 'At-Location' trips in the model. For day trippers, this would include trips for meals and other recreational activities including some shopping trips. For overnight stays, additional trips include trips to the beach, shopping and eating, as well as other tourist sites such as national and state parks, etc. Note that these trips are assumed to stay within the barrier islands or mainland zones that are within 10 miles of the barrier islands as some recreational activities including golf courses and water parks are on the mainland.

The model also has assumptions about the application of these trip purposes for the different months of the year and the day-type assumed in the scenarios. Just as the resident model purposes have variations in their trips by the day of the week and seasonal variation, the visitor trip purposes have certain restrictions. All access journey trips are assumed to occur on the weekend which is the turnover day for the weekly rental of vacation homes. It is also assumed that day trippers predominantly use the weekend days for their recreational activity near the beach as it would not require them to miss work. Note that for the access journey for overnight stays, a certain percentage of trips are assumed to arrive on Saturday. Based on some discussion with rental agencies approximately 47 percent of renters arrive on Saturday. For those trips that are arriving or leaving on the weekend day it is assumed that they are not making any at-location trips as they are either packing to leave or are just arriving after a long drive and looking to rest before

beginning other activities. In contrast on a Wednesday, 100 percent of the overnight stay travelers are assumed to be making additional at-location trips as it is the middle of their vacation.

4.1.3 Modeled Years in NCRTDM R17 for the MCB Study

Stantec calibrated the NCRTDM R17 model parameters using the observed data for the base year (2023) and provided estimations for the 2030, 2040, and 2050 horizon years. The representation of multiple travel days and average travel and peak travel conditions required a fairly complex calibration of the 2023 model. The model can estimate the travel demands for any month and any day type; the MCB T&R study implemented the model runs for three travel seasons (Peak, Shoulder, and Off-Peak), three day types (weekday, Saturday and Sunday), and four time periods (AM Peak, Midday, PM Peak, and Night) for each scenario year as listed in **Table 4.1.** Note that the Off-Peak season estimated weekend as the average of Saturday and Sunday while both Shoulder and Peak seasons estimated Saturday and Sunday separately.

Table 4.1: Travel Demand Models by Season, Day Type, and Time Period

Model Time Periods by Season			
Model Day	**Off-Peak Season**	**Shoulder Season**	**Peak Season**
Weekday	AM, MD, PM, NT	AM, MD, PM, NT	AM, MD, PM, NT
Saturday	N/A	AM, MD, PM, NT	AM, MD, PM, NT
Sunday	N/A	AM, MD, PM, NT	AM, MD, PM, NT
Weekend	AM, MD, PM, NT	N/A	N/A
Total Model Runs	8	12	12

Note: AM (6 AM - 9 AM), MD (9 AM - 3 PM), PM (3 PM - 6 PM), NT (6 PM - 6 AM)

The future year estimations were implemented using base year traffic patterns, the growth in key socioeconomic variables, and any roadway network changes. In the visitor model, for the overnight stay market segment, trip attractions which are generated by the rental bedrooms govern productions, which allow overall trip generation to increase as the number of rental homes and hotels/motel rooms increase in the future years. For the day trip market segment, the future magnitude of day trip access trips can increase due to ongoing residential development in the mainland TAZs. In addition, it is also possible that increases in recreational parking that generate day trip attractions could increase thus inducing more trips to the barrier islands themselves. As an example, another water park could be built, or additional parking could be provided for beachgoers, either of which could induce more day trip generation. Therefore, in any horizon year, it is likely that the total productions may not equal the total attractions. Because of this condition, it is not possible to set the aggregate control total based strictly on total productions or total attractions. As noted, the model uses the maximum of estimated productions and attractions to control total day trip access journey trips to the barrier islands which is sensitive to future development assumptions.

Table 4.2 summarizes growth between the model years 2023, 2030, 2040, and 2050 using the socioeconomic data forecasts developed for this study. The values in the table indicate that VMT growth generally tracks with the increase in population, households and employment which is consistent with expectations. The trip production rate per household is stable at approximately 6.1-6.3 trips per household. The variation is likely due to different rates of population and employment growth in the individual horizon years.

Table 4.2: Socioeconomic Data and VMT Growth

Socioeconomic Input	Scenario Year				CAGR		
	2023	2030	2040	2050	2023 to 2030	2030 to 2040	2040 to 2050
Population	177,902	190,279	206,188	222,043	1.0%	0.8%	0.7%
Household	76,033	81,881	87,670	94,016	1.1%	0.7%	0.7%
Employment	82,682	90,364	101,114	112,382	1.3%	1.1%	1.1%
Daily VMT	5,451,586	5,902,460	6,396,638	6,903,801	1.1%	0.8%	0.8%

Note: Employment is permanent employment during the Off-Peak season. Daily VMTs are based on the Off-Peak weekday.

Socioeconomic Input	Scenario Year			
	2023	2030	2040	2050
Population (Pop)	177,902	190,279	206,188	222,043
Household (HH)	76,033	81,881	87,670	94,016
Pop/HH	2.34	2.32	2.35	2.36
Trip Production (TP)	479,850	512,951	543,924	576,236
TP/HH	6.31	6.26	6.20	6.13

4.2 O-D TRIP MODELING PROCESS

The Origin-Destination (O-D) trip tables utilized in the toll diversion model are prepared through an independent trip modeling process after performing the regional model runs of NCRTDM R17. This includes the development of the local and visitor travel patterns and the development of separate purposes for the local trip markets. The methodology also discusses options for the preparation of the MCB T&R study to better represent visitor trips occurring on the island unrelated to the access journey.

4.2.1 Methodology Overview

The proposed approach for preparing trip tables for the MCB T&R study seeks to leverage the recent investment that NCDOT had made developing a regional model for this area of North Carolina. The NCRTDM R17 explicitly models trips made by local residents as well as trips made by visitors to the region focused on the Outer Banks recreational areas. For the purposes of this study, a subarea extraction process is utilized to create a focused model area that largely consists of Currituck County and Dare County with some adjacent sections of neighboring counties and relevant sections of highway network.

The NCRTDM R17 estimates travel by month and day type. As part of the model calibration, two conditions for the base year (2021) scenario were provided:

- April Weekday - representing the Annual Average Weekday Traffic (AAWT).
- July Saturday - representing Peak demand on NCDOT facilities in the region.

The model generates these specific conditions based on monthly pattern files and day type parameters that control the scaling of variables that generate trips. For the purposes of the MCB T&R study, the updated socioeconomic data for 2023 were utilized to revalidate the traffic patterns along with the recently collected traffic data for counts, speeds, and route travel times. Note that the model validation process was implemented in the subarea model with the toll diversion model because the collected observed data were limited to the northeast area of the coastal region.

4.2.2 Trip Table Preparation

The NCRTDM R17 assigns vehicle trips based on vehicle type which includes segmentation for the level of technology in the vehicle (either Conventional or CAV). This model also provides multiple purposes for both resident travel and visitor travel within the proposed project study area. For the MCB T&R Study, it is assumed that the issue of vehicle technology is not critical and therefore these vehicle types are consolidated. The Toll Diversion Model (TDM) that was developed for the prior MCB T&R forecasts is utilized for this study. That model included four auto-based trip purposes and two truck types. In the NCRTDM R17, the vehicle trip tables produced by the mode choice model component are aggregated into these purposes but retain one additional purpose reflecting local trips made by visitors on the Outer Banks. **Table 4.3** provides an overview of the trip tables at each market segment of the modeling process.

Table 4.3: Trip Purpose Processing and Aggregation

Market Segment	Trip Purpose		
	NCRTDM Region 17		Purposes for Toll Diversion Model
	NCRTDM - Demand Estimation	NCRTDM Highway Assignment Aggregation for Subarea Extraction	
Resident	HBW (Home-Based Work)	HBW	HBW
	HBSCH (Home-Based School)	HBO	HBO
	HBO (Home-Based Other)		
	NHB (Non-Home-Based)	NHB	NHB
	External-External (E-E) Auto	External-Local Auto	
	External-Internal (E-I) Auto		
	Access Journey DT - Direct	DT HBO	HBO
	Access Journey DT - Indirect		
	DT - AL - EAT	DT -NHB	NHB
	DT - AL - Shop		
	DT - AL-Beach		
	DT - AL - Other		
Visitor	Access Journey ONS	Access Journey ONS	E-I Vacation
	ONS - VDU AL-EAT	ONS - HBO	Visitor - Local
	ONS - VDU AL -Shop		
	ONS - VDU AL-Beach		
	ONS - VDU AL-Other		
	ONS - Other AL-EAT	ONS - NHB	
	ONS - Other AL -Shop		
	ONS - Other AL-Beach		
	ONS - Other AL-Other		
Commercial	Light Truck	NHB	NHB
	Medium Truck	Medium Truck	Medium Truck
	E-I Medium Truck		
	E-E Medium Truck		
	Heavy Truck	Heavy Truck	Heavy Truck
	E-I HeavyTruck		
	E-E Heavy Truck		

Note: DT (Day-Trip), AL (At-Location), ONS (Overnight Stay)

In the second column of the table are the trip purposes in NCRTDM at the most disaggregated level. The NCRTDM has 28 purposes, of which nine purposes are related to non-resident visitors and seven purposes are related to trucks. Within the NCRTDM R17 prior to highway assignment, each of the trip purposes has a separate time of day pattern that is utilized to allocate the trips into the standard time periods as AM Peak (6-9 am), Midday (9 am- 3 pm), PM Peak (3-6 pm), and Night (6 pm – 6 am). Note that the auto vehicle trips are mainly classified as resident and visitor trips so that the different values of time can be applied since many of the visitor purposes likely have higher values of time than the resident trip purposes. For that reason, the MCB T&R study retains the visitor-local trips as a separate purpose to be consistent with the current TDM model structure.

The third column of the table shows the aggregation of trips for the special highway assignment process utilized to conduct the subarea extraction. The original 28 trip purposes in the NCRTDM R17 have been aggregated into 11 purposes. The fourth column would be the final purposes available for consolidation for the TDM in the MCB T&R Study. This column just describes the purposes with respect to resident and visitor for the TDM. Note that all of the visitor local trip purposes are just merged as Visitor – Local purpose for convenience.

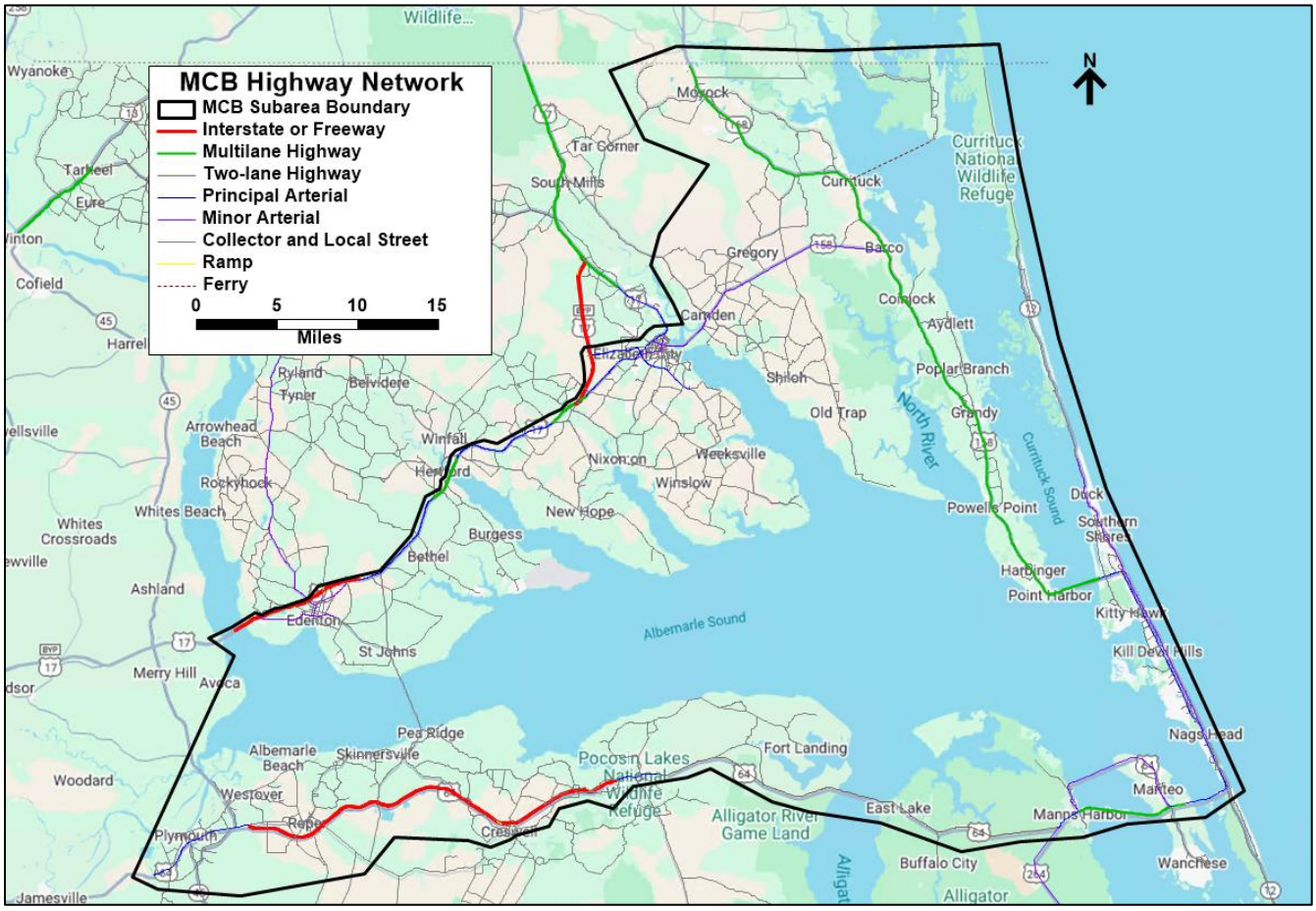
4.2.3 Subarea Extraction Process

The following steps are implemented to perform the subarea extraction process:

- Execute NCRTDM R17 through mode choice - This step generates the necessary vehicle trip tables by occupancy group for each of the individual trip purposes.
- Merge auto vehicle trips for each occupancy group by trip purpose – This step generates the total vehicle trips by purpose and merges the truck vehicle trips to create the final set of 28 purposes.
- Apply Time-of-Day (TOD) Factors for all trips – This step applies the TOD factor to the trip purposes and creates the four separate TOD trip tables as 4 time periods (AM, MD, PM, and NT), and then merges the trips into 11 trip matrices required for each period of the highway assignment that performs the subarea extraction.
- Perform QA/QC Summary – This step simply confirms that no trips were lost in the processing. Note that all of the trips were already in vehicle trips following mode choice, so no trips should be lost during the time period allocation processing.
- Perform Subarea Extraction – In this step, the NCRTDM highway assignment script is adjusted to assign trips for these 11 purposes and extract the trip matrices and relevant portion of the highway network.

Figure 4.5 shows the subarea extraction boundary and area retained for the modeling. The subarea includes 480 total zones with 432 internal zones and 48 external zones. The northern Outer Banks area has 19 internal zones for Duck (TAZ #152-153), Southern Shores (TAZ #154-164) and Corolla (TAZ #73-78). Note that the prior MCB T&R Study conducted in 2019 included only nine zones in the northern Outer Banks area.

Figure 4.5: Subarea for MCB T&R Study



4.2.4 Conversion of O-D Trips

To apply the TDM, it is necessary to convert both the trip matrices and the networks to CUBE format. The matrix and network conversions are straightforward procedures and routines are available to perform this analysis efficiently.

One condition that needed to be addressed was the western boundary which terminates the network prior to the intersection of US 17 and US 64 in Williamston. This junction was included in the prior MCB toll diversion modeling as there was an assumption that traffic could alter its approach to the northern Outer Banks towns contingent on the construction of the new toll bridge. Therefore, it was necessary to extend two representative links out to this common junction point and merge the two external zones that represent US 17 on the western boundary and US 64 into a single external zone. **Table 4.4** lists all the external zones in the subarea model of the NCRTDM R17.

Table 4.4: Subarea External Zones

TAZ	County	Street Number	Street Name	Facility Type
433	Dare (37055)	SR-1243	S Old Oregon Inlet Rd	Local Street
434		NC-12	NC 12 Hwy	Major Collector
435		NC-345	NC 345	Minor Collector
436		US-264	US 264 Hwy	Minor Arterial
437		SR-1103	Buffalo City Rd	Local Street
438	Tyrrell (37177)	SR-1300	Elementary School Rd	Local Street
439		NC-94	Hwy 94	Major Collector
440		SR-1105	Cross Landing Rd	Local Street
441	Washington (37187)	SR-1142	Spruill Bridge Rd	Local Street
442		SR-1155	Cherry Rd	Minor Collector
443		SR-1126	Newland Rd	Minor Collector
444		SR-1180	B Canal Rd	Local Street
445		SR-1127	Railroad Bed Rd	Local Street
446		NC-32	NC Hwy 32 S	Major Collector
447		SR-1100	Long Ridge Rd	Minor Collector
448		US 17 & US 64	US 17 & US 64	Freeway
449		NC-149	Ken Trowbridge Rd	Major Collector
450		SR-1583	Weyco Dr	Local Street
451		NC-45	NC 45	Major Collector
452	Chowan (37041)	SR-1204	W Queen St	Local Street
453		SR-1234	Dr Martin Luther King Jr Ave	Major Collector
454		NC-32	Virginia Rd	Principal Arterial
455		SR-1319	Paradise Rd	Local Street
456		SR-1328	N Broad St	Local Street
457	Perquimans (37043)	SR-1127	Long Ln	Local Street
458		SR-1101	E Bear Swamp Rd	Local Street
459		US-17 BUS	S Edenton Road St	Major Collector
460		SR-1338	Wynne Fork Rd	Local Street
461		SR-1336	S Church St	Minor Collector
462		US-17 BUS	Creek Dr	Major Collector
463		SR-1220	Wiggins Rd	Local Street
464		SR-1227	Swing Gate Rd	Local Street
465		SR-1226	Old Hickory Rd	Local Street
466		SR-1225	Chapanoke Rd	Local Street
467		SR-1224	Weight Station Rd	Local Street
468	Pasquotank (37139)	SR-1140	Okisko Rd	Local Street
469		SR-1144	Foreman Bundy Rd	Local Street
470		US-17 BYP	US 17 Bypass	Freeway
471		SR-1479	Thunder Rd	Local Street
472		SR-1307	Forest Park Rd	Major Collector
473		SR-1309	Main St Ext	Major Collector
474		US-17	N Road St	Principal Arterial
475	Camden (37029)	NC-343	North 343	Major Collector
476		SR-1224	Old Swamp Rd	Minor Collector
477	Currituck (37053)	SR-1218	NW Backwoods Rd	Minor Collector
478		NC-168	Caratoke Hwy	Multilane Highway
479		SR-1251	E Gibbs Rd	Local Street
480		NC-615	Marsh Causeway	Minor Collector

4.2.5 Travel Period Conditions

The MCB T&R forecasts are prepared for multiple travel demand conditions which vary by season type and day of week. The NCRTDM R17 is structured to enable the user to generate selected conditions reflecting individual months and day types. It contains several pattern files which control the variation in demand across the different months. The main pattern files are displayed as part of **Table 4.5**. Note that the NCRTDM R17 model was only calibrated for the April Wednesday condition and the July Saturday condition. All day types were validated in the subarea model.

Table 4.5: Travel Patterns by Model Periods

Demand Condition		Regional Model					
Season	Day Type	Day Type	Month	SE Data	External Zones	Rental Bedrooms	Parking Usage
Off-Peak Season	Weekday	Wednesday	April	Base	pattern - Apr	pattern - Apr	pattern - Apr
	Weekend	Saturday		Base-WKEND	pattern - Apr	pattern - Apr	pattern - Apr
Shoulder Season	Weekday	Wednesday	June	Scaled	pattern - JUN	pattern - JUN	pattern - JUN
	Saturday	Saturday		Scaled - WKEND	pattern - JUN	pattern - JUN	pattern - JUN
	Sunday	Saturday		Scaled - WKEND	pattern - JUN	pattern - JUN	pattern - JUN
Peak Season	Weekday	Wednesday	July	Scaled	pattern - JUL	pattern - JUL	pattern - JUL
	Saturday	Saturday		Scaled - WKEND	pattern - JUL	pattern - JUL	pattern - JUL
	Sunday	Saturday		Scaled - WKEND	pattern - JUL	pattern - JUL	pattern - JUL

The MCB T&R study estimates travel for a total of eight season and day type conditions, each with four time of day periods - AM Peak, Midday, PM Peak, and Night - which provide 32 separate estimates of travel demand. Note that the NCRTDM R17 automatically alters the employment by month to account for seasonal employment and reduces employment for the weekend days. The model also removes school trips from the weekend days and the summer months (June-August).

4.2.6 O-D Trip Calibration Process

While a significant effort was performed to ensure that NCRTDM R17 had the proper directionality and peaking characteristics for the various months and day types, it was necessary to adjust the O-D trips generated by NCRTDM R17 to match the specific traffic counts gathered for the MCB T&R study. The ODME (O-D Matrix Estimation) process was employed for each of the 32 demand conditions to adjust the model trips to replicate the observed counts that were gathered for this updated T&R forecast.

StreetLight data from 2021 was utilized during the development of NCRTDM R17 and therefore it was expected that the O-D trip patterns from the subarea extraction were reasonable representations of travel for the 2023 Base Year Travel Demand Model Calibration.

The model calibration process focused on replicating observed travel times, origin-destination travel patterns and traffic volumes within the study area, with emphasis on the observed conditions for the routes utilized by the choice market segment of travelers. This includes the traffic volumes and travel times along US 158 and NC 12 in Currituck County and Dare County. The

calibration statistics are provided by season and time period for each weekday and weekend category.

4.2.7 Volume Comparisons, Modeled vs Observed

The estimated (modeled) and observed volumes for the two key locations are summarized in **Table 4.6**. US 158 East of Albtuck Road is located at the western end of the WMB on the mainland. NC 12 North of Oyster Catcher Lane is located north of Duck. The observed volumes were collected from ATRs during the 2022 Peak season and 2023 Shoulder season as described in Section 2.3.1. As shown in the table, the estimated volumes reasonably align with the observed values in each time period and season.

Table 4.6: 2023 Volume Comparison, Estimated (Modeled) vs. Observed

Season	Day Type	Description	Daily				AM				MD				PM				NT			
			Obs	Est	Diff	%Diff	Obs	Est	Diff	%Diff	Obs	Est	Diff	%Diff	Obs	Est	Diff	%Diff	Obs	Est	Diff	%Diff
Off-Peak	Weekday	US 158 E of Albtuck Rd_EB	10,191	10,184	-8	0%	2,856	2,851	-5	0%	3,232	3,226	-6	0%	2,826	2,826	-1	0%	1,277	1,281	4	0%
		US 158 E of Albtuck Rd_WB	9,378	9,383	6	0%	2,066	2,074	8	0%	3,147	3,147	0	0%	2,995	2,993	-2	0%	1,170	1,169	-1	0%
		NC 12 N of Oyster Catcher Ln_NB	2,839	2,916	77	3%	903	887	-16	-2%	1,055	1,084	29	3%	600	650	50	8%	281	294	14	5%
		NC 12 N of Oyster Catcher Ln_SB	2,787	2,867	81	3%	384	403	19	5%	1,133	1,169	35	3%	1,090	1,096	6	1%	179	199	21	12%
	Weekend	US 158 E of Albtuck Rd_EB	6,984	7,050	66	1%	1,220	1,223	3	0%	2,661	2,685	24	1%	2,106	2,128	22	1%	997	1,013	17	2%
		US 158 E of Albtuck Rd_WB	8,579	8,544	-35	0%	1,685	1,664	-21	-1%	3,653	3,654	2	0%	2,162	2,151	-10	0%	1,080	1,074	-6	-1%
		NC 12 N of Oyster Catcher Ln_NB	2,079	2,165	86	4%	415	409	-6	-1%	808	844	36	4%	606	651	46	8%	250	260	10	4%
		NC 12 N of Oyster Catcher Ln_SB	2,438	2,549	111	5%	464	476	12	3%	1,069	1,109	39	4%	703	733	30	4%	202	231	29	15%
Shoulder	Weekday	US 158 E of Albtuck Rd_EB	11,583	11,591	8	0%	2,497	2,437	-60	-2%	4,603	4,606	3	0%	2,275	2,312	37	2%	2,208	2,236	28	1%
		US 158 E of Albtuck Rd_WB	11,107	11,220	113	1%	1,465	1,517	51	4%	4,429	4,482	53	1%	2,834	2,822	-12	0%	2,379	2,399	20	1%
		NC 12 N of Oyster Catcher Ln_NB	5,118	5,384	266	5%	910	907	-2	0%	2,229	2,357	129	6%	906	980	75	8%	1,074	1,139	65	6%
		NC 12 N of Oyster Catcher Ln_SB	4,827	5,302	475	10%	453	500	47	10%	2,157	2,346	189	9%	1,231	1,353	122	10%	986	1,103	116	12%
	Saturday	US 158 E of Albtuck Rd_EB	20,210	19,181	-1,029	-5%	2,532	2,404	-128	-5%	9,243	8,659	-584	-6%	4,847	4,639	-208	-4%	3,588	3,480	-108	-3%
		US 158 E of Albtuck Rd_WB	18,640	17,940	-700	-4%	4,178	4,010	-168	-4%	7,108	6,732	-376	-5%	2,916	2,736	-180	-6%	4,438	4,461	23	1%
		NC 12 N of Oyster Catcher Ln_NB	8,153	8,281	128	2%	1,035	1,033	-2	0%	3,531	3,612	81	2%	1,876	1,898	22	1%	1,711	1,738	27	2%
		NC 12 N of Oyster Catcher Ln_SB	7,429	7,620	191	3%	1,913	1,922	9	0%	2,433	2,507	74	3%	1,335	1,341	6	0%	1,748	1,850	102	6%
	Sunday	US 158 E of Albtuck Rd_EB	16,541	15,725	-816	-5%	1,808	1,781	-27	-2%	7,794	7,331	-463	-6%	4,077	3,910	-167	-4%	2,862	2,703	-159	-6%
		US 158 E of Albtuck Rd_WB	16,828	16,431	-397	-2%	2,956	2,978	22	1%	7,004	6,749	-255	-4%	3,255	3,062	-193	-6%	3,613	3,643	30	1%
		NC 12 N of Oyster Catcher Ln_NB	6,959	7,027	68	1%	753	751	-2	0%	3,289	3,318	29	1%	1,700	1,709	9	1%	1,217	1,249	32	3%
		NC 12 N of Oyster Catcher Ln_SB	6,132	6,832	700	11%	1,433	1,423	-10	-1%	2,518	2,601	83	3%	1,256	1,312	56	4%	1,438	1,495	57	4%
Peak	Weekday	US 158 E of Albtuck Rd_EB	12,071	12,190	119	1%	2,330	2,343	13	1%	5,024	5,052	28	1%	2,388	2,415	27	1%	2,330	2,380	50	2%
		US 158 E of Albtuck Rd_WB	11,411	11,570	159	1%	1,575	1,603	28	2%	4,762	4,839	77	2%	2,711	2,731	20	1%	2,364	2,397	33	1%
		NC 12 N of Oyster Catcher Ln_NB	5,053	5,326	273	5%	865	884	19	2%	2,137	2,246	109	5%	842	925	82	10%	1,209	1,271	62	5%
		NC 12 N of Oyster Catcher Ln_SB	5,088	5,552	464	9%	488	563	74	15%	2,226	2,369	142	6%	1,200	1,318	118	10%	1,174	1,303	129	11%
	Saturday	US 158 E of Albtuck Rd_EB	22,501	21,744	-757	-3%	3,233	3,116	-117	-4%	10,135	9,469	-666	-7%	5,014	5,007	-7	0%	4,120	4,153	33	1%
		US 158 E of Albtuck Rd_WB	21,394	20,376	-1,018	-5%	5,512	5,086	-426	-8%	7,781	7,419	-362	-5%	2,867	2,707	-160	-6%	5,234	5,164	-70	-1%
		NC 12 N of Oyster Catcher Ln_NB	8,772	8,974	202	2%	1,150	1,160	9	1%	3,661	3,718	57	2%	2,057	2,109	52	3%	1,904	1,988	84	4%
		NC 12 N of Oyster Catcher Ln_SB	7,845	8,622	777	10%	2,061	2,419	358	17%	2,084	2,285	201	10%	1,360	1,437	77	6%	2,340	2,482	142	6%
	Sunday	US 158 E of Albtuck Rd_EB	18,058	18,159	102	1%	2,019	2,041	22	1%	8,790	8,817	27	0%	4,178	4,176	-2	0%	3,071	3,125	54	2%
		US 158 E of Albtuck Rd_WB	17,919	17,313	-606	-3%	3,869	3,681	-188	-5%	7,336	7,104	-232	-3%	2,978	2,769	-209	-7%	3,736	3,758	22	1%
		NC 12 N of Oyster Catcher Ln_NB	7,690	7,893	203	3%	925	924	-1	0%	3,584	3,676	92	3%	1,912	1,925	13	1%	1,269	1,368	99	8%
		NC 12 N of Oyster Catcher Ln_SB	7,001	7,277	276	4%	1,819	1,833	14	1%	2,450	2,568	118	5%	1,166	1,227	61	5%	1,566	1,649	83	5%

4.2.8 Travel Time and Travel Speed Comparisons, Modeled vs Observed

The estimated (modeled) and observed travel times and travel speeds for the key travel routes are summarized in **Table 4.7** and **Table 4.8**. Observed travel speed data were collected specifically for this project. Travel times collected on Route 1 and Route 2 during the Peak season in 2022 and during the Shoulder season in 2023 were used for calibration. The observed travel speeds reflect the large delays that are encountered during the Peak season Saturday. As shown in the tables, the estimated travel times and speeds adequately replicate the observed values in each time period and season. **Figure 4.6** shows the limits of the routes that were used to calibrate the estimated speeds.

Table 4.7: 2023 Travel Time Comparison, Estimated (Modeled) vs. Observed by Route (minutes)

Season	Day	Time Period	Travel Time via Route 1 (min): US-158: Poplar Branch Rd - NC 12							Travel Time via Route 2 (min): NC-12: US-158 - Blue Heron Lane						
			Distance (Mile)	US 158 NB			US 158 SB			Distance (Mile)	NC-12 NB			NC-12 SB		
				OBS	EST	Diff	OBS	EST	Diff		OBS	EST	Diff	OBS	EST	Diff
Off-Peak	Weekday	AM	17		19			19		8		14			14	
		MD	17		19			19		8		14			14	
		PM	17		19			19		8		14			14	
	Weekend	AM	17		19			19		8		14			14	
		MD	17		19			19		8		14			14	
		PM	17		19			19		8		14			14	
Shoulder	Weekday	AM	17	21	21	0.0	21	21	0.0	8	14	14	0.2	15	15	0.0
		MD	17	20	20	0.0	20	20	0.0	8	15	16	0.2	16	16	-0.1
		PM	17	20	20	0.0	21	21	0.0	8	15	15	0.1	16	16	-0.1
	Saturday	AM	17	20	20	0.0	21	21	0.0	8	14	14	0.0	18	19	0.4
		MD	17	20	20	0.0	23	23	-0.1	8	20	21	1.2	16	16	0.3
		PM	17	20	20	0.0	20	20	0.0	8	48	48	-0.8	16	17	0.1
	Sunday	AM	17	20	20	0.0	21	21	0.0	8	15	15	0.1	18	18	0.0
		MD	17	21	21	0.0	21	21	0.0	8	16	19	2.8	15	15	0.8
		PM	17	19	19	0.0	22	22	0.0	8	18	19	0.5	15	15	0.0
Peak	Weekday	AM	17	18	19	0.9	18	19	0.6	8	14	14	0.6	18	18	0.0
		MD	17	18	19	0.8	18	19	1.1	8	18	18	0.7	36	35	-0.9
		PM	17	21	21	0.0	21	21	0.0	8	16	16	0.1	27	27	-0.1
	Saturday	AM	17	24	24	0.0	20	20	0.0	8	17	18	0.7	32	34	2.3
		MD	17	23	23	-0.1	21	21	0.2	8	71	82	11.5	18	18	0.3
		PM	17	18	19	0.8	19	19	0.4	8	39	44	5.1	17	17	0.2
	Sunday	AM	17	20	20	0.0	20	20	0.0	8	14	14	0.4	23	23	0.1
		MD	17	21	21	0.0	22	22	0.0	8	28	28	-0.1	17	16	-0.7
		PM	17	20	20	0.0	21	21	0.1	8	35	36	1.3	16	16	0.1

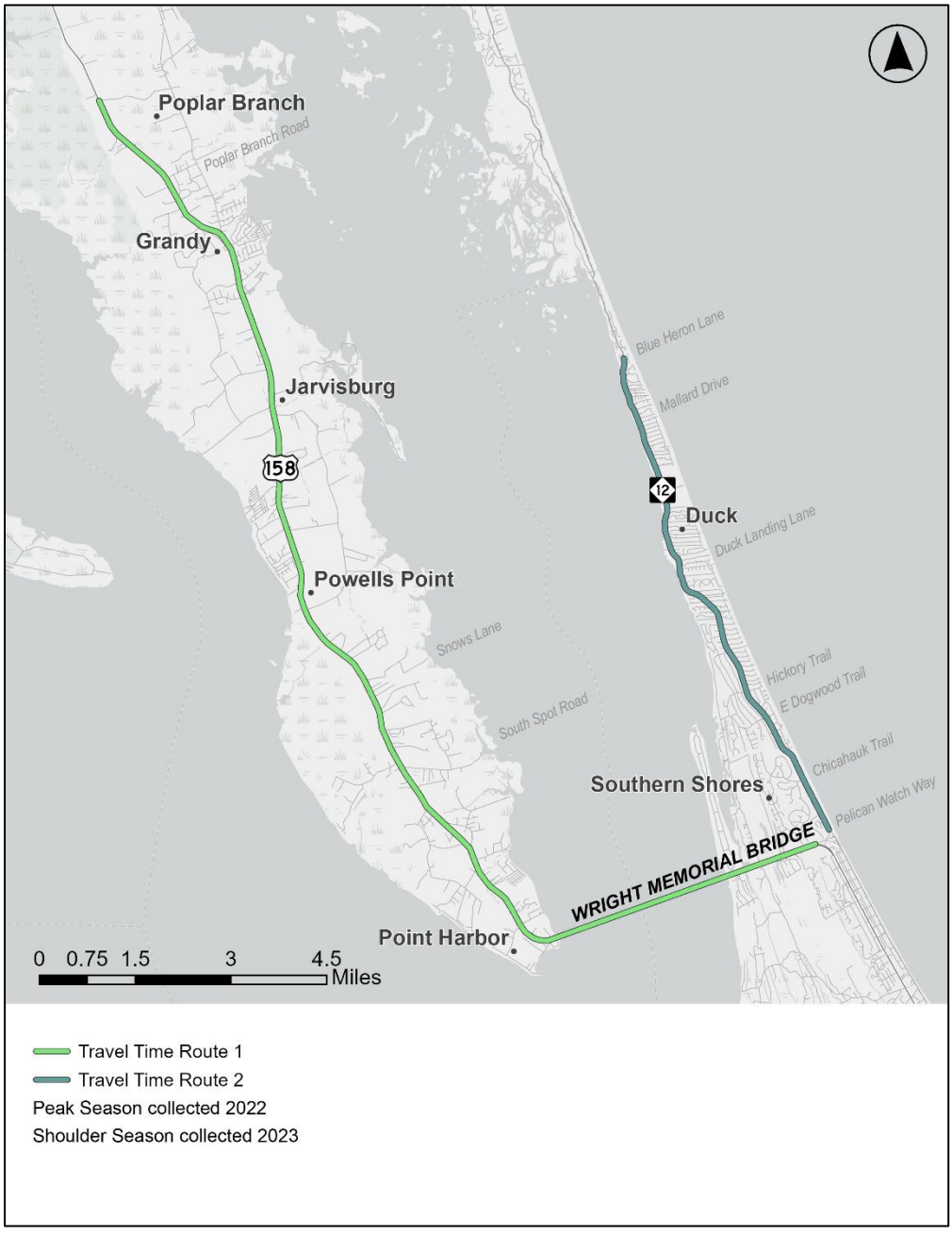
Note: The observed and modeled estimated travel times shown represent typical conditions during each four-hour time period.

Table 4.8: 2023 Travel Speed Comparison, Estimated (Modeled) vs. Observed by and Route (mph)

Season	Day	Time Period	Travel Speed via Route 1 (mph): US-158: Poplar Branch Rd - NC 12							Travel Speed via Route 2 (mph): NC-12: US-158 - Blue Heron Lane						
			Distance (Mile)	US 158 NB			US 158 SB			Distance (Mile)	NC-12 NB			NC-12 SB		
				OBS	EST	Diff	OBS	EST	Diff		OBS	EST	Diff	OBS	EST	Diff
Off-Peak	Weekday	AM	17		55			55		8		32			33	
		MD	17		55			55		8		32			33	
		PM	17		55			55		8		32			33	
	Weekend	AM	17		55			55		8		33			33	
		MD	17		55			55		8		33			33	
		PM	17		55			55		8		33			33	
Shoulder	Weekday	AM	17	48	48	0.0	49	49	0.0	8	32	32	-0.5	32	32	0.0
		MD	17	51	51	0.0	52	52	0.0	8	30	29	-0.5	29	29	0.2
		PM	17	52	52	0.0	50	50	0.0	8	32	32	-0.1	29	29	0.1
	Saturday	AM	17	51	51	0.0	50	50	0.0	8	33	32	-0.1	25	24	-0.5
		MD	17	51	51	0.1	46	46	0.3	8	23	22	-1.3	29	28	-0.5
		PM	17	52	52	0.0	51	51	-0.1	8	10	10	0.2	28	28	-0.2
	Sunday	AM	17	52	52	0.0	49	49	0.0	8	31	31	-0.3	26	26	0.0
		MD	17	51	51	0.0	49	49	0.1	8	29	25	-4.5	31	30	-1.6
		PM	17	54	54	0.0	48	48	0.0	8	25	25	-0.6	31	30	-0.1
Peak	Weekday	AM	17	58	55	-2.9	57	55	-1.9	8	33	32	-1.5	26	26	0.0
		MD	17	57	55	-2.4	58	55	-3.3	8	26	25	-1.0	13	13	0.3
		PM	17	49	49	0.0	48	48	0.0	8	29	29	-0.2	17	17	0.1
	Saturday	AM	17	43	43	0.1	51	51	0.0	8	27	26	-1.1	15	14	-1.0
		MD	17	45	45	0.1	50	49	-0.4	8	6	6	-0.9	26	26	-0.5
		PM	17	57	55	-2.3	56	55	-1.1	8	12	11	-1.4	28	28	-0.3
	Sunday	AM	17	52	52	0.0	51	51	0.0	8	33	32	-0.8	20	20	0.0
		MD	17	49	49	0.0	46	46	0.0	8	16	16	0.1	27	28	1.2
		PM	17	52	52	0.0	49	49	-0.1	8	13	13	-0.5	28	28	-0.1

Note: The observed and modeled estimated speeds shown represent typical conditions during each four-hour time period

Figure 4.6: Travel Routes Used for Travel Time and Travel Speed Comparisons



4.3 TOLL DIVERSION MODEL

The Toll Diversion Model (TDM) developed for this project was structured to meet the specific objectives and conditions of the proposed MCB and the market segments of its potential customers. The core model structure was adopted from similar toll models that Stantec developed and applied to numerous successful investment-grade traffic and revenue forecasts. The model was adjusted to reflect the unique aspects of the corridor and the seasonal travel patterns of trips that originate from areas far outside of the model study area. These adjustments, in part, are based on relationships derived from prior stated preference analysis performed in previous studies for the proposed MCB.

4.3.1 Customized Toll Diversion Model

To estimate the effect of tolls on the demand in the model study area, Stantec utilized a customized TDM embedded directly within the equilibrium assignment process. This process created both tolled and non-tolled paths by vehicle type during each assignment iteration. During each assignment iteration, trips between a given origin and destination were partitioned with a logit-based choice model between the tolled path and the non-tolled path. The TDM created shares of tolled trips and non-tolled trips based on the time savings, toll costs, fuel costs and value of time for travelers using the toll facility. The model also provided additional market segmentation based on the method of payment (cash or transponder).

The structure of the toll diversion model was a basic binary logit equation defined as follows:

$$\text{Toll Share} = 1 / (1 + e^{U})$$

Toll Share	= Probability of selecting a toll road
e	= Base of natural logarithm (ln)
U	= Utility, calculated as $U = a * (Time_{TR} - Time_{FR}) + b * (Cost) + C_{TR} + C_{ETC} + C_{MCB}$
a, b	= Coefficients
$Time_{TR}$	= Toll road travel time in minutes
$Time_{FR}$	= Non-toll road travel time in minutes
Cost	= Toll in dollars and fuel cost differential
C_{TR}	= Constant for toll road bias
C_{ETC}	= Constant for ETC bias
C_{MCB}	= Constant for travel delay and uncertainty bias

The cost term is the difference in costs between the toll route and non-toll routes. Given the large difference in travel distance for certain origin-destination zonal pairs, the cost term includes both the toll cost and fuel cost differential, estimated at 17.99 cents per mile for cars or 36.0 cents per mile for trucks[2] multiplied by the difference in length between the toll path (which includes the proposed MCB) and the non-tolled path (which includes the WMB). For travelers destined to

[2] The 17.99 cents per mile value was adopted from 2022 data from the American Automobile Association (AAA). Truck fuel costs of 36.0 cents per mile were based on information provided by National Private Truck Council (NPTC) in 2021. [3] NuStats Mid-Currituck Bridge Stated Preference Survey Final Report, reviewed by Cambridge Systematics.

Corolla, this difference in travel distance is approximately 30 miles, which results in an average fuel costs savings of $5.40 for cars and $10.80 for trucks. In addition to the quantifiable differences in travel times and travel costs between the toll and non-tolled paths, the stated preference survey conducted in 2009[3] found that many travelers indicated a strong preference to use the proposed MCB to avoid the excessive delays and highly variable travel conditions traveling on NC 12 south of and through the Town of Duck. These slow traffic conditions are particularly evident during peak travel periods during the summer vacation (Shoulder and Peak) season, particularly on Saturdays. Choice models developed from the stated preference data resulted in statistically significant constant terms indicating traveler preference towards using the proposed MCB irrespective of the time savings and toll costs. These constants or 'bias' terms were incorporated into the toll diversion model.

Additionally, many of the seasonally-occupied homes are part of weekly rental programs that result in strong traffic flows on Peak season weekend days as vacationers arrive and leave the Outer Banks. Given the frequent travel delays during these Peak season weekends, the circuitous routing of the existing roadways to access these communities and the high values of time for out-of-state travelers that are spending many hours of travel to reach their vacation destinations, this market segment of travelers is expected to be largely insensitive to the anticipated levels of toll costs, when considering the entire costs of the vacation itself and the sizable distance and time savings available.

The TDM utilized a separate value of time for each trip purpose. This model and the initial coefficients were adopted from recently calibrated model work performed in an area with several toll facilities and were adjusted for the income levels of the travelers to and within the Outer Banks. **Table 4.9** displays the value of time and bias terms in minutes used for this project for each trip purpose.

The E-I (external-internal) trip purpose includes trips from outside the region that travel to or from the coastal zones for vacations. Using the regional average median as the zonal value, the implied value of time for the aggregate E-I vacation purpose was $36.92 per hour. For E-I vacation trips originating outside of the region, the median household income was obtained from the US Census Bureau 2021 ACS 5-Year Estimate and averaged by the assumed shares of traffic from each external region that would use the various external zones representing the approach roads. **Table 4.10** displays the median household income ranges for external zones based on 2021 StreetLight data. Weekday incomes are consistent across seasons, while weekend incomes vary by season. The incomes were then blended with the ACS regional median household income to develop the representative median household income for each external zone.

[3] NuStats Mid-Currituck Bridge Stated Preference Survey Final Report, reviewed by Cambridge Systematics.

Table 4.9: Toll Diversion Model Parameters

Trip Purpose	Toll Diversion Model Coefficients		VOT ($/Hr)	Toll Diversion Model Bias Terms							
				Values				Equivalent Minutes			
	(Alpha) Time (min)	(Beta) Cost ($)		Toll	ETC	MCB		Toll	ETC	MCB	
						Week-day	Week-end			Week-day	Week-end
E-I Vacation	0.1444	0.2347	$36.92	0.3003	-0.4059	-1.00	-2.14	2.1	-2.8	-6.9	-14.8
HBW	0.2106	0.5802	$21.78	0.4380	-0.5920	-1.00	-1.00	2.1	-2.8	-4.7	-4.7
HBO	0.0882	0.4116	$12.86	0.3520	-0.3300	-0.50	-0.50	4.0	-3.7	-5.7	-5.7
NHB	0.1744	0.5244	$19.95	0.6268	-0.3576	-1.00	-1.00	3.6	-2.1	-5.7	-5.7
VBO	0.0882	0.3647	$14.51	0.3520	-0.3300	-0.50	-0.50	4.0	-3.7	-5.7	-5.7
Medium Truck	0.0724	0.1771	$24.53	0.1007	-0.2506	0.00	0.00	1.4	-3.5	0.0	0.0
Heavy Truck	0.0575	0.0580	$59.53	0.3375	0.0000	0.00	0.00	5.9	0.0	0.0	0.0

Note: Based on a regional median household income of $75,499 as sourced from weighted Dare County and Currituck County ACS 2021 5-Year Median income Estimates. A positive bias term reduces the likelihood of vehicles using a toll facility, whereas a negative bias term increases the likelihood of vehicles using a toll facility.

Table 4.10: Median Household Income of External-Internal Trips

Median Household Income from Daily Trips		
Externals	Weekday	Weekend
VA State Line	$90,608	$91,440 - $96,618
Externals west of Study Area	$67,409	$68,028 - $90,328

For the resident purposes, Home-Based-Work (HBW) trips have a value of time of $21.78 per hour, while the Home-Based-Other (HBO) and Non-Home-Based (NHB) trips have lower values of time ($12.86 and $19.95 per hour, respectively). Using the weighted average median household income for Dare and Currituck Counties , the values of time are within the range of 35 to 60 percent of the average wage rate, which is consistent with or less than the expected range of these values. Values of time for medium and heavy truck trips were adopted from the Stantec toll model and adjusted for the study area income.

Table 4.9 also includes the individual bias penalties in minutes that were applied to each trip purpose. The "toll road bias" penalty incorporates the general reluctance to use toll facilities after accounting for tradeoffs between time savings and costs, including the perceived burden of having to have money to pay the toll at the time of travel, and delay from having to stop to pay the toll. This was applied to all payment methods (both cash and electronic toll collection (ETC) transponders). A positive bias term reduces the likelihood of vehicles using a toll facility, whereas a negative bias term increases the likelihood of vehicles using a toll facility. For those that elect to use a transponder, the "ETC bias" constant offsets the negative biases since payment is deferred to a later time and there is no travel delay when paying the toll.

The final bias term, "MCB", reflects the travelers' aversion to having to spend excessive time (more than an hour during the weekends in peak vacation periods) traveling through Duck and the uncertainty or delay in arrival at their intended destination. These penalties were generally worth approximately 5 minutes of travel time, but the weekend penalty for the E-I vacation purpose was a larger value, approximately 15 minutes. The value is generally consistent within a range of 9 to 14 equivalent minutes estimated from the prior stated preference analysis.

4.4 FUTURE YEAR TRAVEL DEMAND MODELS

Future year travel demand models were developed to forecast annual traffic and revenue from the anticipated bridge opening in 2032 until 2081. As described in Section 4.2, the O-D trip modeling process was implemented for the base year (2023) as well as the horizon years (2030, 2040, and 2050) to develop the subarea O-D trips to be utilized in toll diversion model. The trip adjustments had been developed while the base year model was calibrated and validated using observed data in the subarea. These trip adjustments were also applied to the O-D trips in horizon years after performing the subarea process to be consistent with the travel patterns validated in the base year scenario. The subarea O-D trips were finally aggregated by seven trip purposes/modes as described in **Table 4.3**. Toll diversion models for horizon years were also developed in addition to the calibrated base year model, with the application of toll facility identifiers and rates, electronic toll collection (ETC) shares, future project improvements, and so on. Future year models would typically incorporate any funded infrastructure projects that could significantly change the transportation network. In this case however, a review of the most recent VDOT and NCDOT STIPs as well as discussions with local officials found no funded projects that would have a material impact on the study area; therefore, the transportation network is unchanged between model years.

The traffic and revenue forecasts in the three future year models are different from the 2023 base year model and each other as each model incorporates the socioeconomic projections (discussed in Section 3.4) for the model year. Two scenarios, the Base Case and the High Case, were modeled for each future year to estimate a change of toll transactions and revenues. In the Base Case, the value of time and median income rates in future years were conservatively assumed to grow at the same rate as inflation. For the High Case future years, the value of time and median incomes were assumed to grow at a compound annual growth rate of 0.5 percent over the rate of inflation, which was based on an analysis of historical median income growth and inflation rates in North Carolina.

5.0 TOLL TRAFFIC AND GROSS TOLL REVENUE FORECASTS

5.1 METHODOLOGY OVERVIEW

The traffic and revenue forecasts for the proposed MCB have been prepared using the toll diversion models developed by Stantec specifically for the project. A separate model was developed for each of four time periods (AM Peak, Midday, PM Peak and Night), for each day type (average weekday and weekend) and for each season (Off-Peak, Shoulder, and Peak). Saturday and Sunday were examined separately in the Shoulder and Peak seasons. This resulted in a total of 32 individual models. The four time period models for each day type in each season were then combined to develop daily revenues. As detailed in Chapter 4.0, each of these traffic models was subjected to an extensive development and calibration process to provide confidence that the results can be used in this Level 2 study. Interim year traffic and revenue estimates were made by smoothing the forecasted growth between the model years. Long-term traffic and revenue forecasts beyond 2050 are assumed to grow at a lower growth rate than before 2050.

Forecasted traffic and revenue are included for two different scenarios, the Base Case and the High Case. The Base Case includes the socioeconomic variables and land use forecasts described in Section 3.5, whereas the High Case is described in Section 3.6. The details of these scenarios are included in the following sections. Development of two forecasts allows for comparison of the traffic and revenue streams under different socioeconomic growth projections and tourism patterns.

5.2 TRAFFIC AND REVENUE MODELING ASSUMPTIONS

5.2.1 Toll Policy Assumptions

Toll policy assumptions provide a framework for available payment options and pricing strategies for a toll facility. NCTA provided Stantec with a set of toll policy assumptions for the MCB project. These toll policy assumptions, detailed below, are the same for both forecast scenarios:

1. The MCB will begin collecting revenue at the start of Q1 2032 (January 1, 2032).
2. Tolls will be collected via cash and electronic toll collection (ETC).
3. Tolls will be collected in both directions.
4. The minimum cash toll for cars is $6.00 (2023 dollars); all initial (opening year) cash tolls will be in even dollar amounts.
5. Tolls paid by electronic transponder will be discounted 35 percent from the cash toll, up to a maximum discount of $5.00.

6. Truck tolls will be set as multiples of the car toll, similar to the method used on NCTA's Triangle Expressway and Monroe Expressway. Three-axle vehicles will be charged two times the two-axle rate and four-axle vehicles (and larger) will be tolled at a rate four times the two-axle rate.

7. Future tolls will be increased at the rate of inflation. As such, all tolls and revenues shown in this document are in 2023 dollars. Cash tolls would be increased in multiples of $0.25. Electronic tolls would be rounded to the nearest $0.01.

8. In addition to the inflationary increases, tolls will be raised to account for increased demand and congestion.

9. No frequency-of-use discounts or rebates are assumed for either the Base or High Case forecasts.

5.2.2 Future Year Assumptions

Future year models were run for pro forma 2030, 2040 and 2050 for each time period, day type, and season. The future year assumptions are as follows:

1. The 2030 model results are pro forma, as the MCB will not be completed until a later date.

2. The future year models include the land use and socioeconomic assumptions for each year as discussed in Chapter 3.

    a. For the Base Case, the future land use and employment described in Section 3.5 was used in the model.

    b. For the High Case, the future land use and employment described in Section 3.6 was used in the model. Increased growth was assumed in the rental bedrooms for TAZs located in Currituck County on the Outer Banks. These zones would see the biggest benefit from the proposed MCB access and, as such, it could be expected that the growth in these zones would occur at a higher rate than other zones on the Outer Banks. All the other zones in the study area assumed the same rental bedroom and employment growth as in the Base Case. All other socioeconomic variables were the same for both the Base Case and the High Case.

3. Future income rates and values of time for external zone trips were based on a blended median household income for the trips originating in those regions, as discussed in Chapter 4.0.

    a. For the Base Case, these income rates were assumed to grow at the same rate as inflation.

b. For the High Case, these income rates were assumed to grow at a compound annual growth rate of 0.5 percent over the rate of inflation.

4. A review of the statewide transportation plan and discussions with local officials indicated that no funded transportation projects are planned in the study area that would have a noticeable impact on study area traffic patterns. As such, the future year model networks were consistent throughout all years.

5. Since tolls on the MCB were assumed to increase by both the rate of inflation and in response to increases in demand and congestion, tolls were optimized in all model years. All tolls and all revenues in this report are shown in 2023 dollars.

6. Visitors traveling from Chesapeake / Norfolk / Virginia Beach use NC 168 to access the Outer Banks, which includes a toll road, Chesapeake Expressway. ETC usage in the study area was assumed to be slightly higher than the 80 percent current (FY 2021) usage rate on the Chesapeake Expressway. ETC participation rates were conservatively assumed to be higher on the MCB. Since ETC tolls are lower than Cash tolls, higher ETC usage would result in lower toll revenue estimates. The ETC share of trips by future year is shown in **Table 5.1**. As shown, the assumed participation rates vary by trip purpose. Home-based Work (HBW) trips were assumed to have the highest participation rates, as these trips are made by the most frequent travelers who would therefore find the most benefit.

Table 5.1: Electronic Toll Collection (ETC) Participation Rate Assumptions, Pro Forma 2030, and 2040 and 2050

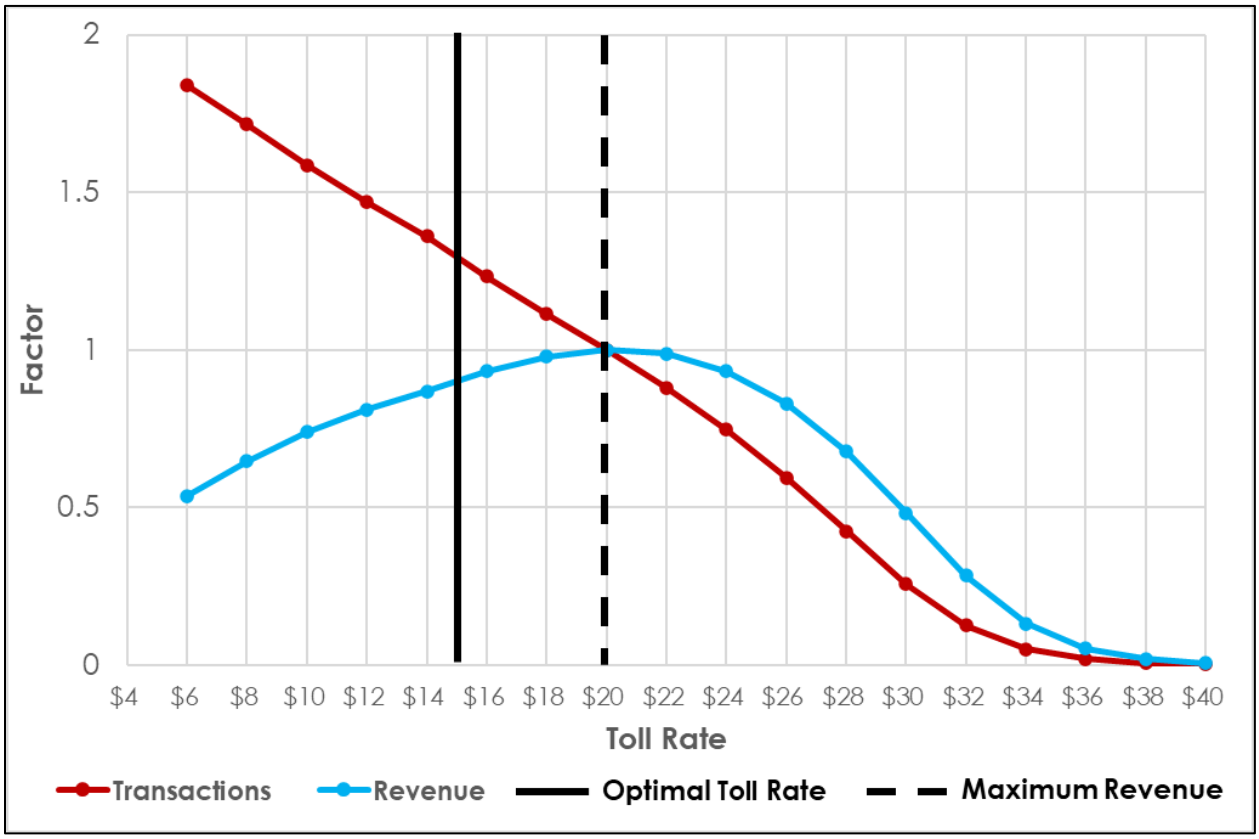
Year	Home-Based Work Trips	Local Trips	Visitor Trips
2030	90%	85%	85%
2040	90%	85%	85%
2050	90%	85%	85%

5.3 MODELED OPTIMAL TOLLS

Each model was run for the 2023 condition with the proposed MCB in the network and the toll was identified that resulted in the maximum revenue for that particular time period, day type and season. Using this maximum revenue toll, the optimal toll was identified for each time period and day type in each season based on professional judgement, industry standards and tolling experience. The optimal toll results in slightly less revenue than the maximum revenue toll; however, it still generates significant revenue and attracts more users to the facility. Setting rates at the optimal versus maximum rate also allows the operating agency the ability to increase tolls should additional revenue be needed for any reason.

For the MCB study, the optimal revenue point was set at the point on the toll revenue curve that results in about 90 percent of the maximum forecasted toll revenue; this range varies depending on the steepness of the curve. **Figure 5.1** shows an example of this analysis; when the maximum revenue base cash toll is $20, the optimal toll is $15 and generates about 90 percent of the maximum revenue. The Base Case tolls were set to optimal toll rates while the High Case tolls were set to the rates that generate maximum revenue.

Figure 5.1: Example Transaction and Toll Revenue Curve



5.3.1 Base Case

The model for each time period, each day type, and each season was run multiple times, with the cash toll increased in $2.00 increments to find the optimal toll in each model year. For the Base Case, the optimal tolls resulted in about 90 percent of the annual maximum revenues in all years. As described earlier, these optimal rates resulted in more MCB trips and still resulted in significant revenue; the optimal tolls would also allow for toll increases should additional revenues be needed. The resulting cash and ETC tolls are shown in **Table 5.2, Table 5.3,** and **Table 5.4** for Pro forma 2030, 2040, and 2050, respectively. Night period (6 PM to 6 AM) tolls were set such that the toll in that period would not exceed the toll in any other time period for each day type in each season and would also encourage travel during traditionally low travel periods. The resulting Peak

season tolls are higher than both the Shoulder and Off-Peak season tolls. The highest tolls occur on a Saturday in the Peak season in the eastbound direction. Though all tolls shown are in 2023 dollars, it should be noted that the tolls for 2030, 2040 and 2050 may differ; any changes reflect the increased advantage of the MCB as travel and congestion into the Outer Banks increases over time.

Table 5.2: Base Case Pro Forma 2030 Optimal Cash and ETC Tolls

Base Case			2030 Cash Toll Rate				2030 ETC Toll Rate			
Dir	Season	Day Type	AM	MD	PM	NT	AM	MD	PM	NT
Eastbound	Off-Peak	Weekday	$14	$14	$16	$12	$9	$9	$11	$8
		Weekend	$18	$20	$20	$16	$13	$15	$15	$11
	Shoulder	Weekday	$16	$16	$16	$14	$11	$11	$11	$9
		Saturday	$20	$24	$24	$16	$15	$19	$19	$11
		Sunday	$18	$24	$24	$16	$13	$19	$19	$11
	Peak	Weekday	$18	$18	$18	$16	$13	$13	$13	$11
		Saturday	$22	$28	$30	$18	$17	$23	$25	$13
		Sunday	$18	$28	$30	$18	$13	$23	$25	$13
Westbound	Off-Peak	Weekday	$14	$14	$14	$12	$9	$9	$9	$8
		Weekend	$20	$20	$18	$16	$15	$15	$13	$11
	Shoulder	Weekday	$16	$16	$16	$14	$11	$11	$11	$9
		Saturday	$24	$24	$18	$16	$19	$19	$13	$11
		Sunday	$24	$22	$18	$16	$19	$17	$13	$11
	Peak	Weekday	$16	$16	$16	$16	$11	$11	$11	$11
		Saturday	$30	$26	$18	$16	$25	$21	$13	$11
		Sunday	$30	$26	$18	$16	$25	$21	$13	$11

Note: All tolls shown in $2023. The ETC toll is discounted by 35 percent of the cash toll to a maximum of a $5 discount. This table presents all tolls rounded to the nearest dollar.

Table 5.3: Base Case 2040 Optimal Cash and ETC Tolls

Base Case			2040 Cash Toll Rate				2040 ETC Toll Rate			
Dir	Season	Day Type	AM	MD	PM	NT	AM	MD	PM	NT
Eastbound	Off-Peak	Weekday	$14	$14	$16	$14	$9	$9	$11	$9
		Weekend	$18	$20	$20	$16	$13	$15	$15	$11
	Shoulder	Weekday	$16	$16	$16	$14	$11	$11	$11	$9
		Saturday	$20	$26	$26	$16	$15	$21	$21	$11
		Sunday	$18	$24	$24	$16	$13	$19	$19	$11
	Peak	Weekday	$18	$18	$18	$16	$13	$13	$13	$11
		Saturday	$22	$28	$30	$18	$17	$23	$25	$13
		Sunday	$18	$28	$30	$18	$13	$23	$25	$13
Westbound	Off-Peak	Weekday	$14	$14	$14	$14	$9	$9	$9	$9
		Weekend	$20	$20	$18	$16	$15	$15	$13	$11
	Shoulder	Weekday	$16	$16	$16	$14	$11	$11	$11	$9
		Saturday	$26	$26	$18	$16	$21	$21	$13	$11
		Sunday	$24	$24	$18	$16	$19	$19	$13	$11
	Peak	Weekday	$16	$16	$16	$16	$11	$11	$11	$11
		Saturday	$30	$26	$18	$16	$25	$21	$13	$11
		Sunday	$30	$26	$18	$16	$25	$21	$13	$11

Note: All tolls shown in $2023. The ETC toll is discounted by 35 percent of the cash toll to a maximum of a $5 discount. This table presents all tolls rounded to the nearest dollar. Highlighted cells indicate an increase in real-dollar tolls relative to 2030 toll rates.

Table 5.4: Base Case 2050 Optimal Cash and ETC Tolls

Base Case			2050 Cash Toll Rate				2050 ETC Toll Rate			
Dir	Season	Day Type	AM	MD	PM	NT	AM	MD	PM	NT
Eastbound	Off-Peak	Weekday	$14	$14	$16	$14	$9	$9	$11	$9
		Weekend	$18	$22	$22	$16	$13	$17	$17	$11
	Shoulder	Weekday	$16	$16	$16	$14	$11	$11	$11	$9
		Saturday	$20	$28	$28	$16	$15	$23	$23	$11
		Sunday	$18	$24	$26	$16	$13	$19	$21	$11
	Peak	Weekday	$18	$18	$18	$16	$13	$13	$13	$11
		Saturday	$22	$30	$30	$18	$17	$25	$25	$13
		Sunday	$18	$28	$30	$18	$13	$23	$25	$13
Westbound	Off-Peak	Weekday	$14	$14	$14	$14	$9	$9	$9	$9
		Weekend	$24	$20	$18	$16	$19	$15	$13	$11
	Shoulder	Weekday	$16	$16	$16	$14	$11	$11	$11	$9
		Saturday	$28	$26	$18	$16	$23	$21	$13	$11
		Sunday	$26	$24	$18	$16	$21	$19	$13	$11
	Peak	Weekday	$16	$16	$16	$16	$11	$11	$11	$11
		Saturday	$30	$26	$18	$16	$25	$21	$13	$11
		Sunday	$30	$26	$18	$16	$25	$21	$13	$11

Note: All tolls shown in $2023. The ETC toll is discounted by 35 percent of the cash toll to a maximum of a $5 discount. This table presents all tolls rounded to the nearest dollar. Highlighted cells indicate an increase in real-dollar tolls relative to 2040 toll rates.

5.3.2 High Case

Like the Base Case, the model for each time period and day type in each season was run to find the revenue maximizing toll in each model year for the High Case. The same methodology for determining the night period tolls was applied. The increased socioeconomic activity in the area immediately surrounding the MCB in Corolla and the assumption that visitor incomes are increasing faster than inflation also contributed to the higher tolls in the High Case. The resulting tolls in the High Case are at least $4 higher than in the Base Case for most periods in pro forma 2030 but are up to $18 higher than in the Base Case during the periods with high visitor trips in the Shoulder and Peak seasons. The tolls are up to $20 higher than in the Base Case in certain periods in 2040 and 2050. The 2030, 2040 and 2050 cash and ETC tolls for the High Case are shown in **Table 5.5**, **Table 5.6** and **Table 5.7**, respectively. As in the Base Case, the 2030, 2040 and 2050 tolls (all shown in 2023 dollars) can differ, reflecting the increase in travel and congestion into and out of the Outer Banks over time.

Table 5.5: High Case Pro Forma 2030 Optimal Cash and ETC Tolls

High Case			2030 Cash Toll Rate				2030 ETC Toll Rate			
Dir	Season	Day Type	AM	MD	PM	NT	AM	MD	PM	NT
Eastbound	Off-Peak	Weekday	$20	$20	$22	$20	$15	$15	$17	$15
		Weekend	$24	$38	$38	$24	$19	$33	$33	$19
	Shoulder	Weekday	$22	$22	$22	$22	$17	$17	$17	$17
		Saturday	$26	$40	$40	$26	$21	$35	$35	$21
		Sunday	$26	$40	$40	$26	$21	$35	$35	$21
	Peak	Weekday	$22	$22	$22	$22	$17	$17	$17	$17
		Saturday	$26	$40	$40	$26	$21	$35	$35	$21
		Sunday	$26	$40	$40	$26	$21	$35	$35	$21
Westbound	Off-Peak	Weekday	$22	$20	$20	$20	$17	$15	$15	$15
		Weekend	$38	$30	$22	$22	$33	$25	$17	$17
	Shoulder	Weekday	$22	$22	$20	$20	$17	$17	$15	$15
		Saturday	$40	$40	$22	$22	$35	$35	$17	$17
		Sunday	$40	$40	$22	$22	$35	$35	$17	$17
	Peak	Weekday	$22	$22	$20	$20	$17	$17	$15	$15
		Saturday	$40	$40	$22	$22	$35	$35	$17	$17
		Sunday	$40	$40	$22	$22	$35	$35	$17	$17

Note: All tolls shown in $2023. The ETC toll is discounted by 35 percent of the cash toll up to a $5 maximum discount. This table presents all tolls rounded to the nearest dollar.

Table 5.6: High Case 2040 Optimal Cash and ETC Tolls

High Case			2040 Cash Toll Rate				2040 ETC Toll Rate			
Dir	Season	Day Type	AM	MD	PM	NT	AM	MD	PM	NT
Eastbound	Off-Peak	Weekday	$22	$20	$22	$20	$17	$15	$17	$15
		Weekend	$26	$40	$40	$26	$21	$35	$35	$21
	Shoulder	Weekday	$22	$24	$22	$22	$17	$19	$17	$17
		Saturday	$28	$40	$40	$28	$23	$35	$35	$23
		Sunday	$26	$40	$40	$26	$21	$35	$35	$21
	Peak	Weekday	$22	$24	$22	$22	$17	$19	$17	$17
		Saturday	$28	$40	$40	$28	$23	$35	$35	$23
		Sunday	$26	$40	$40	$26	$21	$35	$35	$21
Westbound	Off-Peak	Weekday	$22	$20	$20	$20	$17	$15	$15	$15
		Weekend	$40	$38	$24	$24	$35	$33	$19	$19
	Shoulder	Weekday	$22	$22	$22	$22	$17	$17	$17	$17
		Saturday	$40	$40	$24	$24	$35	$35	$19	$19
		Sunday	$40	$40	$24	$24	$35	$35	$19	$19
	Peak	Weekday	$24	$24	$22	$22	$19	$19	$17	$17
		Saturday	$40	$40	$24	$24	$35	$35	$19	$19
		Sunday	$40	$40	$24	$24	$35	$35	$19	$19

Note: All tolls shown in $2023. The ETC toll is discounted by 35 percent of the cash toll up to a $5 maximum discount. This table presents all tolls rounded to the nearest dollar. Highlighted cells indicate an increase in real-dollar tolls relative to 2030 toll rates.

Table 5.7: High Case 2050 Optimal Cash and ETC Tolls

High Case			2050 Cash Toll Rate				2050 ETC Toll Rate			
Dir	Season	Day Type	AM	MD	PM	NT	AM	MD	PM	NT
Eastbound	Off-Peak	Weekday	$22	$22	$22	$22	$17	$17	$17	$17
		Weekend	$26	$40	$40	$26	$21	$35	$35	$21
	Shoulder	Weekday	$24	$24	$24	$24	$19	$19	$19	$19
		Saturday	$28	$40	$40	$28	$23	$35	$35	$23
		Sunday	$28	$40	$40	$28	$23	$35	$35	$23
	Peak	Weekday	$24	$24	$24	$24	$19	$19	$19	$19
		Saturday	$28	$40	$40	$28	$23	$35	$35	$23
		Sunday	$28	$40	$40	$28	$23	$35	$35	$23
Westbound	Off-Peak	Weekday	$22	$20	$20	$20	$17	$15	$15	$15
		Weekend	$40	$40	$24	$24	$35	$35	$19	$19
	Shoulder	Weekday	$24	$24	$22	$22	$19	$19	$17	$17
		Saturday	$40	$40	$24	$24	$35	$35	$19	$19
		Sunday	$40	$40	$24	$24	$35	$35	$19	$19
	Peak	Weekday	$24	$24	$22	$22	$19	$19	$17	$17
		Saturday	$40	$40	$24	$24	$35	$35	$19	$19
		Sunday	$40	$40	$24	$24	$35	$35	$19	$19

Note: All tolls shown in $2023. The ETC toll is discounted by 35 percent of the cash toll up to a $5 maximum discount. This table presents all tolls rounded to the nearest dollar. Highlighted cells indicate an increase in real-dollar tolls relative to 2040 toll rates.

5.4 MODELED SUBAREA TRAFFIC

5.4.1 Subarea Daily Traffic

The growth in future year trips was estimated directly as a function of the change in the socioeconomic data and the relationships established with the external (visitor) traffic outside of the modeled subarea A summary of the future year changes in socioeconomic data was provided in Chapter 3.0. The modeling methodology was described in detail in Chapter 4.0.

5.4.1.1 Base Case

Table 5.8 provides a summary of total trip growth by purpose for each modeled day and season in the Base Case. The estimated growth in trips is consistent with the growth in the underlying socioeconomic data as described earlier in this report. For example, total HBW trips are forecasted to grow between 0.6 and 1.3 percent per year between 2023 and 2050, depending on the season. Over the same period, permanent job growth in Currituck County on the Outer Banks is forecasted at about 1.1 percent per year (averaged over all seasons of the year). For all purposes, trip growth is highest between 2023 and 2030 then tapers downward through 2050.

Estimated traffic growth at key locations is summarized in **Table 5.9**. At the WMB, pro forma 2030 shows a decrease in traffic as visitors take the MCB as an alternative. Between 2030 and 2050, WMB traffic growth is consistent with the trip table growth rates discussed previously. For the weekend days, traffic at the WMB shows a reasonable growth rate consistent with the increase in residential bedrooms and hotel rooms. As expected, a noted reduction in traffic occurs between the 2023 and 2030 pro forma at the NC 12 location south of Duck because the MCB would reduce north-south travel on the island for arriving and departing travelers. In 2040 and 2050, the growth shown is consistent with the growth in vacation trips and recreational travel within the coastal communities.

Table 5.8: Base Case Total Modeled Subarea Daily Trips and Growth by Trip Purpose

Trip Purpose	Model		Model Year (Base Case)						
			2023 Trips	2030		2040		2050	
	Season	Day		Trips	CAGR	Trips	CAGR	Trips	CAGR
HBW (Home-Based Work)	Off	Weekday	73,193	79,175	1.1%	84,282	0.6%	89,828	0.6%
		Weekend	71,904	78,014	1.2%	83,943	0.7%	90,399	0.7%
	Shoulder	Weekday	77,322	84,267	1.2%	90,653	0.7%	97,495	0.7%
		Saturday	82,626	89,631	1.2%	96,721	0.8%	104,358	0.8%
		Sunday	78,795	85,844	1.2%	92,946	0.8%	100,593	0.8%
	Peak	Weekday	77,134	84,256	1.3%	90,840	0.8%	97,828	0.7%
		Saturday	81,682	88,857	1.2%	96,197	0.8%	104,005	0.8%
		Sunday	77,286	84,435	1.3%	91,728	0.8%	99,524	0.8%
HBO (Home-Based Other)	Off	Weekday	95,953	104,078	1.2%	111,589	0.7%	119,828	0.7%
		Weekend	105,714	115,025	1.2%	124,023	0.8%	133,940	0.8%
	Shoulder	Weekday	94,270	102,458	1.2%	109,964	0.7%	118,116	0.7%
		Saturday	115,518	124,855	1.1%	133,850	0.7%	143,654	0.7%
		Sunday	111,095	120,451	1.2%	129,446	0.7%	139,254	0.7%
	Peak	Weekday	91,219	99,450	1.2%	106,911	0.7%	114,913	0.7%
		Saturday	116,089	125,794	1.2%	135,085	0.7%	145,076	0.7%
		Sunday	110,322	120,033	1.2%	129,305	0.7%	139,297	0.7%
NHB (Non-Home-Based)	Off	Weekday	203,294	217,808	1.0%	234,603	0.7%	251,872	0.7%
		Weekend	168,098	180,552	1.0%	196,094	0.8%	212,355	0.8%
	Shoulder	Weekday	217,238	233,384	1.0%	252,267	0.8%	271,727	0.7%
		Saturday	186,544	199,402	1.0%	215,948	0.8%	233,742	0.8%
		Sunday	179,941	192,793	1.0%	209,345	0.8%	227,144	0.8%
	Peak	Weekday	258,072	277,681	1.1%	301,503	0.8%	325,886	0.8%
		Saturday	222,326	238,058	1.0%	259,080	0.8%	281,748	0.8%
		Sunday	216,002	231,730	1.0%	252,738	0.9%	275,406	0.9%
Visitor - Local	Off	Weekday	15,584	17,276	1.5%	18,456	0.7%	18,619	0.1%
		Weekend	13,088	14,768	1.7%	15,951	0.8%	16,116	0.1%
	Shoulder	Weekday	60,438	68,388	1.8%	73,914	0.8%	74,708	0.1%
		Saturday	61,961	69,797	1.7%	75,339	0.8%	76,144	0.1%
		Sunday	60,065	67,895	1.8%	73,440	0.8%	74,250	0.1%
	Peak	Weekday	78,480	89,344	1.9%	96,847	0.8%	97,935	0.1%
		Saturday	76,871	87,510	1.9%	95,042	0.8%	96,146	0.1%
		Sunday	70,310	80,947	2.0%	88,473	0.9%	89,571	0.1%
External-Internal Vacation	Off	Weekend	5,708	5,921	0.5%	6,064	0.2%	6,086	0.0%
	Shoulder	Saturday	19,155	20,154	0.7%	20,821	0.3%	20,928	0.1%
		Sunday	15,558	16,557	0.9%	17,224	0.4%	17,331	0.1%
	Peak	Saturday	21,119	22,475	0.9%	23,380	0.4%	23,524	0.1%
		Sunday	16,756	18,112	1.1%	19,018	0.5%	19,162	0.1%

Note: The five trip classifications presented in this table represent all of the modeled trip classifications.

Table 5.9: Base Case Modeled Subarea Daily Trips and Growth at Key Roadway Network Locations

Network Location	Model		2023 Observed Traffic	Model Year (Base Case)						
				2023 Estimated Traffic	2030		2040		2050	
	Season	Day			ADT	CAGR	ADT	CAGR	ADT	CAGR
Wright Memorial Bridge (EB & WB)	Off	Weekday	19,036	19,567	20,499	0.7%	22,781	1.1%	24,931	0.9%
		Weekend	17,309	15,594	16,402	0.7%	19,148	1.6%	21,856	1.3%
	Shoulder	Weekday	23,193	22,811	23,947	0.7%	27,119	1.3%	29,979	1.0%
		Saturday	35,911	37,121	33,018	-1.7%	37,598	1.3%	41,704	1.0%
		Sunday	29,500	32,156	29,297	-1.3%	33,713	1.4%	37,720	1.1%
	Peak	Weekday	25,421	23,760	25,574	1.1%	29,356	1.4%	32,735	1.1%
		Saturday	47,468	42,120	37,098	-1.8%	42,760	1.4%	47,608	1.1%
		Sunday	38,021	35,472	32,909	-1.1%	38,424	1.6%	43,227	1.2%
NC 12 South of Duck (NB & SB)	Off	Weekday	11,131	10,752	10,753	0.0%	11,469	0.6%	12,118	0.6%
		Weekend	8,259	7,922	7,685	-0.4%	8,409	0.9%	8,892	0.6%
	Shoulder	Weekday	17,520	17,192	17,760	0.5%	18,883	0.6%	19,791	0.5%
		Saturday	16,349	15,857	11,897	-4.0%	13,296	1.1%	14,282	0.7%
		Sunday	18,500	18,322	14,593	-3.2%	16,287	1.1%	17,376	0.6%
	Peak	Weekday	18,391	18,181	18,479	0.2%	20,021	0.8%	20,399	0.2%
		Saturday	17,746	19,343	12,145	-6.4%	14,119	1.5%	15,398	0.9%
		Sunday	18,787	18,971	14,320	-3.9%	16,299	1.3%	16,921	0.4%

5.4.1.2 High Case

The construction of the proposed MCB will make Corolla and the surrounding areas considerably more accessible to travelers from the mainland, driving an increased demand for development. In the High Case, the model zones that represent the Currituck County portion of the Outer Banks have a higher growth rate in rental bedrooms than the Base Case. In 2030, there are five percent more bedrooms in the High Case; in 2050 there are 14 percent more. The High Case also assumes the external trip (visitor trips) incomes increase at a compound annual growth rate of 0.5 percent above inflation. Note that this assumption only affects visitor trips.

Table 5.10 provides a summary of trip growth by purpose for each modeled day and season in the High Case. In all trip purposes, the estimated growth rate is slightly higher in the High Case than the Base Case. This is consistent with the higher growth in economic activity near the proposed MCB and the higher incomes for visitor trips assumed in development of the High Case model.

Estimated traffic growth at key locations is summarized in **Table 5.11**. High Case growth rates in traffic on the WMB and on NC 12 south of Duck are generally similar to or higher than the Base Case growth.

Table 5.10: High Case Total Modeled Subarea Daily Trips and Growth by Trip Purpose

Trip Purpose	Model		Model Year (High Case)						
			2023 Trips	2030		2040		2050	
	Season	Day		Trips	CAGR	Trips	CAGR	Trips	CAGR
HBW (Home-Based Work)	Off	Weekday	73,193	80,009	1.3%	85,736	0.7%	91,755	0.7%
		Weekend	71,904	78,975	1.3%	85,689	0.8%	92,798	0.8%
	Shoulder	Weekday	77,322	85,771	1.5%	93,214	0.8%	100,924	0.8%
		Saturday	82,626	91,234	1.4%	99,536	0.9%	108,177	0.8%
		Sunday	78,795	87,441	1.5%	95,751	0.9%	104,403	0.9%
	Peak	Weekday	77,134	85,817	1.5%	93,486	0.9%	101,354	0.8%
		Saturday	81,682	90,483	1.5%	99,044	0.9%	107,838	0.9%
		Sunday	77,286	86,078	1.6%	94,587	0.9%	103,363	0.9%
HBO (Home-Based Other)	Off	Weekday	95,953	105,295	1.3%	113,789	0.8%	122,856	0.8%
		Weekend	105,714	116,514	1.4%	126,722	0.8%	137,722	0.8%
	Shoulder	Weekday	94,270	103,639	1.4%	112,092	0.8%	121,062	0.8%
		Saturday	115,518	126,310	1.3%	136,453	0.8%	147,298	0.8%
		Sunday	111,095	121,904	1.3%	132,046	0.8%	142,895	0.8%
	Peak	Weekday	91,219	100,582	1.4%	108,942	0.8%	117,689	0.8%
		Saturday	116,089	127,229	1.3%	137,641	0.8%	148,637	0.8%
		Sunday	110,322	121,469	1.4%	131,864	0.8%	142,860	0.8%
NHB (Non-Home-Based)	Off	Weekday	203,294	219,948	1.1%	238,337	0.8%	256,991	0.8%
		Weekend	168,098	182,119	1.2%	198,861	0.9%	215,953	0.8%
	Shoulder	Weekday	217,238	235,900	1.2%	256,649	0.8%	277,815	0.8%
		Saturday	186,544	201,072	1.1%	218,813	0.8%	237,510	0.8%
		Sunday	179,941	194,465	1.1%	212,217	0.9%	230,920	0.8%
	Peak	Weekday	258,072	280,336	1.2%	306,109	0.9%	332,265	0.8%
		Saturday	222,326	239,783	1.1%	262,048	0.9%	285,581	0.9%
		Sunday	216,002	233,463	1.1%	255,718	0.9%	279,250	0.9%
Visitor - Local	Off	Weekday	15,584	17,587	1.7%	19,163	0.9%	19,559	0.2%
		Weekend	13,088	15,079	2.0%	16,659	1.0%	17,056	0.2%
	Shoulder	Weekday	60,438	69,863	2.1%	77,219	1.0%	79,116	0.2%
		Saturday	61,961	71,275	2.0%	78,654	1.0%	80,561	0.2%
		Sunday	60,065	69,374	2.1%	76,756	1.0%	78,667	0.2%
	Peak	Weekday	78,480	91,351	2.2%	101,328	1.0%	103,910	0.3%
		Saturday	76,871	89,519	2.2%	99,545	1.1%	102,135	0.3%
		Sunday	70,310	82,956	2.4%	92,976	1.1%	95,562	0.3%
External-Internal Vacation	Off	Weekend	5,708	5,958	0.6%	6,149	0.3%	6,199	0.1%
	Shoulder	Saturday	19,155	20,331	0.9%	21,218	0.4%	21,457	0.1%
		Sunday	15,558	16,734	1.0%	17,621	0.5%	17,860	0.1%
	Peak	Saturday	21,119	22,716	1.0%	23,917	0.5%	24,242	0.1%
		Sunday	16,756	18,354	1.3%	19,555	0.6%	19,880	0.2%

Note: The five trip classifications presented in this table represent all of the modeled trip classifications.

Table 5.11: High Case Modeled Subarea Daily Trips and Growth at Key Roadway Network Locations

Network Location	Model		2023 Observed Traffic	Model Year (High Case)						
				2023 Estimated Traffic	2030		2040		2050	
	Season	Day			ADT	CAGR	ADT	CAGR	ADT	CAGR
Wright Memorial Bridge (EB & WB)	Off	Weekday	19,036	19,567	21,611	1.4%	24,386	1.2%	26,870	1.0%
		Weekend	18,139	15,594	17,779	1.9%	21,181	1.8%	24,152	1.3%
	Shoulder	Weekday	23,193	22,811	25,353	1.5%	29,232	1.4%	32,503	1.1%
		Saturday	35,911	37,121	36,081	-0.4%	41,139	1.3%	45,450	1.0%
		Sunday	29,500	32,156	32,725	0.3%	37,791	1.4%	42,088	1.1%
	Peak	Weekday	25,421	23,760	27,028	1.9%	31,601	1.6%	35,367	1.1%
		Saturday	47,468	42,120	39,848	-0.8%	46,144	1.5%	51,348	1.1%
		Sunday	38,021	35,472	35,895	0.2%	42,106	1.6%	47,272	1.2%
NC 12 South of Duck (NB & SB)	Off	Weekday	11,131	10,752	11,316	0.7%	12,261	0.8%	12,881	0.5%
		Weekend	8,259	7,922	8,454	0.9%	9,207	0.9%	10,155	1.0%
	Shoulder	Weekday	17,520	17,192	18,549	1.1%	20,239	0.9%	21,281	0.5%
		Saturday	16,349	15,857	13,126	-2.7%	14,981	1.3%	15,893	0.6%
		Sunday	18,500	18,322	16,920	-1.1%	18,536	0.9%	19,588	0.6%
	Peak	Weekday	18,391	18,181	19,379	0.9%	21,195	0.9%	22,217	0.5%
		Saturday	17,746	19,343	13,994	-4.5%	15,869	1.3%	16,260	0.2%
		Sunday	18,787	18,971	16,554	-1.9%	18,284	1.0%	18,542	0.1%

5.4.2 Future Estimated Travel Times

Travel distances to towns north of the WMB on the Outer Banks could be greatly reduced by using the proposed MCB. As shown in **Table 5.12**, the mileage from Barco (US158/NC-168 intersection) to Southern Shores, Duck, Corolla, and Carova is shorter via the proposed MCB. The distances to Corolla and Carova via MCB are approximately 30 and 37 miles shorter, respectively, which could save travelers a significant amount of time and fuel.

Table 5.12: Travel Distance Comparison between Barco and Selected Outer Banks' Cities, via WMB or MCB (miles)

Destination	Travel Distance from Barco via Wright Memorial Bridge (mi)	Travel Distance from Barco via Mid-Currituck Bridge (mi)
Kitty Hawk	30.1	31.8
Southern Shores	31.5	28.4
Duck	34.4	25.5
Corolla	44.7	15.2
Carova	51.5	15.0

The total travel time from the mainland to the Outer Banks is impacted by congestion. Congested travel times to the primary destinations on the Outer Banks were estimated for each model year.

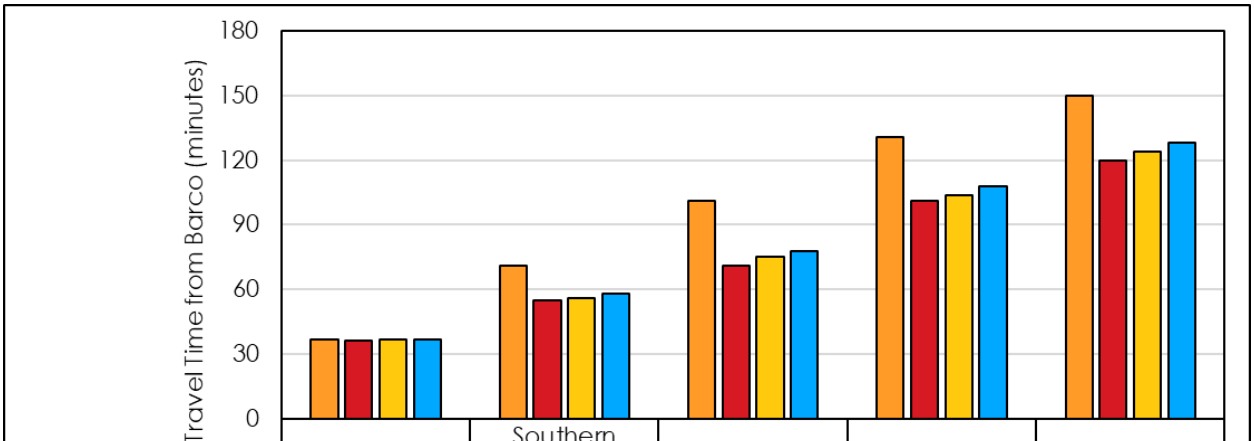
These travel times are described in the sections that follow and are different between the Base Case and High Case due to the difference in congestion levels at certain locations.

5.4.2.1 Base Case

Travel times are estimated to decrease significantly on weekends during the Peak season with the implementation of the proposed MCB, as shown in **Figure 5.2**. From Barco to Southern Shores, the Peak season Saturday MD travel time will decrease from 71 minutes in 2023 to 55 minutes in pro forma 2030; from Barco to Carova, travel time is estimated to decrease from 150 minutes to 120 minutes in pro forma 2030.

Figure 5.3 compares the Peak season travel times from Barco to the Outer Banks via the WMB and proposed MCB. Only the travel time from Barco to Kitty Hawk is estimated to be shorter using the WMB. Pro forma 2030 travel time from Barco to Southern Shores is estimated to be 11 minutes shorter using the MCB. For the journey from Barco to Carova, the MCB provides 88 minutes of travel time savings compared to the WMB in pro forma 2030. This trend holds true in 2040 and 2050 as well.

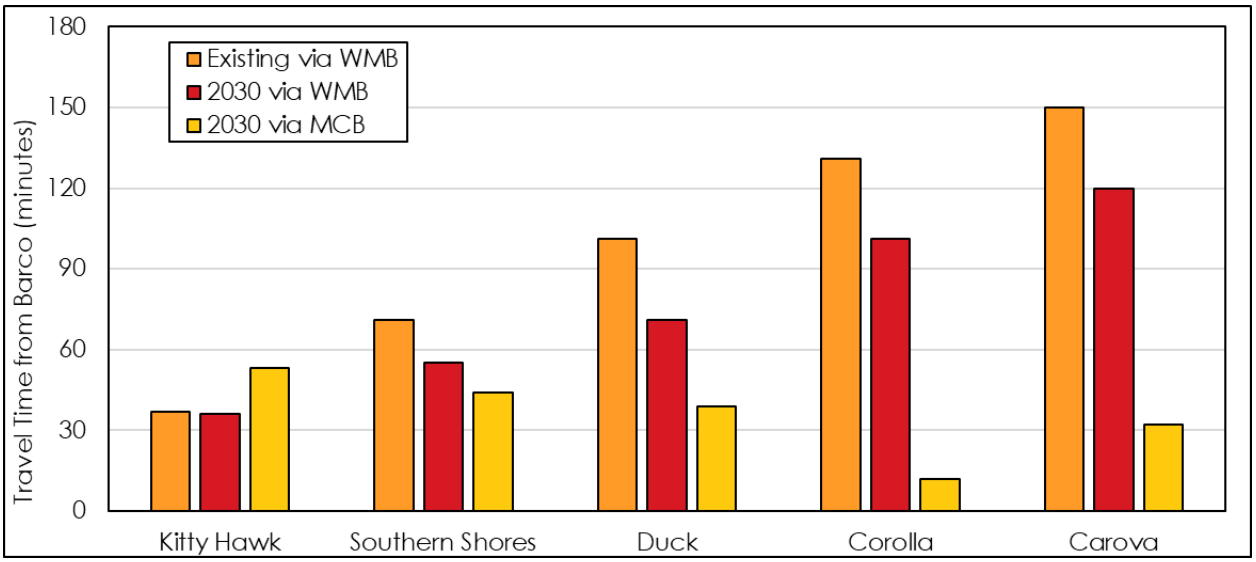
Figure 5.2: Actual 2023 and Estimated Base Case Peak Saturday MD Travel Times from Barco to Outer Banks' Areas via WMB



	Kitty Hawk	Southern Shores	Duck	Corolla	Carova
Existing (No MCB)	37	71	101	131	150
2030	36	55	71	101	120
2040	37	56	75	104	124
2050	37	58	78	108	128

Note: 2030 results are pro forma as the MCB is not expected to open to traffic until Q1 2032.

Figure 5.3: Actual 2023 and Estimated 2030 Base Case Peak Saturday MD Travel Time from Barco to Outer Banks' Areas via WMB or MCB



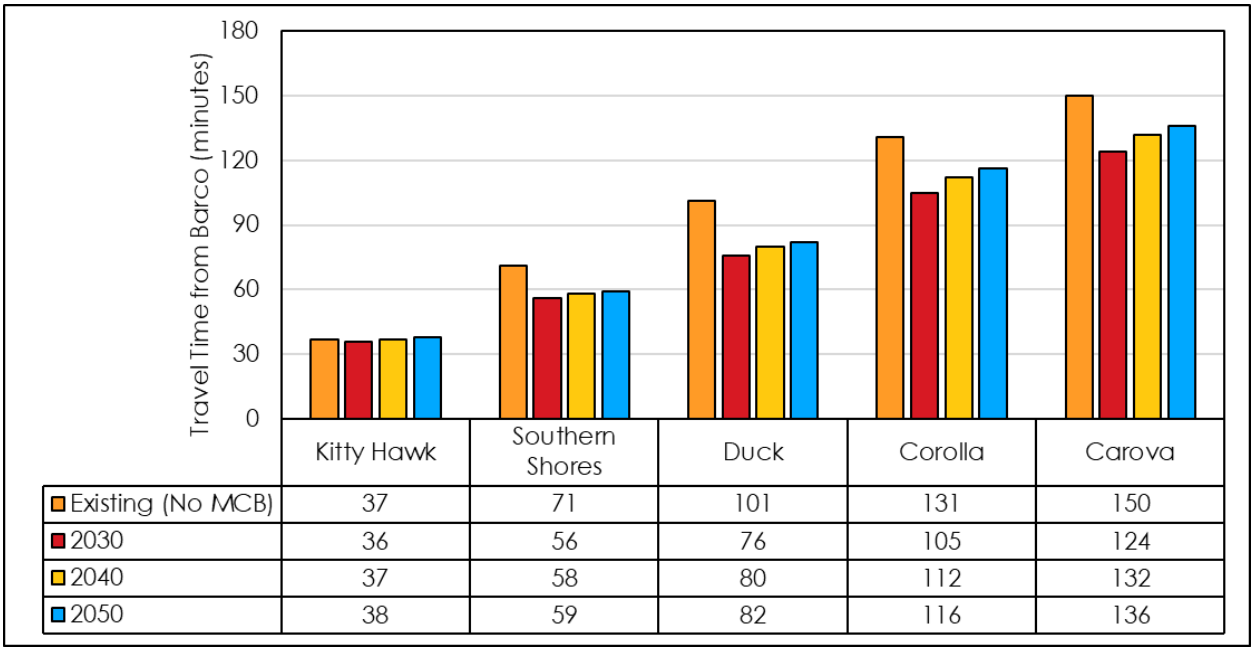
Note: 2030 results are pro forma as the MCB is not expected to open to traffic until Q1 2032.

5.4.2.2 High Case

Travel times on the WMB are estimated to be slightly longer in the High Case than the Base Case in 2040 and 2050. This is due to higher tolls (therefore fewer MCB customers) and greater socioeconomic activity generating more traffic than the Base Case. As shown in **Figure 5.4**, 2040 Saturday MD travel times from Barco to Carova are estimated to be 132 minutes, which is 8 minutes longer than the Base Case estimate. This occurs as more traffic uses the WMB because of the additional congestion in the High Case that stems from the increase in rental bedrooms.

Figure 5.5 compares the Peak season travel times from Barco to the Outer Banks via the WMB and proposed MCB for the High Case. These travel times are not substantially different between the Base Case and the High Case.

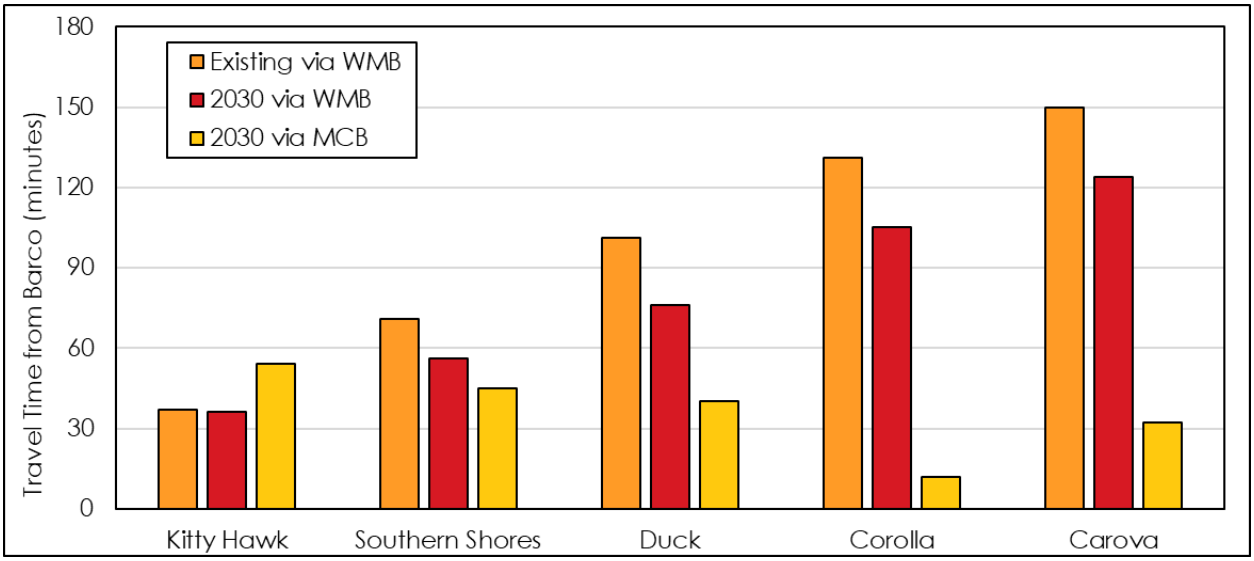
Figure 5.4: Actual 2023 and Estimated High Case Peak Saturday MD Travel Time from Barco to Outer Banks' Areas via WMB



	Kitty Hawk	Southern Shores	Duck	Corolla	Carova
Existing (No MCB)	37	71	101	131	150
2030	36	56	76	105	124
2040	37	58	80	112	132
2050	38	59	82	116	136

Note: 2030 results are pro forma as the MCB is not expected to open to traffic until Q1 2032.

Figure 5.5: Actual 2023 and Estimated 2030 High Case Peak Saturday MD Travel Time from Barco to Outer Banks' Areas via WMB or MCB



Note: 2030 results are pro forma as the MCB is not expected to open to traffic until Q1 2032.

5.4.3 Estimated Tolled Traffic and Currituck Sound Crossing Market Share

Market share is defined herein as the percentage of total traffic traveling from the mainland to the Outer Banks that chooses a given crossing, such as the WMB or MCB. The estimated future market share for the MCB is discussed in the following sections for both cases.

5.4.3.1 Base Case

Estimated tolled traffic on the MCB and its share of total traffic crossing the Currituck Sound are summarized in **Table 5.13**. The proposed MCB with the optimal tolls is estimated to capture approximately 6.1 percent of the total traffic crossing the sound during the Off-Peak season weekday in pro forma 2030, with the vast majority of this traffic destined to coastal zones in Corolla and Duck. By the year 2050, the weekday Off-Peak season traffic on the MCB is estimated to decrease to 5.6 percent of the total crossing volume. During the Shoulder and Peak season weekdays, the traffic on the MCB is estimated to be between 6 and 7 percent in pro forma 2030 and will remain around 5 to 7 percent of the crossing totals over time.

On weekends, the MCB market share will be higher, even with the higher tolls. This is due to both the larger traffic flows destined to coastal towns for weekly vacations along with the increased delay along NC 12 near Duck, which currently affects travel across the WMB. Market shares during Peak season weekends are estimated to be approximately 19.5 percent in pro forma 2030 and decrease to about 17.1 percent by 2050. The slight decrease in MCB market share is due to toll increases and the higher growth in seasonal and permanent employment south of the WMB than north of it.

Table 5.13: Pro Forma 2030, 2040 and 2050 Base Case Estimated Average Daily Tolled Traffic and Market Share

Location	Model		2023 Observed Traffic	Model Year (Base Case)								
				2030			2040			2050		
	Season	Day		ADT	2023-2030 CAGR	MCB Share of Both Bridges	ADT	2030-2040 CAGR	MCB Share of Both Bridges	ADT	2040-2050 CAGR	MCB Share of Both Bridges
Mid-Currituck Bridge (MCB)	Off-Peak	Weekday		1,325		6.1%	1,394	0.5%	5.8%	1,470	0.5%	5.6%
		Weekend		1,951		10.6%	2,125	0.9%	10.0%	2,125	0.0%	8.9%
	Shoulder	Weekday		1,789		6.9%	1,875	0.5%	6.5%	1,950	0.4%	6.1%
		Saturday		8,370		20.1%	8,684	0.4%	18.7%	8,602	-0.1%	17.0%
		Sunday		7,162		19.6%	7,668	0.7%	18.5%	7,681	0.0%	16.8%
	Peak	Weekday		1,699		6.2%	1,795	0.6%	5.8%	1,875	0.4%	5.4%
		Saturday		9,542		20.0%	10,246	0.7%	19.0%	10,295	0.0%	17.4%
		Sunday		7,845		19.1%	8,570	0.9%	18.1%	8,724	0.2%	16.7%
Total Traffic (Mid-Currituck and Wright Memorial Bridge)	Off-Peak	Weekday	19,036	21,824	2.0%		24,174	1.0%		26,400	0.9%	
		Weekend	17,309	18,353	0.8%		21,273	1.5%		23,981	1.2%	
	Shoulder	Weekday	23,193	25,792	1.5%		29,053	1.2%		31,992	1.0%	
		Saturday	35,911	41,603	2.1%		46,525	1.1%		50,564	0.8%	
		Sunday	29,500	36,626	3.1%		41,556	1.3%		45,597	0.9%	
	Peak	Weekday	25,421	27,278	1.0%		31,131	1.3%		34,586	1.1%	
		Saturday	47,468	47,714	0.1%		54,057	1.3%		59,017	0.9%	
		Sunday	38,021	41,071	1.1%		47,345	1.4%		52,283	1.0%	

5.4.3.2 High Case

Estimated tolled traffic on the MCB and its market share of total traffic crossing the Currituck Sound for the High Case are summarized in **Table 5.14**. The trends are similar to the Base Case. The weekday share of total crossing traffic is lower for the High Case due to the higher tolls than in the Base Case. The weekend share is higher than the weekday share, reaching 15.4 percent of total Peak season Saturday crossings by 2050. This is a result of the increase in rental bedrooms near the MCB assumed in the High Case. With more estimated tourism activity and rental bedrooms in the northern Outer Banks, a greater share of the total crossing traffic will be inclined to use the proposed MCB.

Table 5.14: Pro Forma 2030, and 2040 and 2050 High Case Estimated Average Daily Tolled Traffic and Market Share

Location	Model		2023 Observed Traffic	Model Year (High Case)								
				2030			2040			2050		
	Season	Day		ADT	2023-2030 CAGR	MCB Share of Both Bridges	ADT	2030-2040 CAGR	MCB Share of Both Bridges	ADT	2040-2050 CAGR	MCB Share of Both Bridges
Mid-Currituck Bridge (MCB)	Off-Peak	Weekday		1,007		4.5%	1,091	0.8%	4.3%	1,156	0.6%	4.1%
		Weekend		1,430		7.4%	1,490	0.4%	6.6%	1,585	0.6%	6.2%
	Shoulder	Weekday		1,447		5.4%	1,516	0.5%	4.9%	1,546	0.2%	4.5%
		Saturday		6,459		15.0%	7,266	1.2%	14.8%	7,760	0.7%	14.5%
		Sunday		5,170		13.6%	5,993	1.5%	13.6%	6,349	0.6%	13.1%
	Peak	Weekday		1,457		5.1%	1,508	0.3%	4.6%	1,592	0.5%	4.3%
		Saturday		7,993		16.2%	9,053	1.3%	15.9%	9,642	0.6%	15.4%
		Sunday		6,453		15.1%	7,554	1.6%	15.1%	8,039	0.6%	14.4%
Total Traffic (Mid-Currituck and Wright Memorial Bridge)	Off-Peak	Weekday	19,036	22,618	2.5%		25,476	1.2%		28,026	1.0%	
		Weekend	18,139	19,209	0.8%		22,671	1.7%		25,738	1.3%	
	Shoulder	Weekday	23,193	26,862	2.1%		30,814	1.4%		34,123	1.0%	
		Saturday	35,911	43,061	2.6%		48,953	1.3%		53,576	0.9%	
		Sunday	29,500	38,084	3.7%		43,985	1.5%		48,625	1.0%	
	Peak	Weekday	25,421	28,451	1.6%		33,051	1.5%		36,891	1.1%	
		Saturday	47,468	49,422	0.6%		56,840	1.4%		62,461	0.9%	
		Sunday	38,021	42,793	1.7%		50,143	1.6%		55,750	1.1%	

5.5 ESTIMATED DAILY TOLL TRAFFIC AND GROSS TOLL REVENUES

5.5.1 Pro Forma 2030 Toll Traffic and Gross Toll Revenues

5.5.1.1 Pro Forma 2030 Base Case

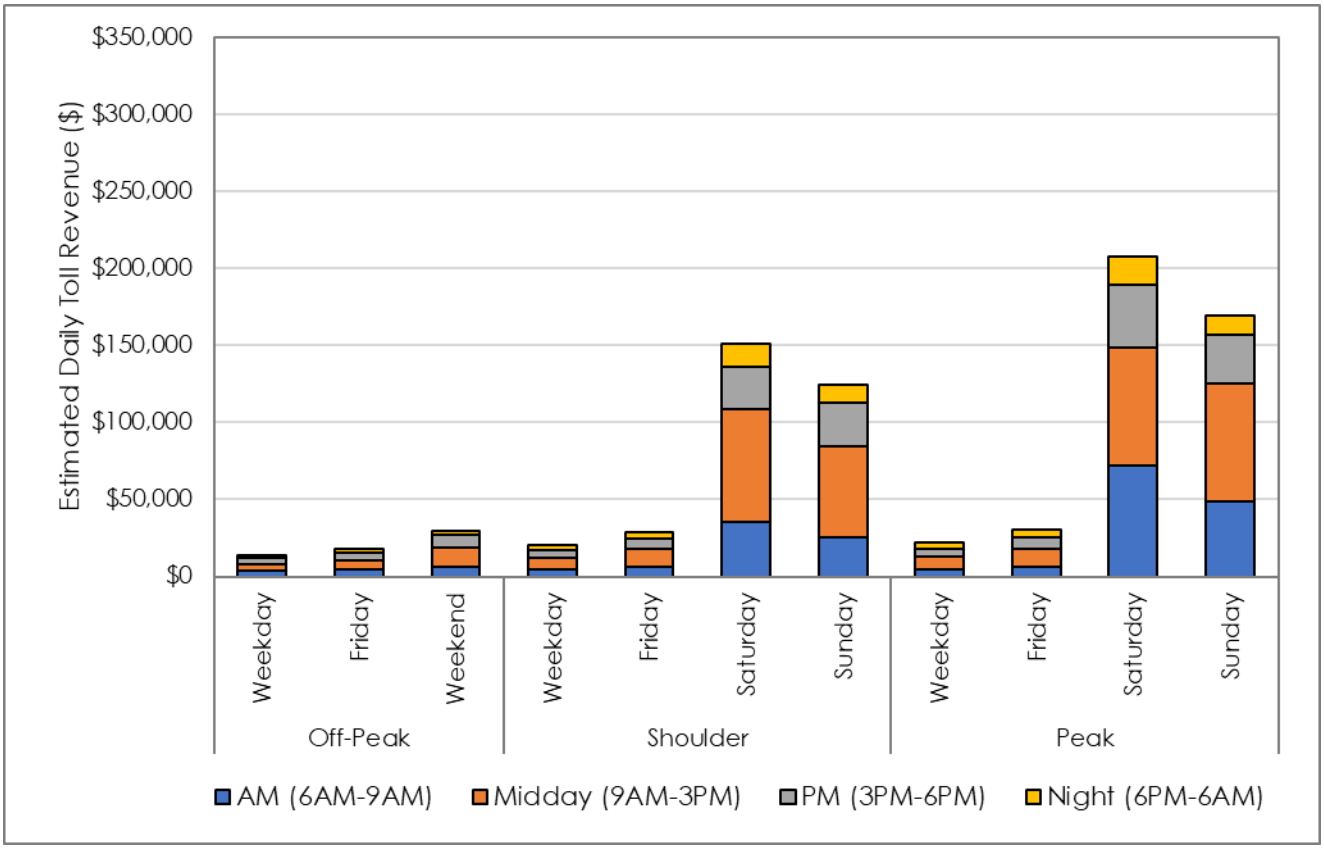
The estimated Base Case pro forma 2030 daily tolled traffic and revenue estimates are shown in **Table 5.15** and **Figure 5.6**. Because 2030 is a pro forma model year – the MCB is not expected to open until 2032 – no adjustments have been made for ramp-up. Traffic and revenue are totaled for each day type in each season. To account for higher traffic volumes on the WMB, the forecast includes a separate day type for Fridays to distinguish it from weekday volumes. The Friday tolls are assumed to be $2 higher than the respective weekday tolls for each season. As expected, daily revenues are greatest on a Saturday in the Peak season when congestion on the Outer Banks is the most severe; people are willing to pay higher tolls on the MCB to avoid the congestion and longer travel times on routes that include the WMB. Peak season weekday total daily revenue is estimated to be about 60 percent higher than average Off-Peak weekday revenue. As shown in the figure, the AM revenue on a Peak season Saturday is more than the total daily revenue on a weekday in the Shoulder or Off-Peak seasons.

Table 5.15: 2030 Pro Forma Base Case Estimated Daily Gross Toll Revenue and Transactions

Base Case			2030 Daily Revenue by Period (2023$)					2030 Daily Transactions by Period				
	Season	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
Eastbound	Off-Peak	Weekday	$2,074	$2,378	$2,651	$917	$8,020	208	236	226	108	778
		Friday	$2,736	$3,134	$3,419	$1,177	$10,466	229	260	249	118	856
		Weekend	$1,988	$5,772	$5,022	$1,370	$14,152	145	367	320	116	949
	Shoulder	Weekday	$2,332	$4,519	$2,611	$1,602	$11,064	197	381	223	161	962
		Friday	$3,284	$6,361	$3,672	$2,301	$15,619	237	458	267	193	1,155
		Saturday	$4,772	$47,199	$23,143	$8,056	$83,170	305	2,399	1,175	688	4,567
		Sunday	$5,917	$37,665	$22,034	$6,611	$72,227	435	1,918	1,121	566	4,040
	Peak	Weekday	$2,433	$5,123	$2,920	$1,629	$12,105	177	369	213	137	896
		Friday	$3,352	$7,055	$4,019	$2,292	$16,718	213	443	256	164	1,075
		Saturday	$11,194	$45,741	$36,026	$10,341	$103,302	638	1,933	1,403	754	4,728
		Sunday	$7,206	$48,462	$27,869	$8,530	$92,068	529	2,049	1,085	623	4,286
Westbound	Season	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
	Off-Peak	Weekday	$1,471	$1,783	$1,636	$537	$5,427	148	173	163	63	547
		Friday	$1,939	$2,350	$2,157	$689	$7,135	163	190	179	69	601
		Weekend	$4,365	$6,766	$2,717	$1,139	$14,987	277	430	199	97	1,003
	Shoulder	Weekday	$1,981	$3,608	$2,298	$1,595	$9,482	168	302	195	161	826
		Friday	$2,786	$5,078	$3,235	$2,293	$13,392	201	363	234	194	992
		Saturday	$30,463	$25,893	$4,453	$7,147	$67,955	1,546	1,316	326	614	3,803
		Sunday	$19,350	$21,704	$5,657	$5,784	$52,495	983	1,228	415	497	3,122
	Peak	Weekday	$2,002	$3,464	$2,348	$1,761	$9,576	168	287	198	150	803
		Friday	$2,816	$4,875	$3,306	$2,479	$13,476	201	345	237	180	963
		Saturday	$60,572	$30,999	$4,748	$7,881	$104,200	2,357	1,430	348	678	4,814
		Sunday	$41,125	$28,195	$3,953	$4,280	$77,553	1,601	1,301	289	368	3,559
Both Directions	Season	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
	Off-Peak	Weekday	$3,546	$4,161	$4,288	$1,454	$13,448	356	409	389	171	1,325
		Friday	$4,675	$5,484	$5,576	$1,866	$17,601	392	450	428	188	1,457
		Weekend	$6,353	$12,538	$7,739	$2,508	$29,139	423	797	519	213	1,951
	Shoulder	Weekday	$4,313	$8,128	$4,909	$3,197	$20,546	365	683	418	322	1,789
		Friday	$6,071	$11,438	$6,907	$4,595	$29,011	438	820	501	387	2,146
		Saturday	$35,235	$73,091	$27,596	$15,203	$151,126	1,851	3,715	1,501	1,302	8,370
		Sunday	$25,266	$59,369	$27,690	$12,396	$124,721	1,418	3,147	1,536	1,062	7,162
	Peak	Weekday	$4,435	$8,587	$5,268	$3,390	$21,680	345	657	411	287	1,699
		Friday	$6,168	$11,930	$7,325	$4,772	$30,194	414	788	493	344	2,039
		Saturday	$71,765	$76,740	$40,773	$18,222	$207,501	2,995	3,363	1,752	1,432	9,542
		Sunday	$48,332	$76,657	$31,822	$12,810	$169,620	2,130	3,350	1,374	990	7,845

Note: 2030 results are pro forma as the MCB is not expected to open to traffic until Q1 2032.

Figure 5.6: 2030 Pro Forma Base Case Estimated Daily Gross Toll Revenues



Note: 2030 results are pro forma as the MCB is not expected to open to traffic until Q1 2032.

5.5.1.2 Pro Forma 2030 High Case

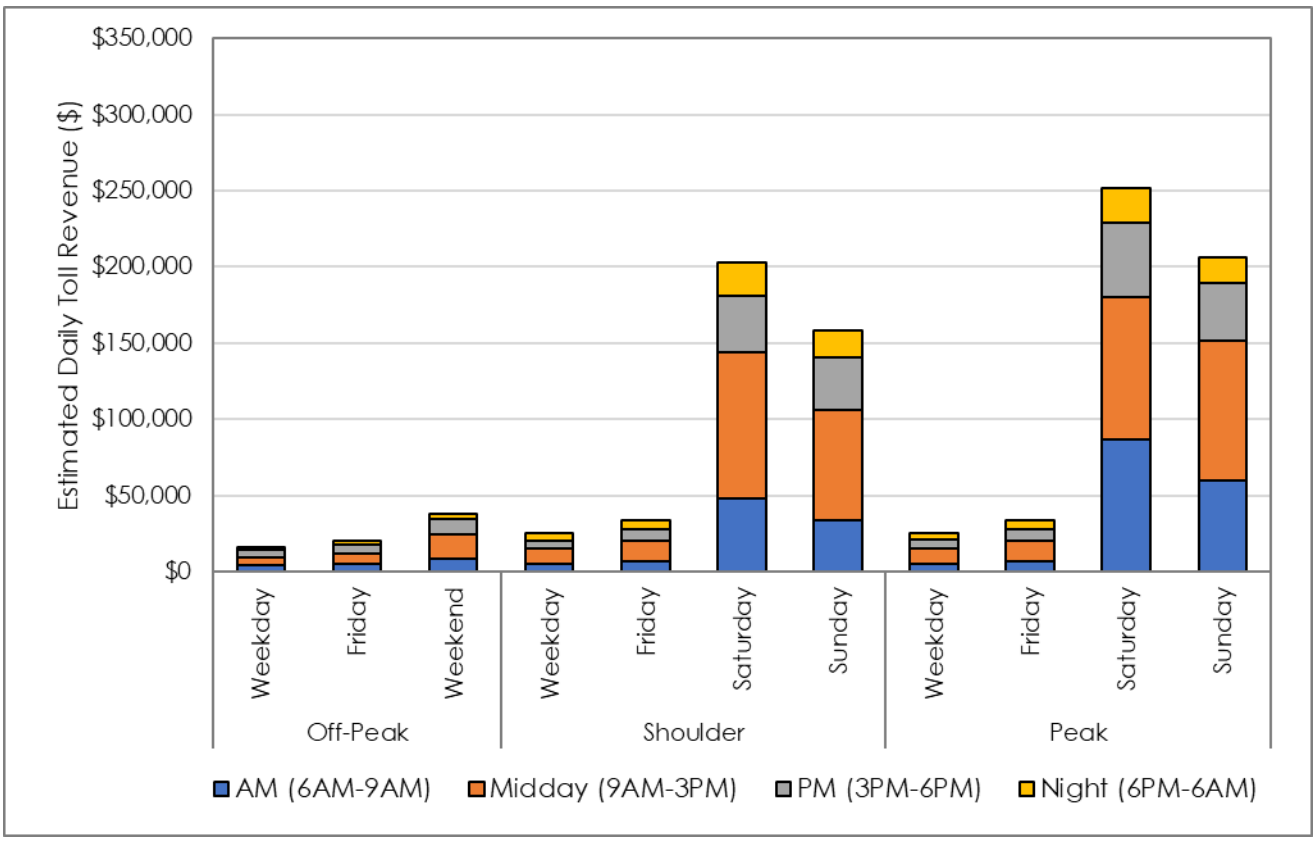
The estimated pro forma 2030 daily traffic and revenue for the High Case are shown in **Table 5.16** and **Figure 5.7**. Similar to the Base Case, daily revenues are greatest on a Saturday in the Peak season, followed by a Sunday in the Peak season. The Peak season Saturday and Sunday total daily revenues are 21 and 22 percent higher in the High Case than the Base Case, respectively. This is due to higher toll rates, plus greater economic activity which leads to additional regional travel. The Peak season weekday total daily revenue is about 53 percent higher than the average Off-Peak season weekday revenue.

Table 5.16: 2030 Pro Forma High Case Estimated Daily Gross Toll Revenue and Transactions

High Case			2030 Daily Revenue by Period (2023$)					2030 Daily Transactions by Period				
	Season	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
Eastbound	Off-Peak	Weekday	$2,486	$2,887	$3,151	$1,296	$9,820	159	183	179	83	603
		Friday	$3,088	$3,585	$3,862	$1,609	$12,145	174	201	197	91	664
		Weekend	$2,422	$7,713	$6,760	$1,898	$18,794	124	229	201	97	651
	Shoulder	Weekday	$2,797	$5,429	$3,155	$2,141	$13,521	159	307	180	121	767
		Friday	$3,741	$7,259	$4,219	$2,862	$18,081	191	368	216	146	920
		Saturday	$5,915	$63,314	$32,101	$12,280	$113,610	275	1,777	901	567	3,521
		Sunday	$7,567	$44,996	$28,183	$9,447	$90,193	353	1,263	791	437	2,844
	Peak	Weekday	$2,733	$5,742	$3,266	$1,993	$13,734	155	323	186	113	777
		Friday	$3,656	$7,679	$4,367	$2,664	$18,366	186	388	223	135	932
		Saturday	$12,439	$55,468	$42,985	$13,558	$124,450	579	1,556	1,207	627	3,968
		Sunday	$9,207	$57,869	$33,558	$11,208	$111,842	429	1,623	942	518	3,513
Westbound	Off-Peak	Weekday	$1,805	$2,088	$1,928	$763	$6,584	102	131	122	49	404
		Friday	$2,213	$2,593	$2,395	$948	$8,148	113	144	135	54	445
		Weekend	$6,219	$8,328	$3,179	$1,579	$19,304	185	325	180	90	780
	Shoulder	Weekday	$2,369	$4,265	$2,642	$2,130	$11,405	135	240	169	136	680
		Friday	$3,167	$5,703	$3,580	$2,886	$15,335	161	288	202	164	816
		Saturday	$42,285	$32,195	$5,357	$9,505	$89,343	1,188	904	304	542	2,938
		Sunday	$26,405	$27,012	$6,705	$7,800	$67,923	742	759	381	444	2,326
	Peak	Weekday	$2,414	$4,145	$2,705	$2,176	$11,440	137	233	172	139	680
		Friday	$3,228	$5,542	$3,665	$2,949	$15,384	164	279	206	167	816
		Saturday	$74,635	$37,879	$5,343	$9,806	$127,663	2,096	1,064	305	561	4,025
		Sunday	$50,675	$33,759	$4,472	$5,516	$94,422	1,423	948	254	315	2,940
Both Directions	Off-Peak	Weekday	$4,291	$4,974	$5,079	$2,060	$16,404	261	313	302	131	1,007
		Friday	$5,301	$6,178	$6,257	$2,558	$20,294	287	345	332	145	1,108
		Weekend	$8,641	$16,042	$9,938	$3,477	$38,098	309	554	381	186	1,430
	Shoulder	Weekday	$5,165	$9,693	$5,797	$4,270	$24,926	293	547	348	258	1,447
		Friday	$6,909	$12,962	$7,798	$5,748	$33,417	352	657	418	309	1,736
		Saturday	$48,201	$95,509	$37,458	$21,785	$202,953	1,463	2,681	1,206	1,109	6,459
		Sunday	$33,972	$72,008	$34,887	$17,248	$158,116	1,095	2,021	1,172	882	5,170
	Peak	Weekday	$5,147	$9,887	$5,971	$4,169	$25,174	292	556	358	252	1,457
		Friday	$6,884	$13,221	$8,032	$5,613	$33,750	350	667	429	302	1,749
		Saturday	$87,074	$93,347	$48,328	$23,364	$252,112	2,675	2,619	1,511	1,187	7,993
		Sunday	$59,882	$91,628	$38,030	$16,723	$206,263	1,852	2,571	1,196	833	6,453

Note: 2030 results are pro forma as the MCB is not expected to open to traffic until Q1 2032.

Figure 5.7: 2030 Pro Forma High Case Estimated Daily Gross Toll Revenues



Note: 2030 results are pro forma as the MCB is not expected to open to traffic until Q1 2032.

5.5.2 2040 Toll Traffic and Gross Toll Revenues

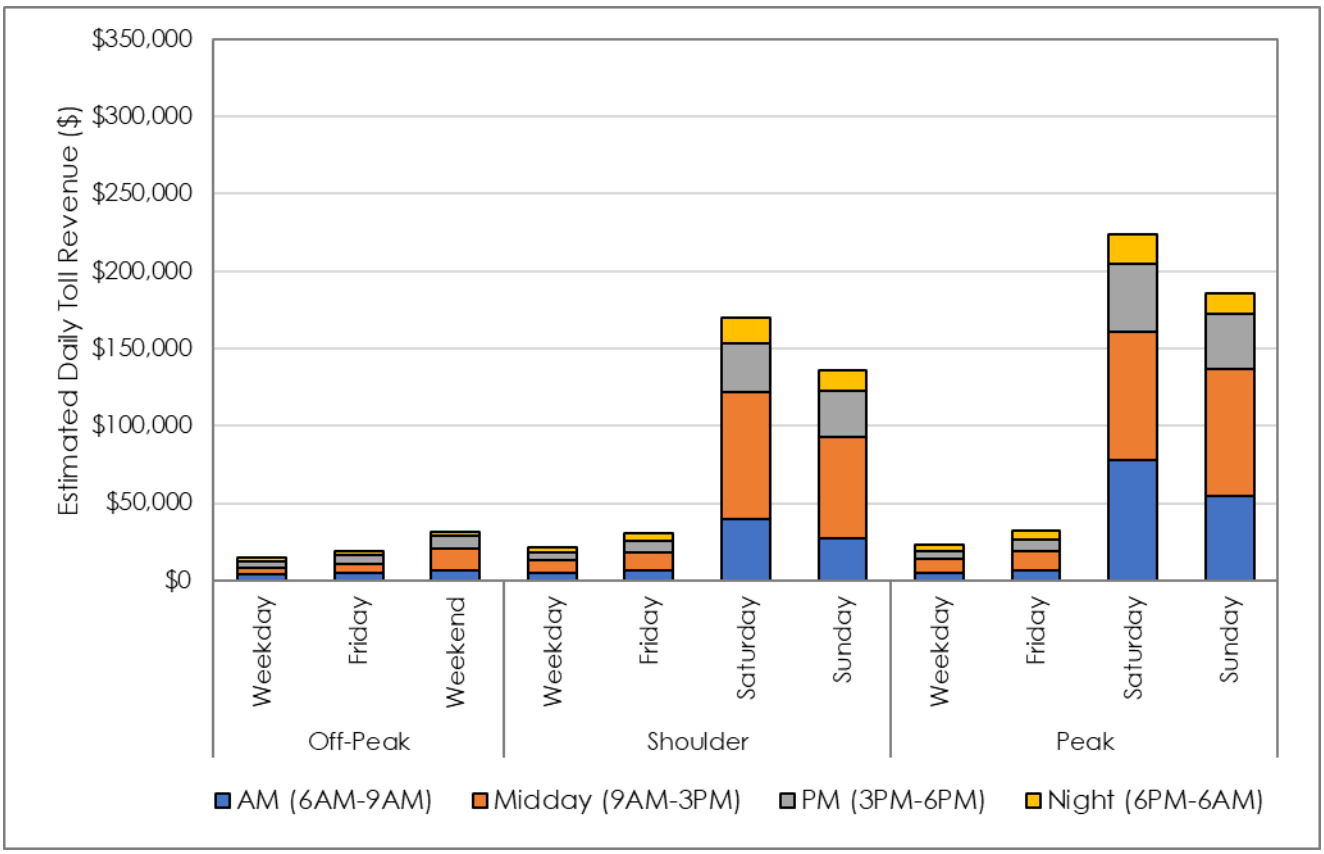
5.5.2.1 2040 Base Case

The estimated Base Case 2040 estimated daily traffic and revenue are shown in **Table 5.17** and **Figure 5.8**. Daily revenues continue to be the greatest on a Saturday in the Peak season. In 2040, Peak season Saturday daily revenue is about seven times the average daily Off-Peak season weekend revenue and about 32 percent more than an average Shoulder season Saturday. Depending on the day type, daily revenues increase an average of 0.5 to 1.2 percent per year between pro forma 2030 and 2040. Daily traffic increases between 0.4 and 0.9 percent per year on average from pro forma 2030 to 2040. Daily revenue increases at a rate higher than traffic because the tolls during certain periods are increased as congestion increases.

Table 5.17: 2040 Base Case Estimated Daily Gross Toll Revenue and Transactions

Base Case			2040 Daily Revenue by Period (2023$)					2040 Daily Transactions by Period				
	Season	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
Eastbound	Off-Peak	Weekday	$2,115	$2,535	$2,752	$1,118	$8,519	212	251	234	113	811
		Friday	$2,790	$3,341	$3,548	$1,473	$11,152	233	276	258	124	892
		Weekend	$2,110	$6,406	$5,334	$1,576	$15,425	154	407	340	134	1,035
	Shoulder	Weekday	$2,391	$4,755	$2,712	$1,721	$11,579	202	400	231	173	1,005
		Friday	$3,367	$6,692	$3,816	$2,473	$16,348	242	480	277	207	1,207
		Saturday	$5,121	$52,926	$26,332	$8,531	$92,910	327	2,442	1,214	728	4,711
		Sunday	$6,241	$40,738	$23,433	$7,099	$77,512	458	2,073	1,192	607	4,331
	Peak	Weekday	$2,514	$5,418	$3,019	$1,773	$12,723	183	389	220	149	940
		Friday	$3,464	$7,461	$4,156	$2,494	$17,575	219	467	264	178	1,129
		Saturday	$11,715	$49,664	$39,168	$10,750	$111,297	667	2,098	1,526	783	5,073
		Sunday	$7,620	$52,354	$30,805	$9,128	$99,906	559	2,212	1,200	666	4,637
Westbound	eason	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
	Off-Peak	Weekday	$1,553	$1,952	$1,712	$676	$5,894	156	189	170	68	583
		Friday	$2,047	$2,574	$2,257	$891	$7,769	172	208	187	75	641
		Weekend	$4,646	$7,310	$2,917	$1,391	$16,264	295	464	213	119	1,091
	Shoulder	Weekday	$2,064	$3,825	$2,396	$1,714	$9,998	175	319	203	173	870
		Friday	$2,903	$5,382	$3,373	$2,464	$14,123	209	383	244	208	1,044
		Saturday	$34,764	$29,202	$4,909	$7,720	$76,595	1,603	1,348	359	663	3,973
		Sunday	$21,351	$24,807	$6,114	$6,337	$58,610	1,084	1,261	448	544	3,337
	Peak	Weekday	$2,069	$3,733	$2,478	$1,945	$10,225	173	308	208	165	855
		Friday	$2,911	$5,253	$3,489	$2,738	$14,391	208	370	250	198	1,025
		Saturday	$66,123	$32,872	$5,074	$8,265	$112,334	2,573	1,516	372	712	5,173
		Sunday	$46,745	$30,260	$4,265	$4,740	$86,011	1,820	1,396	311	407	3,934
Both Directions	Season	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
	Off-Peak	Weekday	$3,669	$4,487	$4,464	$1,794	$14,413	368	440	404	181	1,394
		Friday	$4,837	$5,915	$5,805	$2,364	$18,921	405	484	445	199	1,533
		Weekend	$6,756	$13,716	$8,250	$2,967	$31,690	449	871	553	252	2,125
	Shoulder	Weekday	$4,454	$8,579	$5,108	$3,435	$21,577	376	718	434	346	1,875
		Friday	$6,270	$12,074	$7,188	$4,938	$30,471	452	862	521	415	2,250
		Saturday	$39,885	$82,129	$31,241	$16,251	$169,506	1,930	3,790	1,573	1,391	8,684
		Sunday	$27,592	$65,546	$29,547	$13,437	$136,121	1,543	3,335	1,640	1,150	7,668
	Peak	Weekday	$4,583	$9,151	$5,497	$3,718	$22,948	356	697	428	314	1,795
		Friday	$6,374	$12,714	$7,644	$5,233	$31,965	427	837	514	376	2,154
		Saturday	$77,839	$82,536	$44,242	$19,015	$223,631	3,240	3,614	1,897	1,495	10,246
		Sunday	$54,365	$82,614	$35,070	$13,868	$185,917	2,379	3,608	1,511	1,072	8,570

Figure 5.8: 2040 Base Case Estimated Daily Gross Toll Revenues



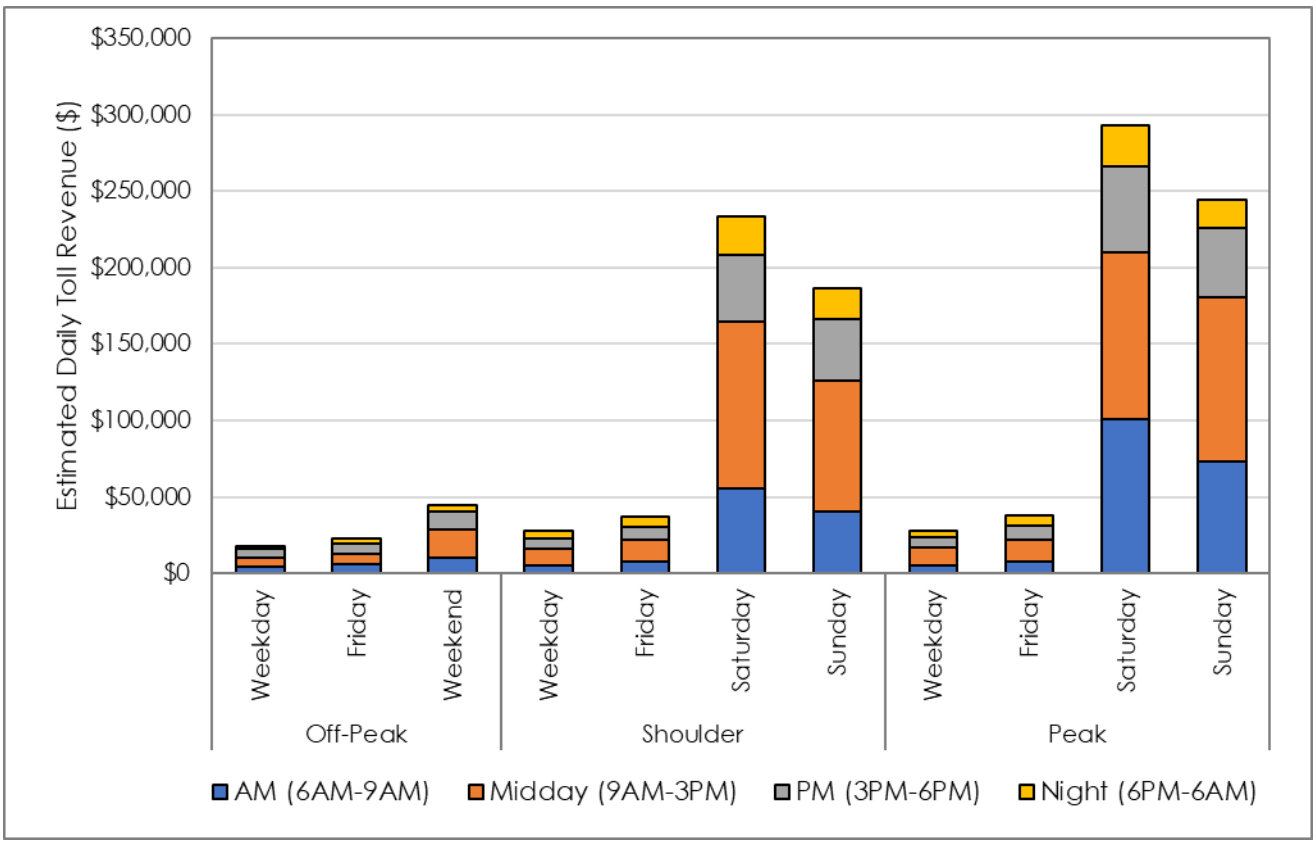
5.5.2.2 2040 High Case

The estimated 2040 daily traffic and revenue for the High Case are shown in **Table 5.18** and **Figure 5.9**. Daily revenues continue to be the greatest on a Saturday in the Peak season. In 2040, Peak season Saturday daily revenue is greater than six times the average daily Off-Peak season weekend revenue and 25 percent more than an average Shoulder season Saturday. Daily revenues increase at a greater rate from pro forma 2030 to 2040 in the High Case than the Base Case, between 0.9 and 1.7 percent per year on average depending on the period. Daily traffic increases between 0.3 to 1.6 percent per year on average from pro forma 2030 to 2040.

Table 5.18: 2040 High Case Estimated Daily Toll Revenue and Transactions

High Case			2040 Daily Revenue by Period (2023$)					2040 Daily Transactions by Period				
	Season	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
Eastbound	Off-Peak	Weekday	$2,648	$3,211	$3,388	$1,486	$10,732	150	202	192	94	638
		Friday	$3,246	$3,988	$4,152	$1,844	$13,230	165	222	212	104	702
		Weekend	$2,730	$9,258	$7,650	$2,330	$21,968	127	260	215	108	709
	Shoulder	Weekday	$2,989	$6,019	$3,399	$2,416	$14,822	169	305	193	136	803
		Friday	$3,997	$7,965	$4,544	$3,230	$19,736	203	366	232	164	964
		Saturday	$6,820	$71,875	$36,656	$14,149	$129,500	290	2,016	1,029	598	3,932
		Sunday	$8,513	$53,111	$32,244	$10,900	$104,767	396	1,490	905	504	3,294
	Peak	Weekday	$2,955	$6,554	$3,506	$2,259	$15,275	167	331	199	127	823
		Friday	$3,953	$8,672	$4,688	$3,020	$20,333	201	397	238	152	988
		Saturday	$13,863	$65,818	$50,009	$15,514	$145,204	590	1,845	1,403	655	4,494
		Sunday	$10,350	$68,193	$40,051	$12,673	$131,268	481	1,912	1,124	585	4,102
Westbound	Season	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
	Off-Peak	Weekday	$1,977	$2,396	$2,109	$933	$7,415	112	148	133	59	453
		Friday	$2,423	$2,976	$2,619	$1,159	$9,177	123	163	146	65	498
		Weekend	$7,116	$9,674	$3,664	$2,093	$22,547	200	288	187	107	781
	Shoulder	Weekday	$2,549	$4,728	$2,899	$2,458	$12,634	144	264	164	140	712
		Friday	$3,408	$6,321	$3,877	$3,288	$16,893	173	317	197	167	855
		Saturday	$48,524	$37,797	$6,514	$11,327	$104,162	1,362	1,061	332	579	3,334
		Sunday	$31,956	$32,599	$7,929	$9,438	$81,922	897	915	404	482	2,699
	Peak	Weekday	$2,578	$4,713	$3,017	$2,586	$12,894	131	237	170	147	685
		Friday	$3,412	$6,236	$4,035	$3,458	$17,141	157	284	204	176	822
		Saturday	$87,326	$42,904	$6,045	$11,619	$147,893	2,451	1,204	309	595	4,559
		Sunday	$62,786	$39,084	$5,118	$6,489	$113,477	1,762	1,096	261	333	3,452
Both Directions	Season	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
	Off-Peak	Weekday	$4,624	$5,607	$5,496	$2,419	$18,146	261	350	325	154	1,091
		Friday	$5,669	$6,963	$6,771	$3,003	$22,407	288	385	358	169	1,200
		Weekend	$9,845	$18,932	$11,314	$4,423	$44,515	326	547	401	214	1,490
	Shoulder	Weekday	$5,538	$10,747	$6,297	$4,874	$27,456	313	570	357	276	1,516
		Friday	$7,405	$14,286	$8,420	$6,518	$36,629	376	683	428	331	1,819
		Saturday	$55,344	$109,672	$43,170	$25,476	$233,662	1,652	3,076	1,361	1,177	7,266
		Sunday	$40,469	$85,711	$40,173	$20,337	$186,689	1,293	2,404	1,309	986	5,993
	Peak	Weekday	$5,533	$11,267	$6,523	$4,845	$28,168	298	567	369	274	1,508
		Friday	$7,365	$14,908	$8,722	$6,479	$37,474	358	681	442	328	1,809
		Saturday	$101,188	$108,721	$56,055	$27,133	$293,097	3,041	3,049	1,712	1,251	9,053
		Sunday	$73,136	$107,277	$45,170	$19,162	$244,745	2,243	3,009	1,385	918	7,554

Figure 5.9: 2040 High Case Estimated Daily Toll Revenues



5.5.3 2050 Toll Traffic and Gross Toll Revenues

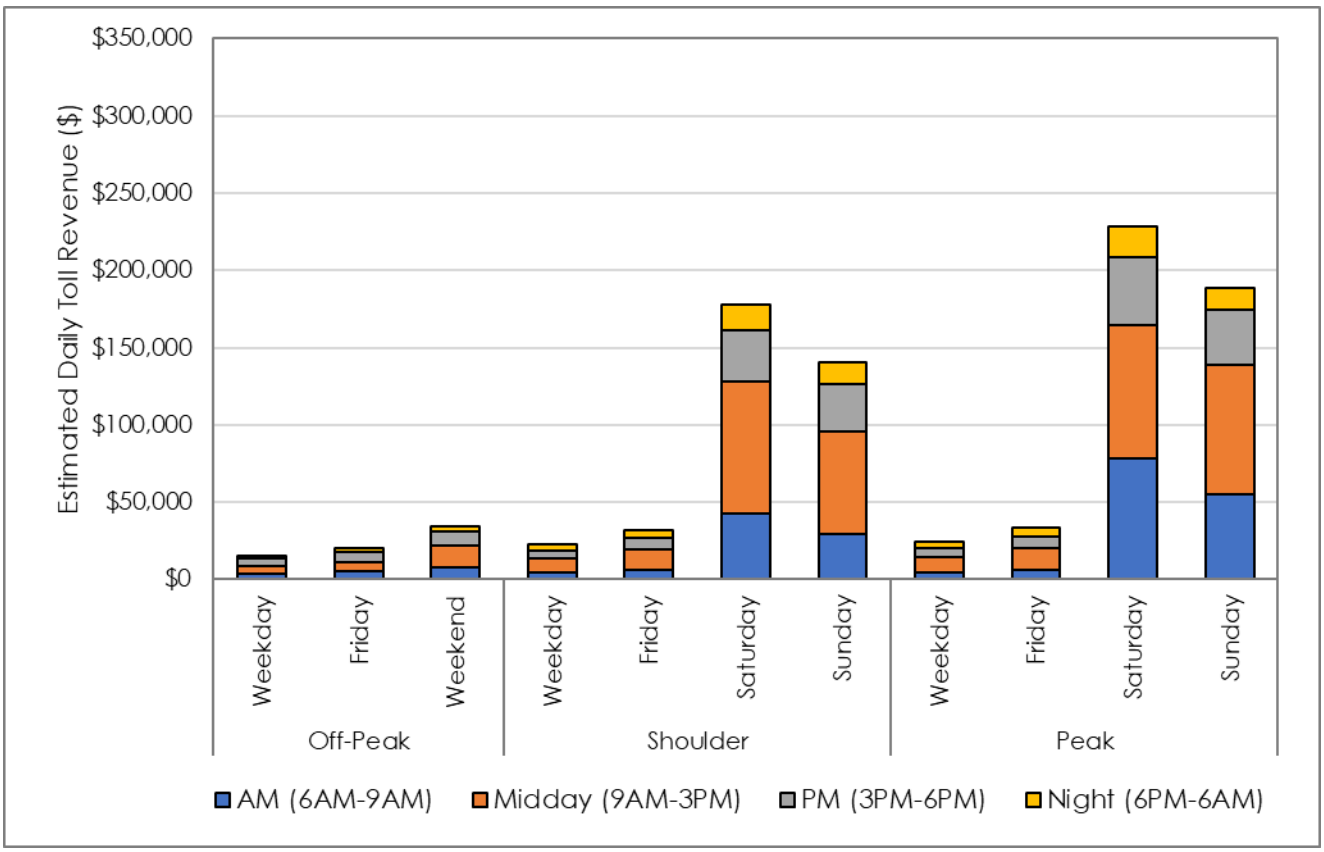
5.5.3.1 2050 Base Case

The estimated Base Case 2050 daily traffic and revenue are shown in **Table 5.19** and **Figure 5.10**. Daily revenues continue to be the greatest on a Saturday in the Peak season. Peak season Saturday daily revenue is almost seven times the average daily Off-Peak season weekend revenue and about 29 percent more than an average Shoulder season Saturday. Depending on the day type, daily revenues increase an average of 0.2 to 0.7 percent per year between 2040 and 2050. Daily traffic changes by an average of -0.1 to 0.5 percent per year between 2040 and 2050; negative growth in Shoulder Saturdays is due to the increase in toll rate.

Table 5.19: 2050 Base Case Estimated Daily Toll Revenue and Transactions

Base Case			2050 Daily Revenue by Period (2023$)					2050 Daily Transactions by Period				
	Season	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
Eastbound	Off-Peak	Weekday	$2,148	$2,683	$2,853	$1,233	$8,917	215	265	243	124	847
		Friday	$2,834	$3,537	$3,679	$1,624	$11,674	237	291	267	137	932
		Weekend	$2,153	$7,037	$5,810	$1,690	$16,690	157	397	329	143	1,026
	Shoulder	Weekday	$2,431	$4,957	$2,813	$1,830	$12,031	205	415	240	184	1,043
		Friday	$3,424	$6,977	$3,958	$2,629	$16,988	246	498	287	220	1,252
		Saturday	$5,200	$56,179	$27,969	$8,675	$98,023	332	2,374	1,181	740	4,627
		Sunday	$6,326	$41,193	$24,823	$7,256	$79,599	464	2,096	1,147	620	4,327
	Peak	Weekday	$2,561	$5,670	$3,114	$1,886	$13,232	186	406	227	158	977
		Friday	$3,529	$7,808	$4,288	$2,654	$18,279	223	487	272	190	1,172
		Saturday	$11,882	$52,561	$39,372	$10,807	$114,622	676	2,048	1,533	786	5,044
		Sunday	$7,752	$53,489	$31,112	$9,353	$101,706	568	2,260	1,212	682	4,722
Westbound	eason	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
	Off-Peak	Weekday	$1,641	$2,122	$1,783	$756	$6,301	165	205	177	76	622
		Friday	$2,162	$2,797	$2,350	$997	$8,307	181	225	195	84	685
		Weekend	$5,423	$7,507	$3,005	$1,503	$17,440	275	476	219	128	1,099
	Shoulder	Weekday	$2,153	$4,009	$2,478	$1,805	$10,444	182	333	210	182	907
		Friday	$3,028	$5,642	$3,488	$2,595	$14,754	218	400	252	219	1,088
		Saturday	$37,055	$29,534	$5,051	$7,904	$79,544	1,564	1,363	369	679	3,975
		Sunday	$22,969	$25,170	$6,241	$6,514	$60,894	1,059	1,279	457	559	3,354
	Peak	Weekday	$2,140	$3,989	$2,581	$2,051	$10,761	179	328	216	174	897
		Friday	$3,011	$5,614	$3,634	$2,887	$15,146	215	393	260	209	1,077
		Saturday	$66,625	$33,254	$5,232	$8,630	$113,741	2,593	1,533	383	742	5,251
		Sunday	$47,249	$30,706	$4,417	$4,937	$87,309	1,839	1,416	322	424	4,001
Both Directions	Season	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
	Off-Peak	Weekday	$3,789	$4,805	$4,636	$1,988	$15,218	380	469	420	201	1,470
		Friday	$4,996	$6,334	$6,029	$2,620	$19,980	418	516	462	221	1,617
		Weekend	$7,576	$14,545	$8,816	$3,193	$34,130	432	873	548	272	2,125
	Shoulder	Weekday	$4,583	$8,966	$5,291	$3,635	$22,475	387	748	449	366	1,950
		Friday	$6,452	$12,619	$7,446	$5,224	$31,742	464	898	539	439	2,340
		Saturday	$42,255	$85,713	$33,020	$16,579	$177,567	1,896	3,736	1,551	1,419	8,602
		Sunday	$29,296	$66,363	$31,064	$13,770	$140,493	1,524	3,376	1,604	1,178	7,681
	Peak	Weekday	$4,701	$9,659	$5,696	$3,936	$23,993	365	734	443	333	1,875
		Friday	$6,540	$13,422	$7,921	$5,541	$33,425	438	881	532	399	2,249
		Saturday	$78,507	$85,815	$44,605	$19,437	$228,363	3,269	3,581	1,917	1,528	10,295
		Sunday	$55,001	$84,195	$35,529	$14,290	$189,016	2,408	3,676	1,534	1,106	8,724

Figure 5.10: 2050 Base Case Estimated Daily Toll Revenues



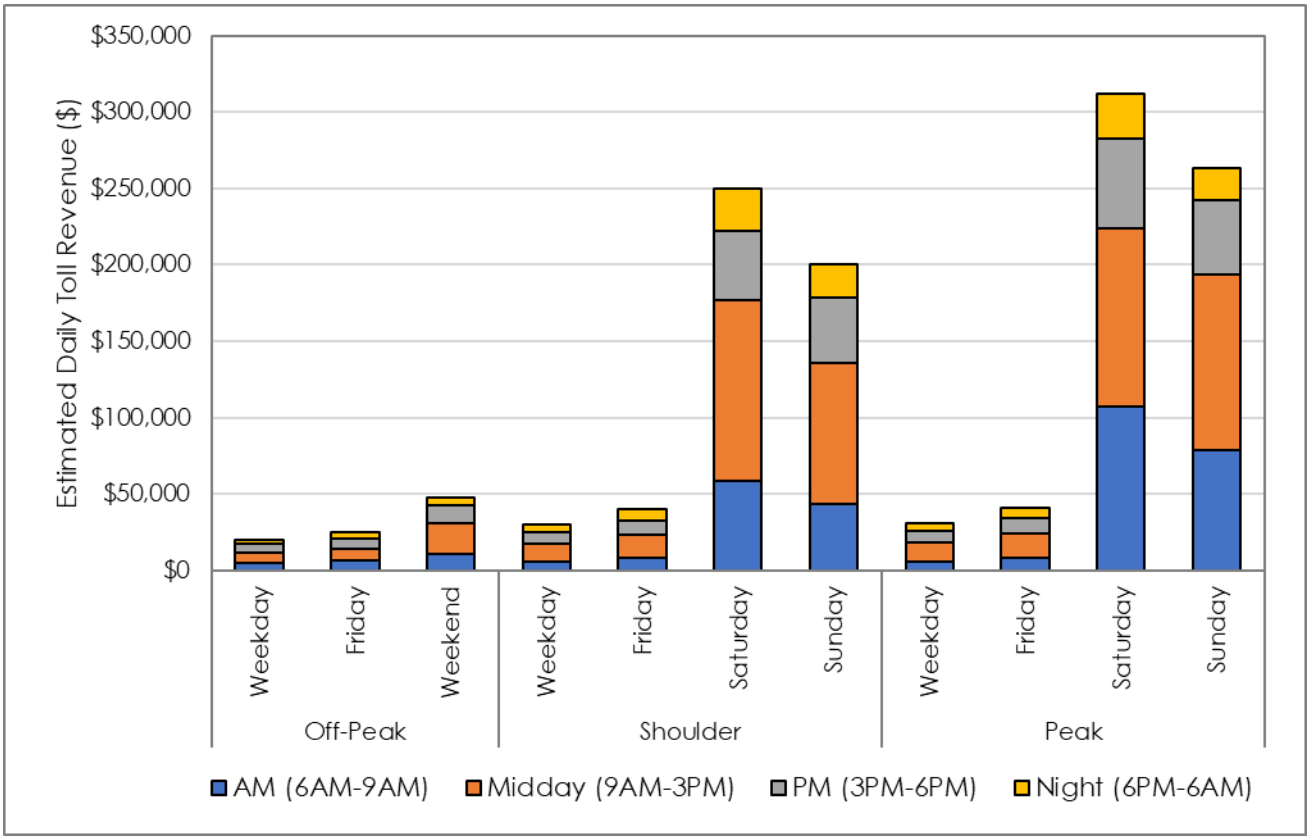
5.5.3.2 2050 High Case

The estimated 2050 daily traffic and revenue for the High Case are shown in **Table 5.20** and **Figure 5.11**. Daily revenues continue to be the greatest on a Saturday in the Peak season. Peak season Saturday daily revenue is about 6.5 times the average daily Off-Peak season weekend revenue and about 25 percent more than an average Shoulder season Saturday. Again, daily revenues increase more quickly in the High Case than the Base Case from 2040 to 2050, averaging growth of 0.6 to 0.9 percent per year. Daily traffic also increases more rapidly, with an average growth of 0.2 to 0.7 percent per year between 2040 and 2050.

Table 5.20: 2050 High Case Estimated Daily Toll Revenue and Transactions

High Case			2050 Daily Revenue by Period (2023$)					2050 Daily Transactions by Period				
	Season	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
Eastbound	Off-Peak	Weekday	$2,808	$3,525	$3,616	$1,719	$11,668	158	196	205	97	656
		Friday	$3,443	$4,321	$4,431	$2,106	$14,302	174	216	225	107	721
		Weekend	$2,912	$9,972	$8,145	$2,572	$23,601	135	280	229	119	762
	Shoulder	Weekday	$3,163	$6,593	$3,652	$2,694	$16,102	161	332	186	137	815
		Friday	$4,186	$8,722	$4,833	$3,564	$21,305	193	398	224	164	979
		Saturday	$7,260	$77,313	$38,570	$14,937	$138,080	308	2,167	1,082	631	4,188
		Sunday	$9,085	$57,017	$34,426	$11,843	$112,371	387	1,599	965	501	3,452
	Peak	Weekday	$3,142	$7,252	$3,792	$2,539	$16,726	160	363	193	128	843
		Friday	$4,159	$9,594	$5,018	$3,360	$22,131	191	435	232	154	1,012
		Saturday	$14,699	$70,878	$52,540	$16,496	$154,613	625	1,987	1,474	696	4,782
		Sunday	$11,098	$73,590	$42,880	$13,889	$141,457	472	2,063	1,202	587	4,324
Westbound	Season	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
	Off-Peak	Weekday	$2,166	$2,722	$2,286	$1,075	$8,250	122	167	143	68	500
		Friday	$2,655	$3,381	$2,840	$1,336	$10,210	134	183	158	75	550
		Weekend	$7,588	$10,385	$3,926	$2,352	$24,252	213	291	200	120	824
	Shoulder	Weekday	$2,750	$5,243	$3,130	$2,682	$13,805	140	263	176	152	731
		Friday	$3,639	$6,937	$4,186	$3,587	$18,348	168	315	212	182	877
		Saturday	$51,465	$40,766	$7,001	$12,331	$111,563	1,444	1,143	356	629	3,572
		Sunday	$34,319	$35,188	$8,461	$10,120	$88,086	963	987	431	516	2,897
	Peak	Weekday	$2,784	$5,297	$3,285	$2,845	$14,211	141	263	184	161	749
		Friday	$3,683	$7,008	$4,393	$3,805	$18,889	169	316	221	193	898
		Saturday	$92,513	$45,679	$6,548	$12,743	$157,482	2,595	1,281	334	650	4,860
		Sunday	$67,389	$41,861	$5,600	$7,151	$122,000	1,890	1,174	285	365	3,714
Both Directions	Season	Day Type	AM	MD	PM	NT	Total	AM	MD	PM	NT	Total
	Off-Peak	Weekday	$4,974	$6,248	$5,902	$2,794	$19,918	280	363	348	165	1,156
		Friday	$6,097	$7,702	$7,271	$3,442	$24,512	308	399	383	182	1,271
		Weekend	$10,500	$20,357	$12,072	$4,924	$47,853	348	571	428	238	1,585
	Shoulder	Weekday	$5,912	$11,836	$6,783	$5,376	$29,907	300	595	363	288	1,546
		Friday	$7,825	$15,659	$9,019	$7,151	$39,654	360	714	435	346	1,855
		Saturday	$58,725	$118,079	$45,571	$27,268	$249,643	1,752	3,310	1,438	1,260	7,760
		Sunday	$43,403	$92,205	$42,887	$21,963	$200,458	1,350	2,586	1,396	1,018	6,349
	Peak	Weekday	$5,926	$12,549	$7,077	$5,384	$30,937	300	626	377	289	1,592
		Friday	$7,843	$16,602	$9,410	$7,164	$41,020	360	751	452	346	1,910
		Saturday	$107,212	$116,556	$59,089	$29,239	$312,096	3,220	3,268	1,807	1,347	9,642
		Sunday	$78,487	$115,450	$48,479	$21,040	$263,456	2,362	3,237	1,487	952	8,039

Figure 5.11: 2050 High Case Estimated Annual Toll Revenues by Season and Day Type



5.6 ANNUAL TOLL TRAFFIC AND GROSS TOLL REVENUE FORECASTS

This section presents the assumptions and results of the annual toll traffic and gross toll revenue forecasts.

5.6.1 Annualization Factors

The AM Peak, Midday, PM Peak, and Night period revenues were summed to a daily revenue for each day type in each season. As such, daily revenues for the Off-Peak weekday, Off-Peak Friday, Off-Peak weekend, Shoulder weekday, Shoulder Friday, Shoulder Saturday, Shoulder Sunday, Peak weekday, Peak Friday, Peak Saturday, and Peak Sunday were created. To convert these daily revenues to an annual revenue, factors were applied based on the number of instances per year that each day type would occur. The additional day in a leap year has a minimal impact as it would occur during the Off-Peak season and was therefore not accounted for in the forecasts.

The annualization factors were developed by analyzing the daily traffic trends over the course of the year. Based on this analysis, eight full weeks of Peak season traffic were assumed between mid-June and mid-August (approximately June 16th to August 15th). The 12-week Shoulder season

envelops the Peak season, six full weeks occurring before the Peak season and six full weeks occurring after the Peak season. The approximate dates of the Shoulder season occur between May 1st and June 15th and between August 16th and September 30th. The Off-Peak season encompasses the rest of the year with 32 Fridays, Saturdays and Sundays, and 129 weekdays. These factors were applied to the daily revenues by day and season type and the results were summed to calculate the expected annual gross toll revenues. The annualization factors were assumed to be the same for both the Base Case and High Case. **Table 5.21** shows the factors applied to the daily revenues for each day type in each season.

Table 5.21: Annualization Factors by Season and Day Type

Annualization by Day Type			
Season	**Dates**	**Day Type**	**Number of Days**
Off-Peak	Oct 1 - Apr 30	Weekday	129
		Friday	32
		Weekend	64
Shoulder	May 1 - Jun 15, Aug 16 - Sep 30	Weekday	48
		Friday	12
		Saturday	12
		Sunday	12
Peak	Jun 16 - Aug 15	Weekday	32
		Friday	8
		Saturday	8
		Sunday	8
Total Days			365

5.6.2 Ramp-up Assumptions

The traffic models used for predicting traffic on new roadways assume that when future land development occurs, drivers alter their trip patterns instantly and that all users completely understand the access features of the facility. Experience with the traffic growth on start-up toll facilities has proven that these events occur over several years. The time during which this occurs is known as the ramp-up period. Ramp-up typically accounts for the build-up of traffic associated with travelers finding the new route. Ramp-up also accounts for the facility not being on maps or phone apps and advance signage not being completed in the region. Ramp-up factors are typically applied to annual traffic forecasts for new facilities to account for this process.

Table 5.22 shows the ramp-up factors used for the MCB. The ramp-up factors were assumed to be the same for both the Base Case and High Case. In determining the ramp-up factors for this project, Stantec considered the access routes to the MCB, the amount of seasonal and local traffic on the facility, and the purposes of the trips on the MCB. The ramp-up period for the MCB

will be affected by the fact that MCB is positioned so that the people who will benefit the most from the project in terms of distance and time saved will pass the MCB before reaching the WMB. Southbound US 158 traffic destined for the Outer Banks and originating north of Coinjock reaches the MCB before the WMB. A similar situation occurs for southbound NC 12 traffic on the Outer Banks, north of Corolla, destined for the mainland.

Table 5.22: Annual Ramp-Up Factors

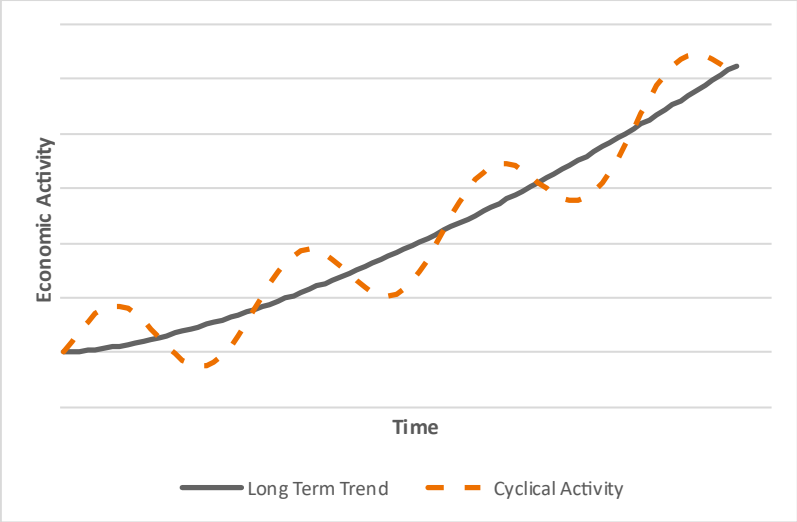
Year	Ramp Up Factors
Y1	0.75
Y2	0.85
Y3	0.95
Y4	1.00

5.6.3 Economic Cycles and Long-Range Forecasting

The year-by-year forecasts presented herein represent the middle of the future economic cycles that, based on historical experience, are likely to occur. Travel forecasts estimate the future conditions of a facility assuming a particular set of economic conditions and changes in the surrounding transportation network. For the MCB project, model estimates of traffic volumes for future years (pro forma 2030, 2040, and 2050) are available for such analyses, and these estimates provide intermediate single-year "slices" that portray the influence of additional roadway improvements anticipated for these horizon years and how demand in the region grows. The estimated toll transactions and gross toll revenues for the project are then provided year-by-year in a continuous stream.

Clearly, during times of expansion, the traffic and revenue data tend to be above the long-term growth trend, while during periods of economic contraction, the traffic and revenue data tend to be below the long-term growth trend; the amplitude of the variations depend on the strength or weakness of the economy and the duration of these conditions. Typical economic trends are shown in **Figure 5.12**.

Figure 5.12: Sample of Cyclical Economic Activity vs. Long Term Trends



5.6.4 Base Case Estimated Annual Toll Traffic and Gross Toll Revenues

As mentioned previously, it is assumed for this analysis that the MCB project will be open and tolled at the beginning of the first quarter of calendar year 2032 (January 1, 2032).

The estimated daily toll traffic and gross toll revenues for each model timeframe were annualized and used to develop the year-by-year revenue and traffic streams shown in **Table 5.23** and **Table 5.24**, respectively. The revenue and traffic streams are shown graphically in **Figure 5.13** and **Figure 5.14**, respectively. Growth was smoothed between the 2030, 2040, and 2050 model years and ramp-up factors were applied as described in Section 5.6.2.

Between 2032 (the first full calendar year of MCB operations) and 2040, traffic is expected to grow at an average rate of 0.61 percent per year while revenues are expected to grow at a higher rate of 0.81 percent per year[4]. The toll increases cause the revenue to grow higher than the traffic. Between 2040 and 2050, traffic is expected to grow at an average rate of about 0.23 percent per year while revenue grows at 0.43 percent per year.

Traffic and toll revenue growth for the period beyond 2050 was estimated using conservative growth assumptions. Annual traffic growth was slowly reduced to 0.20 percent and held constant at that rate for the last 31 years of the forecast period. 2040 annual toll revenues are estimated at $13.8 million, more than 40 percent higher than the revenues in the first full year of toll collection. 2040 annual toll traffic is estimated at 903 thousand crossings, 40 percent higher than the first full year of traffic.

[4] Excluding ramp-up.

Table 5.23: Base Case Estimated Annual Gross Toll Revenues, 2032 - 2081 ($2023 thousands)

Base Case	Estimated Annual Revenues w/Ramp Up ($000)				
Year	Passenger Car ETC	Passenger Car CASH	Commercial Vehicle ETC	Commercial Vehicle CASH	Total
2032	$8,028	$1,522	$134	$11	$9,696
2033	$9,172	$1,738	$154	$13	$11,078
2034	$10,333	$1,958	$175	$15	$12,481
2035	$10,964	$2,077	$187	$16	$13,243
2036	$11,052	$2,092	$189	$16	$13,350
2037	$11,141	$2,108	$192	$16	$13,458
2038	$11,230	$2,124	$195	$17	$13,566
2039	$11,320	$2,140	$198	$17	$13,675
2040	$11,411	$2,157	$200	$17	$13,786
2041	$11,461	$2,164	$202	$17	$13,845
2042	$11,511	$2,171	$205	$18	$13,904
2043	$11,562	$2,178	$207	$18	$13,964
2044	$11,613	$2,184	$209	$18	$14,024
2045	$11,663	$2,191	$211	$18	$14,084
2046	$11,714	$2,198	$213	$19	$14,145
2047	$11,766	$2,205	$216	$19	$14,206
2048	$11,817	$2,212	$218	$19	$14,267
2049	$11,869	$2,220	$220	$19	$14,328
2050	$11,921	$2,227	$223	$20	$14,390
2051	$11,969	$2,233	$225	$20	$14,447
2052	$12,018	$2,239	$227	$20	$14,505
2053	$12,066	$2,246	$229	$21	$14,562
2054	$12,115	$2,252	$232	$21	$14,620
2055	$12,164	$2,259	$234	$21	$14,678
2056	$12,214	$2,265	$237	$21	$14,737
2057	$12,263	$2,272	$239	$22	$14,795
2058	$12,313	$2,278	$241	$22	$14,854
2059	$12,362	$2,285	$244	$22	$14,913
2060	$12,413	$2,291	$246	$23	$14,973
2061	$12,463	$2,298	$249	$23	$15,032
2062	$12,513	$2,304	$251	$23	$15,092
2063	$12,564	$2,311	$254	$23	$15,152
2064	$12,615	$2,318	$257	$24	$15,213
2065	$12,666	$2,324	$259	$24	$15,273
2066	$12,717	$2,331	$262	$24	$15,334
2067	$12,769	$2,337	$265	$25	$15,395
2068	$12,820	$2,344	$267	$25	$15,457
2069	$12,872	$2,351	$270	$25	$15,518
2070	$12,924	$2,358	$273	$26	$15,580
2071	$12,977	$2,364	$276	$26	$15,643
2072	$13,029	$2,371	$278	$26	$15,705
2073	$13,082	$2,378	$281	$27	$15,768
2074	$13,135	$2,385	$284	$27	$15,831
2075	$13,188	$2,392	$287	$28	$15,894
2076	$13,241	$2,398	$290	$28	$15,958
2077	$13,295	$2,405	$293	$28	$16,021
2078	$13,349	$2,412	$296	$29	$16,085
2079	$13,403	$2,419	$299	$29	$16,150
2080	$13,457	$2,426	$302	$29	$16,214
2081	$13,512	$2,433	$305	$30	$16,279

Note: First three years of forecast include ramp-up factors of 75, 85, and 95 percent, respectively.

Table 5.24: Base Case Estimated Annual Toll Transactions 2032-2081 (thousands)

Base Case	Estimated Annual Transactions w/Ramp Up (000)				
Year	Passenger Car ETC	Passenger Car CASH	Commercial Vehicle ETC	Commercial Vehicle CASH	Total
2032	562	78	5	0	645
2033	641	89	6	0	736
2034	721	100	7	0	828
2035	763	106	7	0	876
2036	768	106	7	0	882
2037	773	107	7	0	887
2038	777	107	7	0	892
2039	782	108	7	0	898
2040	787	109	7	0	903
2041	789	109	8	0	905
2042	790	109	8	0	908
2043	792	109	8	0	910
2044	794	109	8	0	912
2045	796	110	8	0	914
2046	798	110	8	0	916
2047	800	110	8	0	918
2048	802	110	8	0	920
2049	804	110	8	0	922
2050	805	110	8	1	925
2051	807	110	8	1	926
2052	809	111	8	1	928
2053	810	111	9	1	930
2054	812	111	9	1	932
2055	814	111	9	1	934
2056	815	111	9	1	936
2057	817	111	9	1	938
2058	819	111	9	1	940
2059	820	112	9	1	941
2060	822	112	9	1	943
2061	824	112	9	1	945
2062	825	112	9	1	947
2063	827	112	9	1	949
2064	829	112	10	1	951
2065	830	112	10	1	953
2066	832	112	10	1	955
2067	834	113	10	1	957
2068	835	113	10	1	959
2069	837	113	10	1	961
2070	839	113	10	1	962
2071	840	113	10	1	964
2072	842	113	10	1	966
2073	844	113	10	1	968
2074	846	113	11	1	970
2075	847	114	11	1	972
2076	849	114	11	1	974
2077	851	114	11	1	976
2078	852	114	11	1	978
2079	854	114	11	1	980
2080	856	114	11	1	982
2081	858	114	11	1	984

Note: First three years of forecast include ramp-up factors of 75, 85, and 95 percent, respectively.

Figure 5.13: Base Case Estimated Annual Gross Toll Revenues, 2032 - 2081 ($2023)

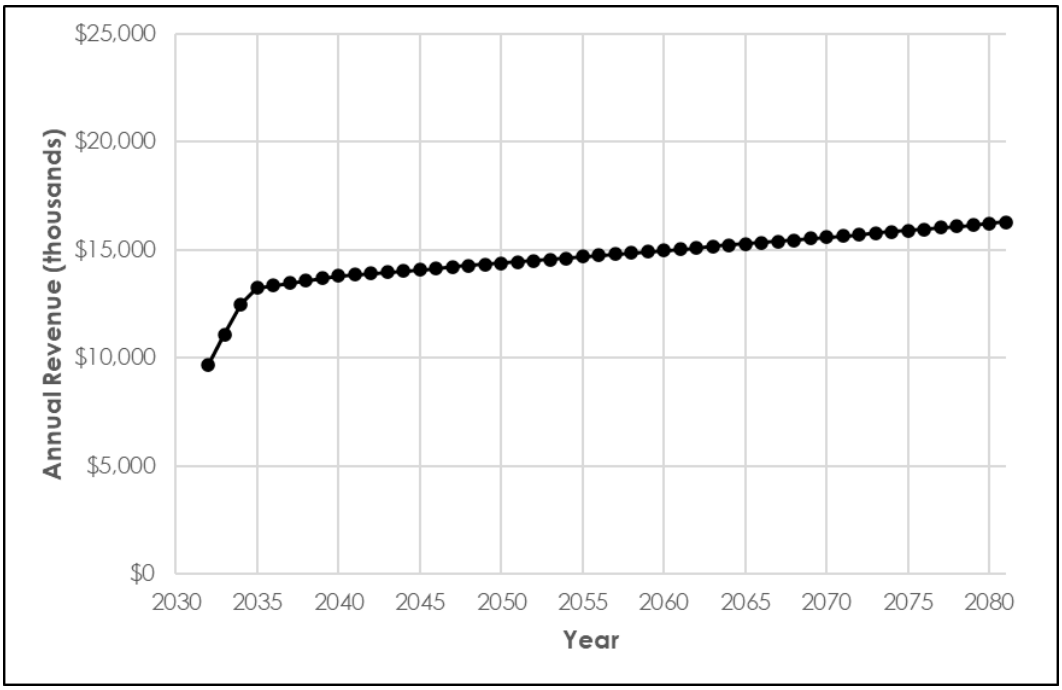


Figure 5.14: Base Case Estimated Annual Toll Transactions, 2032-2081

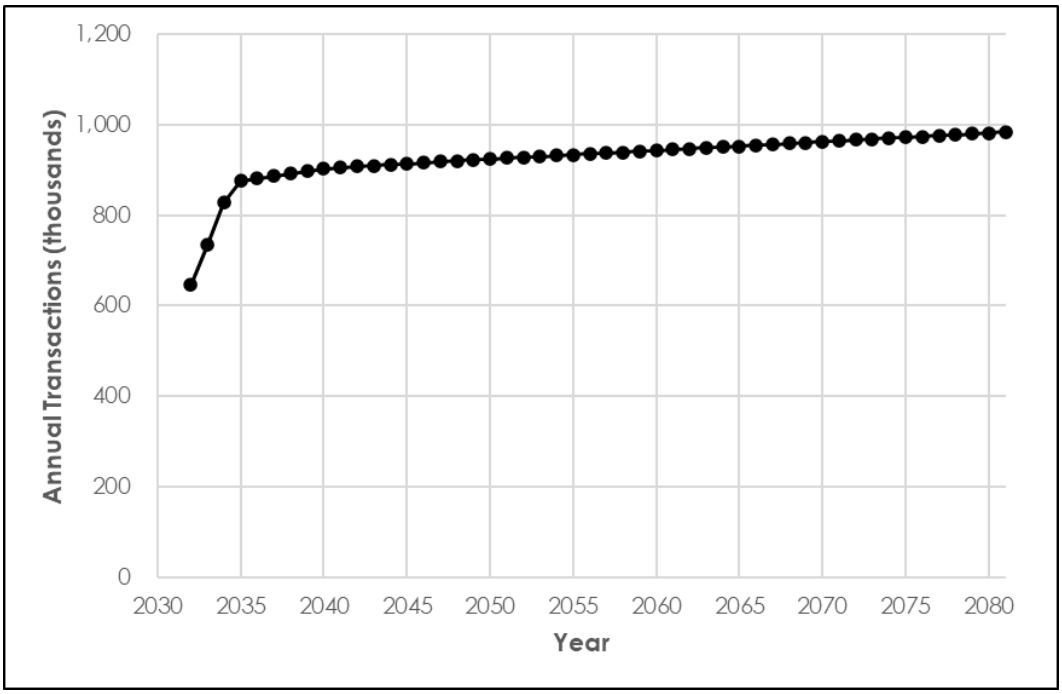
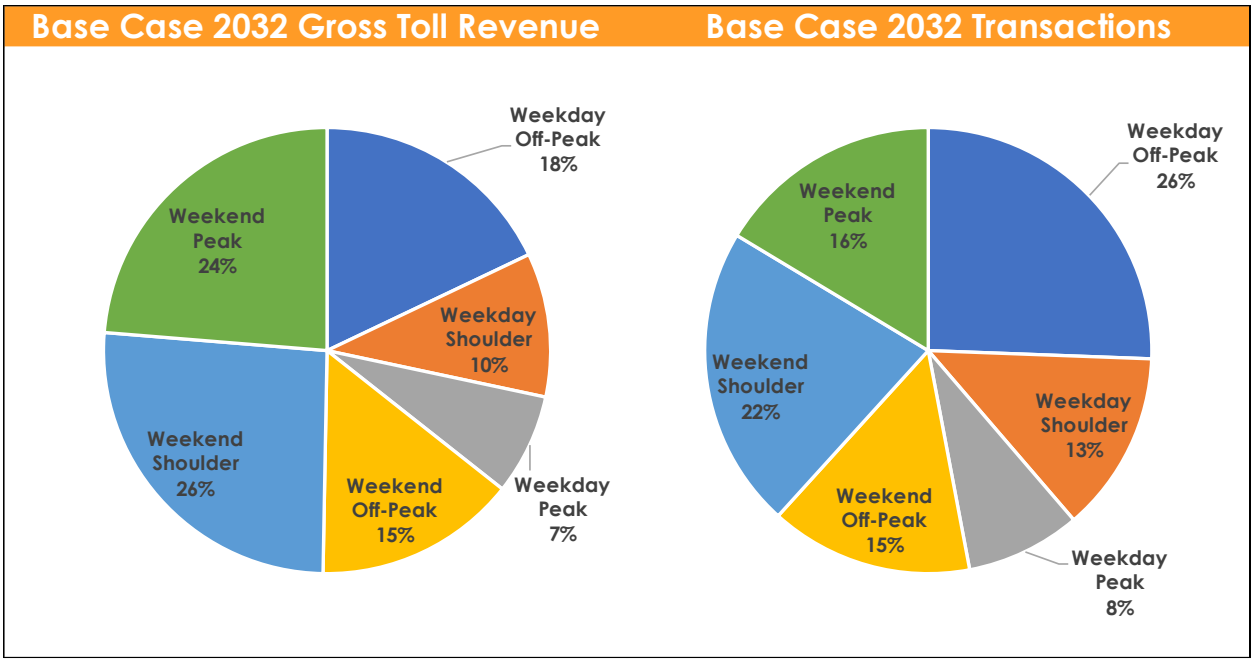


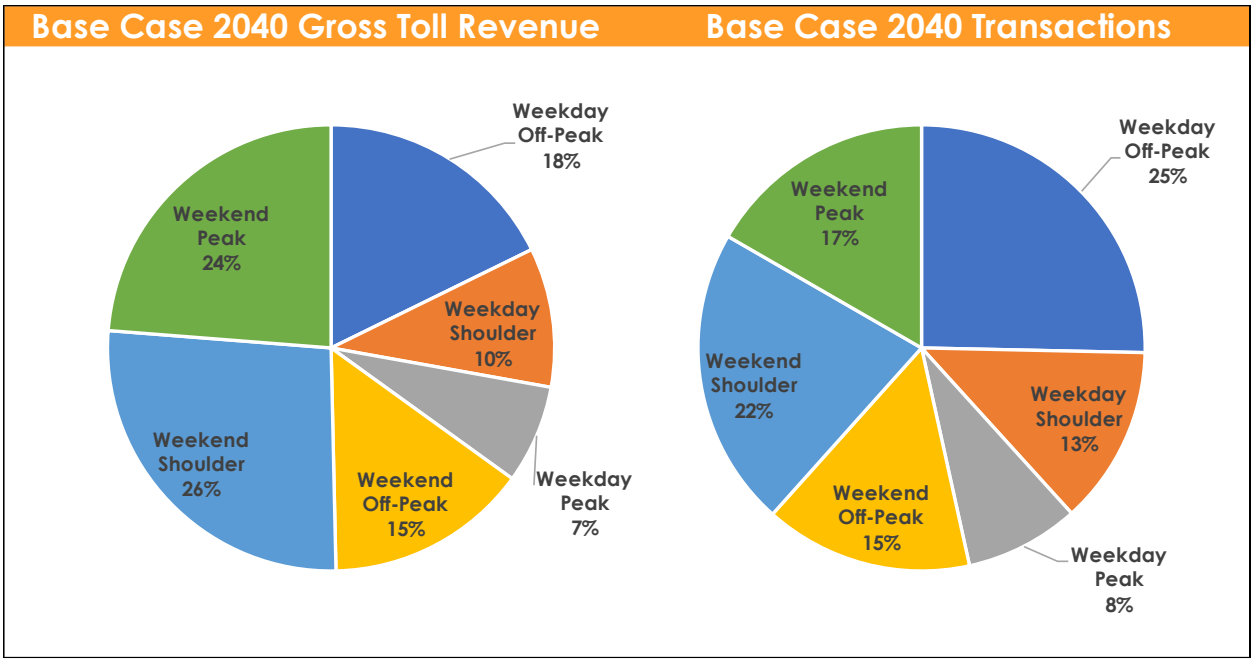
Figure 5.15 through **Figure 5.17** show the proportion each day type contributes to the total revenues and transactions for 2032, 2040, and 2050. In 2032, the first full calendar year of revenue collection, the weekday and weekend Off-Peak season represents about 33 percent of the total revenues and 41 percent of the total transactions. Tolls are lowest during the Off-Peak season, so even though this season is the longest in duration and has the most transactions, the proportion of the total annual revenue produced (33 percent) is less than the proportion of total annual transactions (41 percent). In the Peak season, tolls are highest, therefore the Peak season proportion of annual revenues is more than the proportion of transactions. The weekday and weekend Peak season represent 31 percent of total annual revenue and 24 percent of total annual transactions.

Figure 5.15: Base Case 2032 (First Full Year) Estimated Gross Toll Revenues and Toll Transactions by Season and Day Type



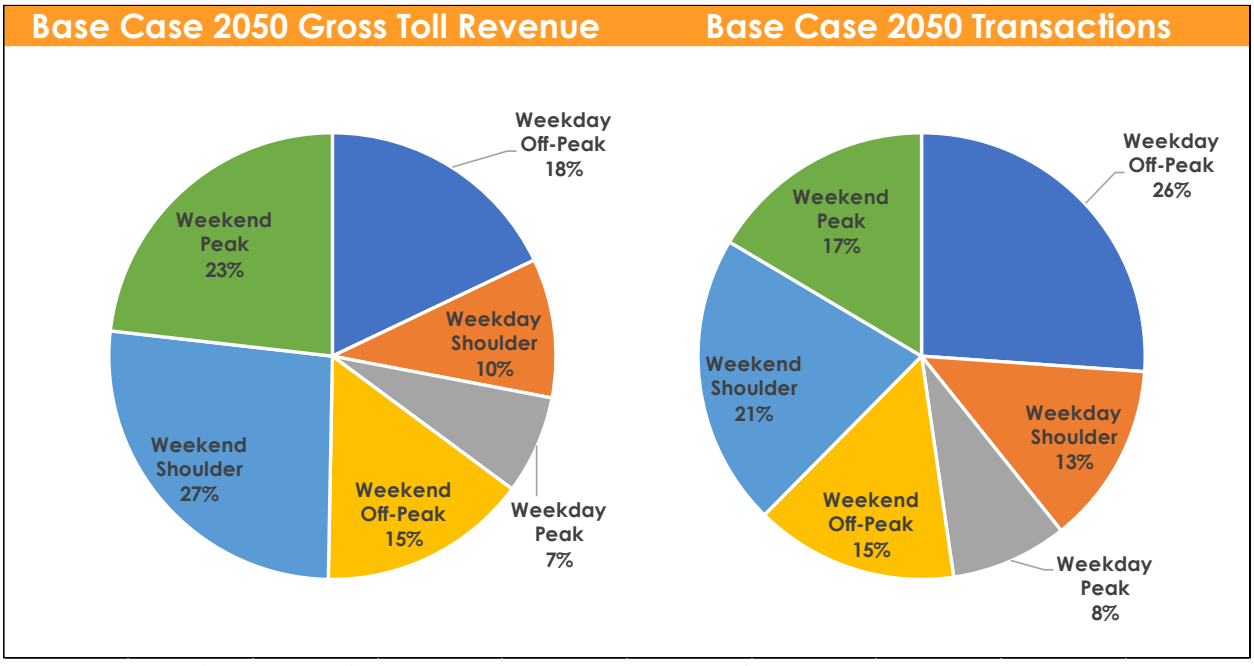
Note: Due to rounding, the sum of the percentages may not equal 100%.

Figure 5.16: Base Case 2040 Estimated Gross Toll Revenues and Toll Transactions by Season and Day Type



Note: Due to rounding, the sum of the percentages may not equal 100%.

Figure 5.17: Base Case 2050 Estimated Gross Toll Revenues and Toll Transactions by Season and Day Type



Note: Due to rounding, the sum of the percentages may not equal 100%.

Generally, the proportions of revenues and transactions remain consistent over time, with only minor changes occurring between 2032 and 2050.

5.6.5 High Case Estimated Annual Toll Traffic and Gross Toll Revenues

The annual traffic and revenue forecasts for the High Case were determined using the same methodology described in the Base Case section. The daily gross traffic and revenues for each modeled year were annualized and used to develop the revenue and traffic streams shown in **Table 5.25** and **Table 5.26**. The revenue and traffic streams are shown graphically in **Figure 5.18** and

Figure 5.19. The differences in traffic and revenue between the two cases are minimal in the years immediately following the MCB opening but grow larger over time.

Between 2032 and 2040, traffic is expected to grow at a higher rate than the Base Case, 0.88 percent per year; revenues are also expected to grow at a higher rate than the Base Case at 1.38 percent per year[5]. The toll is estimated to increase more rapidly in the High Case than the Base Case due to the increased economic activity, therefore causing the toll revenues to grow more quickly than in the Base Case. Between 2040 and 2050, traffic is expected to grow at an average rate of about 0.55 percent per year while revenue grows at 0.76 percent per year.

Like the Base Case, traffic and toll revenue growth for the period beyond 2050 was estimated using conservative growth assumptions. Annual traffic growth was slowly reduced to about 0.41 percent per year for the last 31 years of the forecast period. 2040 annual toll revenues are estimated at $18.2 million, or $4.4 million more than the Base Case forecast. 2040 annual toll traffic is estimated at 724 thousand crossings, about 180 thousand fewer trips than the Base Case forecast.

[5] Excluding ramp-up.

Table 5.25: High Case Estimated Annual Gross Toll Revenues, 2032 - 2081 ($2023 thousands)

High Case	Estimated Annual Revenues w/Ramp Up ($000)				
Year	Passenger Car ETC	Passenger Car CASH	Commercial Vehicle ETC	Commercial Vehicle CASH	Total
2032	$10,532	$1,618	$69	$6	$12,224
2033	$12,096	$1,863	$80	$7	$14,045
2034	$13,700	$2,114	$92	$8	$15,914
2035	$14,614	$2,260	$100	$8	$16,983
2036	$14,810	$2,295	$103	$9	$17,217
2037	$15,009	$2,331	$107	$9	$17,455
2038	$15,210	$2,367	$110	$9	$17,696
2039	$15,414	$2,404	$113	$10	$17,940
2040	$15,620	$2,441	$117	$10	$18,188
2041	$15,732	$2,463	$120	$10	$18,326
2042	$15,845	$2,484	$124	$10	$18,465
2043	$15,959	$2,506	$128	$11	$18,605
2044	$16,074	$2,528	$132	$11	$18,746
2045	$16,189	$2,551	$137	$12	$18,888
2046	$16,306	$2,573	$141	$12	$19,032
2047	$16,423	$2,596	$146	$12	$19,176
2048	$16,541	$2,618	$150	$13	$19,322
2049	$16,660	$2,641	$155	$13	$19,469
2050	$16,780	$2,665	$160	$14	$19,618
2051	$16,875	$2,684	$165	$14	$19,737
2052	$16,970	$2,703	$170	$14	$19,858
2053	$17,066	$2,723	$175	$15	$19,979
2054	$17,163	$2,743	$180	$15	$20,102
2055	$17,260	$2,763	$186	$16	$20,225
2056	$17,358	$2,783	$191	$16	$20,349
2057	$17,457	$2,803	$197	$17	$20,474
2058	$17,555	$2,824	$203	$17	$20,600
2059	$17,655	$2,844	$210	$18	$20,726
2060	$17,755	$2,865	$216	$19	$20,854
2061	$17,856	$2,886	$222	$19	$20,983
2062	$17,957	$2,907	$229	$20	$21,112
2063	$18,058	$2,928	$236	$20	$21,243
2064	$18,161	$2,949	$243	$21	$21,374
2065	$18,264	$2,970	$251	$22	$21,506
2066	$18,367	$2,992	$258	$22	$21,640
2067	$18,471	$3,014	$266	$23	$21,774
2068	$18,576	$3,036	$274	$24	$21,910
2069	$18,681	$3,058	$283	$24	$22,046
2070	$18,787	$3,080	$291	$25	$22,183
2071	$18,893	$3,102	$300	$26	$22,322
2072	$19,000	$3,125	$309	$27	$22,462
2073	$19,108	$3,148	$319	$28	$22,602
2074	$19,216	$3,170	$329	$29	$22,744
2075	$19,325	$3,193	$339	$29	$22,887
2076	$19,435	$3,217	$349	$30	$23,031
2077	$19,545	$3,240	$360	$31	$23,176
2078	$19,656	$3,264	$371	$32	$23,322
2079	$19,767	$3,287	$382	$33	$23,469
2080	$19,879	$3,311	$393	$34	$23,618
2081	$19,992	$3,335	$405	$35	$23,768

Note: First three years of forecast include ramp-up factors of 75, 85, and 95 percent, respectively.

Table 5.26: High Case Estimated Annual Toll Transactions, 2032 – 2081 (thousands)

High Case	Estimated Annual Transactions w/Ramp Up (000)				
Year	Passenger Car ETC	Passenger Car CASH	Commercial Vehicle ETC	Commercial Vehicle CASH	Total
2032	449	55	2	0	506
2033	513	63	2	0	579
2034	579	71	2	0	652
2035	614	76	2	0	693
2036	619	77	2	0	699
2037	625	78	3	0	705
2038	630	78	3	0	711
2039	635	79	3	0	717
2040	641	80	3	0	724
2041	644	81	3	0	728
2042	647	81	3	0	732
2043	651	82	3	0	736
2044	654	83	3	0	740
2045	657	83	3	0	744
2046	661	84	3	0	748
2047	664	84	3	0	752
2048	668	85	3	0	756
2049	671	85	4	0	760
2050	675	86	4	0	765
2051	677	87	4	0	768
2052	680	87	4	0	771
2053	682	87	4	0	774
2054	685	88	4	0	777
2055	687	88	4	0	780
2056	690	89	4	0	783
2057	692	89	4	0	786
2058	695	90	4	0	790
2059	698	90	5	0	793
2060	700	91	5	0	796
2061	703	91	5	0	799
2062	705	92	5	0	803
2063	708	92	5	0	806
2064	711	93	5	0	809
2065	713	93	5	0	812
2066	716	94	5	0	816
2067	718	95	6	0	819
2068	721	95	6	0	822
2069	724	96	6	0	826
2070	726	96	6	0	829
2071	729	97	6	0	832
2072	732	97	6	0	836
2073	734	98	7	0	839
2074	737	98	7	0	843
2075	740	99	7	0	846
2076	743	99	7	0	850
2077	745	100	7	1	853
2078	748	100	8	1	857
2079	751	101	8	1	860
2080	754	102	8	1	864
2081	756	102	8	1	867

Note: First three years of forecast include ramp-up factors of 75, 85, and 95 percent, respectively.

Figure 5.18: High Case Estimated Annual Gross Toll Revenues, 2032 – 2081 ($2023 millions)

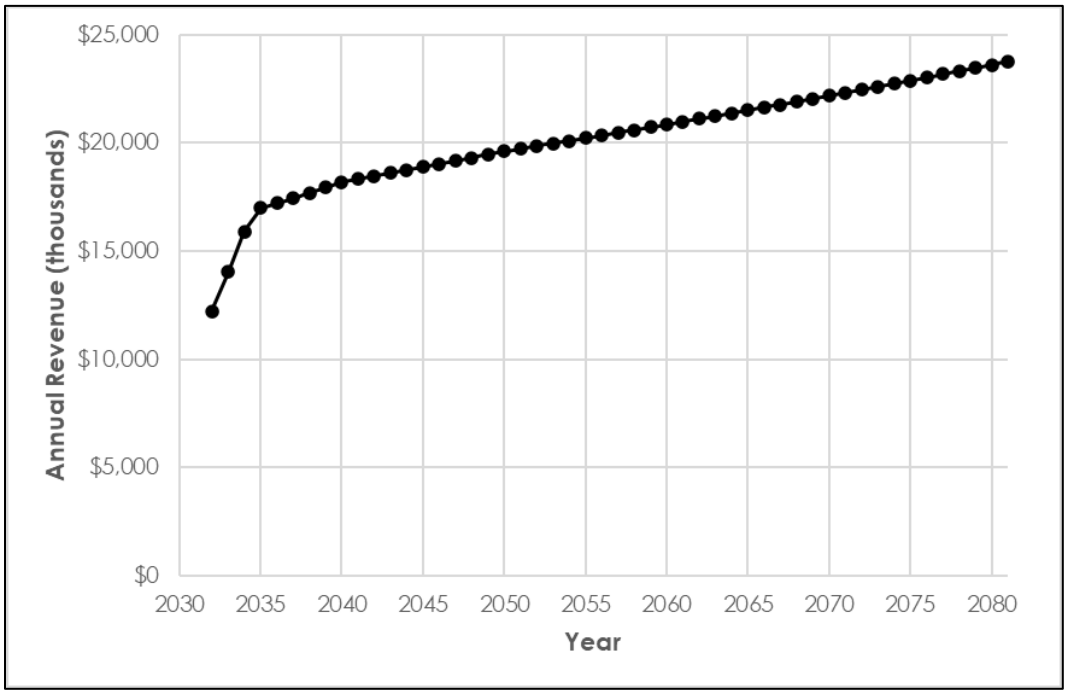


Figure 5.19: High Case Estimated Annual Toll Transactions, 2032 – 2081 (millions)

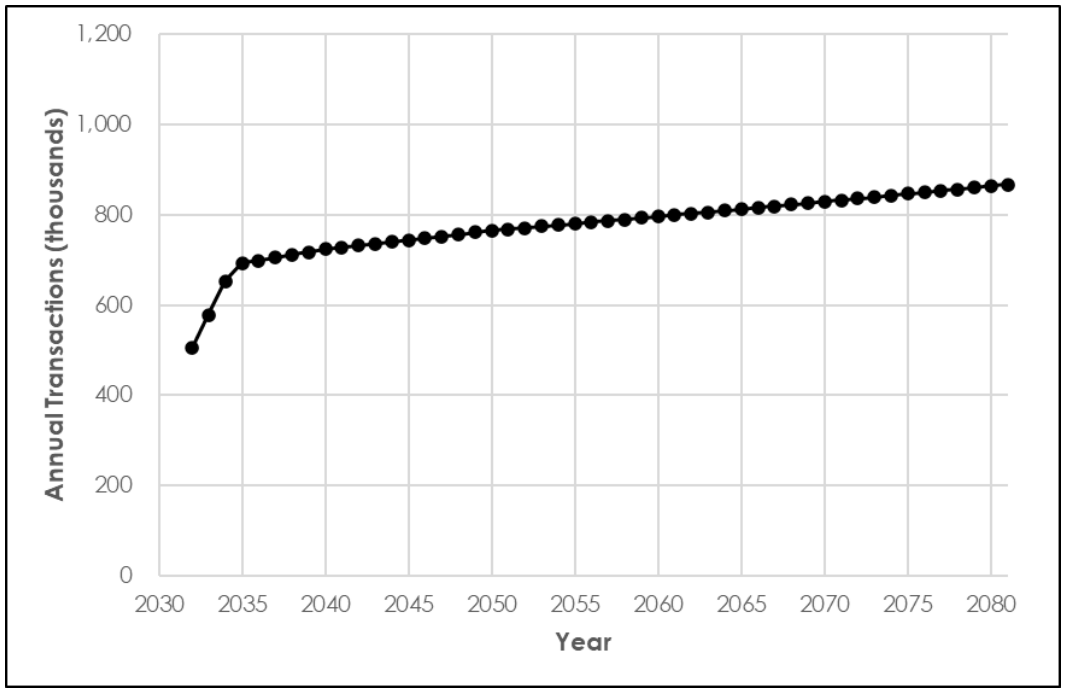
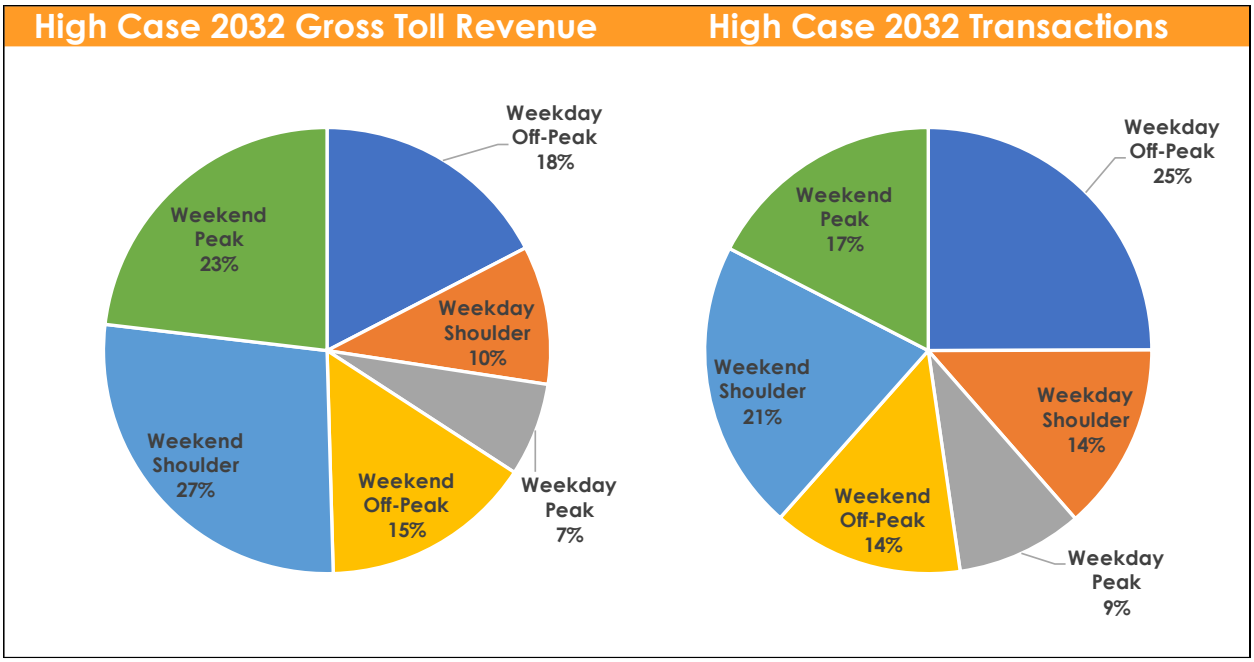


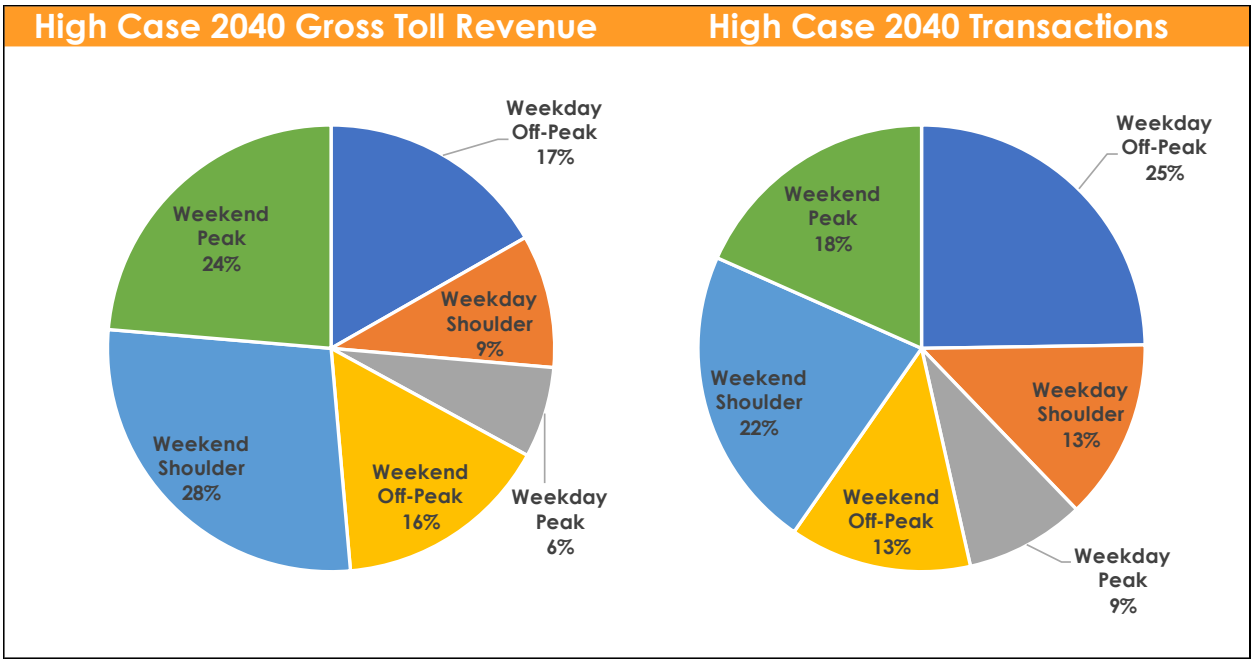
Figure 5.20 through **Figure 5.22** show the proportion each day type contributes to the total revenues and transactions for 2032, 2040, and 2050 in the High Case. In 2032, the first full calendar year of revenue collection, the weekday and weekend Off-Peak season represents about 33 percent of the total revenues and 39 percent of the total transactions. Tolls are lowest during the Off-Peak season, so even though this season is the longest in duration and has the most transactions, the proportion of the total annual revenue produced (33 percent) is less than the proportion of total annual transactions (39 percent). In the Peak season, tolls are highest, therefore the Peak season proportion of annual revenues is more than the proportion of transactions. The weekday and weekend Peak season represent 30 percent of total annual revenue and 26 percent of total annual transactions.

Figure 5.20: High Case 2032 (First Full Year) Estimated Gross Toll Revenues and Toll Transactions by Season and Day Type



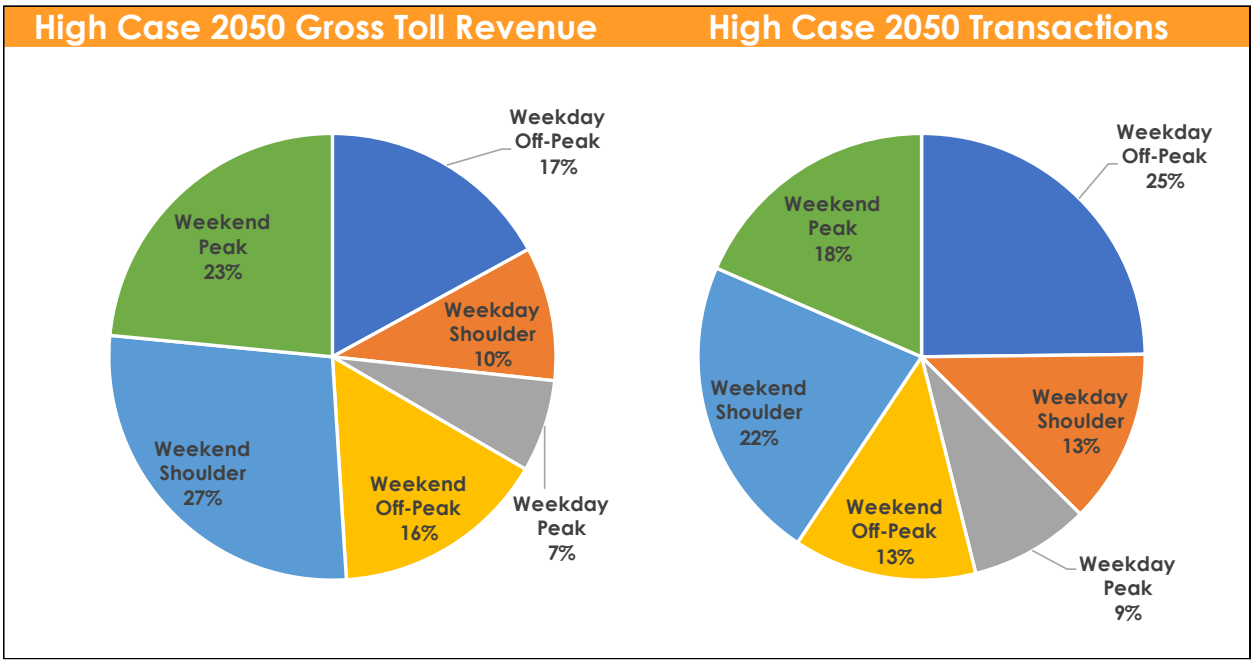
Note: Due to rounding, the sum of the percentages may not equal 100%.

Figure 5.21: High Case 2040 Estimated Gross Toll Revenues and Toll Transactions by Season and Day Type



Note: Due to rounding, the sum of the percentages may not equal 100%.

Figure 5.22: High Case 2050 Estimated Gross Toll Revenues and Toll Transactions by Season and Day Type



Note: Due to rounding, the sum of the percentages may not equal 100%.

The proportions of traffic and revenue in the High Case are largely similar to the Base Case.

5.6.6 Sensitivity Analyses

Sensitivity analyses were performed on the Base Case to understand the effect that key project assumptions would have on the model output. Two sensitivity tests for the project were typical, or "traditional"; they assumed variations in direct model assumptions. Scenario 1 tested the effect that a lower and higher value of time would have on traffic and revenue while Scenario 2 tested the effect of a lower and a higher socioeconomic forecast.

5.6.6.1 Modeling Assumption Sensitivities

Two sensitivity scenarios that varied model assumptions were evaluated. Scenario 1 tested the effect a lower and higher value of time would have on traffic and revenue:

- Scenario 1A tested the effect of a 25 percent increase in the assumed value of time.
- Scenario 1B tested the effect of a 25 percent decrease in the assumed value of time.

Scenario 2 tested the effects of both higher and lower socioeconomic growth estimates:

- Scenario 2A tested the effect of increasing the socioeconomic growth in the study area by 10 percent.
- Scenario 2B tested the effect of reducing the socioeconomic growth in the study area by 10 percent.

The results of Sensitivity Scenarios 1 and 2 are presented in **Table 5.27** for 2040. A review of the data for Scenario 1 indicates that a lower value of time reduces the revenue on the MCB, while traffic remains about the same. Conversely, a higher value of time increases MCB revenue. Scenario 1 traffic does not differ much from the Base Case because tolls are changed to optimal levels in parallel with the value of time changes.

For the Scenario 2 socioeconomic growth sensitivities, the higher growth assumption in Scenario 2A results in 9.6 percent more traffic and 12.4 percent more revenue in 2040. As shown, the lower growth assumption in Scenario 2B results in 10 percent less traffic and 9 percent less revenue than the Base Case in 2040. The results for the low and high socioeconomic forecast are logical. Less growth results in fewer transactions on the MCB and the more development there is, the more traffic and revenue will be realized.

Table 5.27: 2040 Model Assumption Sensitivity Impacts

Scenario Number	Sensitivity Scenario Description	Difference from 2040 Base Case Traffic	Difference from 2040 Base Case Revenue
1A	+25% Value of Time	0.5%	20.2%
1B	-25% Value of Time	0.0%	-19.4%
2A	+10% Household and Rental Bedroom Growth	9.6%	12.4%
2B	-10% Household and Rental Bedroom Growth	-10.0%	-9.0%

5.7 LIMITATIONS AND DISCLAIMERS

It is Stantec's opinion that the traffic and toll revenue estimates provided herein represent reasonable and achievable levels of traffic and toll revenues that can be expected to accrue on the Mid-Currituck Bridge over the forecast period and that they have been prepared in accordance with accepted industry-wide practice. However, as should be expected with any forecast, it is important to note the following assumptions which, in our opinion, are reasonable:

- This limited synopsis presents the highlighted results of Stantec's consideration of the information available as of the date hereof and the application of our experience and professional judgment to that information. It is not a guarantee of any future events or trends.

- The traffic and toll revenue estimates will be subject to future economic and social conditions, demographic developments and regional transportation construction activities that cannot be predicted with certainty.

- The estimates contained in this document, while presented with numeric specificity, are based on a number of estimates and assumptions which, though considered reasonable to us, are inherently subject to economic and competitive uncertainties and contingencies, most of which are beyond the control of the Authority and cannot be predicted with certainty. In many instances, a broad range of alternative assumptions could be considered reasonable with the availability of alternative toll schedules, and any changes in the assumptions used could result in material differences in estimated outcomes.

- The standards of operation and maintenance on the MCB will be maintained as planned within the business rules and practices.

- The general configuration and location of the MCB will remain as discussed in the report.

- Access to and from the MCB will remain as discussed in the report.

- No other new competing highway projects are assumed to be constructed or significantly improved in the project area during the project period, except those identified within the report.

- Major highway improvements that are currently underway or fully funded will be completed as planned.

- The MCB will be well maintained, efficiently operated, and effectively signed to encourage usage.

- No reduced growth initiatives or related controls that would significantly inhibit normal development patterns will be introduced during the forecast period.
- There will be no future serious protracted recession during the forecast period.
- There will be no protracted fuel shortage during the forecast period.
- No local, regional, or national emergency will arise that will abnormally restrict the use of motor vehicles.

In Stantec's opinion, the assumptions underlying the study provide a reasonable basis for the analysis. However, any financial projection is subject to uncertainties. Inevitably, some assumptions used to develop the projections will not be realized, and unanticipated events and circumstances may occur. There are likely to be differences between the projections and actual results, and those differences may be material. Because of these uncertainties, Stantec makes no guaranty or warranty with respect to the projections in this study.

This document, and the opinions, analysis, evaluations, or recommendations contained herein are for the sole use and benefit of the contracting parties. There are no intended third-party beneficiaries, and Stantec Consulting Services Inc. (and its affiliates) shall have no liability whatsoever to any third parties for any defect, deficiency, error, omission in any statement contained in or in any way related to this document or the services provided.

Stantec is not, and has not been, a municipal advisor as defined in Federal law (the Dodd Frank Bill) to NCTA and does not owe a fiduciary duty pursuant to Section 15B of the Exchange Act to NCTA with respect to the information and material contained in this document. Stantec is not recommending and has not recommended any action to NCTA. NCTA should discuss the information and material contained in this document with any and all internal and external advisors that it deems appropriate before acting on this information.

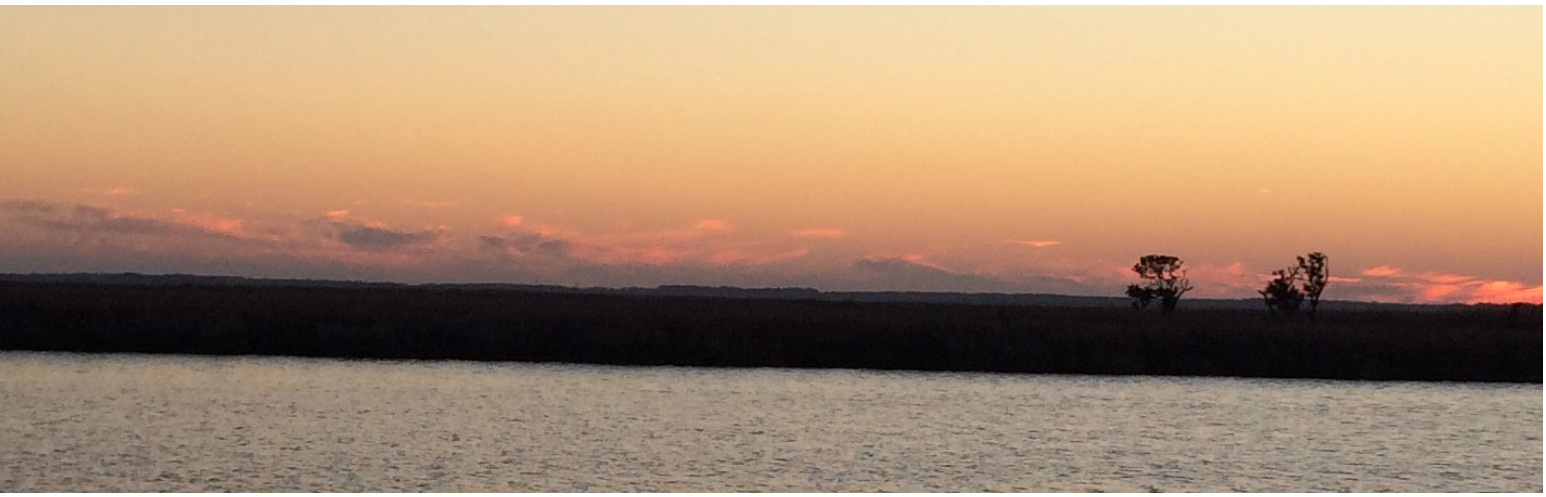
Neither this document nor any information contained therein or otherwise supplied by Stantec Consulting Services Inc. in connection with the study and the services provided to our client shall be used in connection with any financing solicitation, proxy, and proxy statement, proxy soliciting materials, prospectus, Securities Registration Statement or similar document without the express written consent of Stantec Consulting Services Inc.

APPENDIX A: MID-CURRITUCK SOUND SOCIOECONOMIC DATA REVIEW

Prepared by J. S. Lane Company, LLC

MID-CURRITUCK SOUND

SOCIO-ECONOMIC DATA REVIEW



03.08.2024

J. S. Lane Company, LLC for:

Stantec Consulting Services Inc.

CON-
TENTS

SUMMARY & ORGANIZATION

Purpose. The purpose of this report is to describe county, subarea, and traffic analysis zone (TAZ) comparisons of population and employment data, with the Region 17 model (TDM) data being the basis of comparisons. This report acknowledges that macro-economic conditions, climate change, consumer preferences, and many other factors can and will affect the accuracy of forecasts.

Study Area. The ten-county Mid-Currituck Sound Bridge (MCB) Region studied here is not only associated with the popular tourist destination of the Outer Banks of North Carolina, but extends over 50 miles inland to the Chowan River. The study area extends from the Virginia line on the north to Hyde County in the south, with Gates and Chowan counties defining the west edge. A string of barrier islands 20 miles long in Currituck and Dare counties terminates at Cape Hatteras in the east.

The Outer Banks is visited by tourists from within North Carolina and without, accounting for 45% of jobs in Dare County. (*Long-Range Tourism Management Plan 2023 - 2033*, Outer Banks Visitors Bureau, 2023) Tourism also contributes to occupancy and sales tax collections, and secondary expenditures across the region. Visitors increased sharply in 2020 and 2021 (67% in Dare County, for example) but are normalizing in the wake of the global Covid-19 pandemic. (Tabb, Kip, "After two boom years, fewer OBX visitors in 2022," *Outer Banks Voice*, April 13, 2023; interviews with property managers.)

The inland areas benefit economically from tourist-related traffic and industry (and some Virginia relocatees), but not to the same extent as the coastal communities. Both "base" (off-season) and in-season employment forecasts were developed for this study to capture seasonal variations in traffic and economic activity. Other sources of data, such as the U.S. Bureau of the Census and Woods & Poole (privately provided vendor of population and employment data for counties across the U.S.) do not have seasonal adjustments in their figures. Rising property values and limited availability are creating more residential demand further inland from the Outer Banks.

County Assessments. The county-level assessments indicate that the base year (2023) TDM *population* data are similar between the NC State Demographer, Census, and Woods & Poole (W&P) sources.

The differences in TDM employment and other data sources - here the W&P data was primarily used for comparison - are more substantial in the 2023 base year. With the exception of Washington County, the estimated 2023 TDM employment values are lower than W&P data (11.4% lower for base employment of all counties; with seasonal employment added to the TDM these two sources of employment are almost the same). Currituck (-17.7%) and Dare (-12.6%), both high-employment counties, have lower employment in 2023 than the W&P data.

TAZ Population and Employment Forecasting. After considering several options, the Census trends were used for population forecasts and Woods & Poole growth trends were used for employment forecasts (with a few adjustments to several TAZ-level population forecasts based on comments from professional county planning staff and modifications to some growth trends suggested by Stantec).

TAZ Rental Room Forecasts. Currituck and Dare county tax data was compared to AirDNA and parcel data (for bedrooms) to directly create the rental rooms in 2023 in those two counties. Other counties with rental rooms were adjusted at the same pace as employment growth. Several TAZs with large numbers of base rental rooms were manually checked, and some forecasts were "capped" in out years to reflect lower growth potential.

The report is organized so that the initial summary of key findings and context is followed by an assessment of county-level population and employment data.

The second major section considers the important topic of variations in seasonal habitation and employment, primarily seen through the lens of rental occupancy rates. The insights of four county planning staffs as well as numerous private realty companies were sought out with phone, remote survey, or in-person contacts to refine an understanding of seasonality, booking durations, and occupancy as well as potential or "pipeline" development prospects.

The last two sections consider sub-allocations of the proposed 2023 county control totals to the TAZ level for 2023 and forecasting for 2030, 2040, and 2050 horizon years. There are 695 TAZs in the 10 counties, making other sources of third-party data impossible to use directly for sub-allocation in TAZ-level employment.

To overcome this issue, TAZs were individually examined for the four counties that may be most affected by the development of another crossing of the Intercoastal Waterway in Currituck County (Currituck, Camden, Dare, and Pasquotank). TAZs were "flagged" to adjust based on a shift-share methodology or to hold constant at the 2023 employment and population. The "flagged" TAZs were subsequently validated during conversations with professional county planning staffs, leading to several manual adjustments of some TAZs to improve accuracy in the 2030 and later year forecasts.

Appendices provide additional content on interviews and hotel survey responses.

Lastly, a separate MS-Excel(TM) workbook contains the source data for many of the graphics used in the report as well as a final adjustment for TAZ-level data in 2023 and in five-year increments from 2030 to 2050 (with 2035 and 2045 being straight-line interpolations of "adjacent" years). This same workbook includes a set of "Low" and "High" range values for TAZs for the 2030, 2040, and 2050 forecast years.

Land Area

3,223 SQUARE MILES

Population

177,885 RESIDENTS (2023 EST.)

Employment

81,346 (2023 TDM EST.) EMPLOYEES INCREASING SEASONALLY BY 13% IN TWO COUNTIES (DARE AND CURRITUCK)

Figure 1. Study Area, encompassing 10 counties and over 3,200 square miles (land)

COUNTY ESTIMATES POPULATION

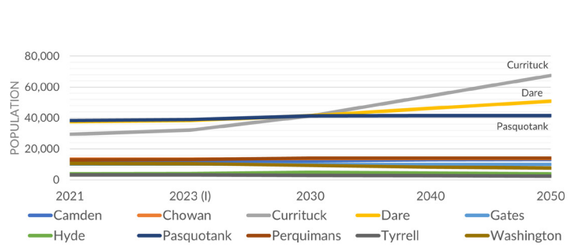
POPULATION. County forecasts for the region's travel demand model (TDM) were provided by NCDOT for a base year of 2021 and forecast years of 2030, 2040, and 2050 for each of the 10 counties in the study area. The 2023 data shown in some charts has been interpolated from 2021 to 2030 data (designated by the letter "i").

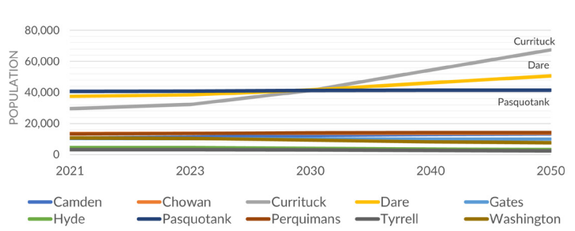
This population data was compared to two other sources: the North Carolina State Demographer's Office and Woods & Poole, Inc. Descriptions of data sources can be found in Appendix A.

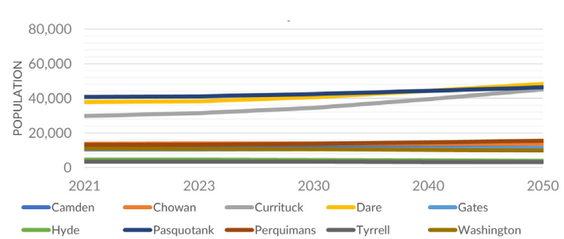
The first observation is that the county forecasts provided for the TDM and those obtained from the State Demographer's Office and extrapolated from the U.S. Census are similar for nearly every county except for Hyde County (Figure 4a, next page).

Small adjustments would be required to the TDM values to make them match Census extrapolations to 2023: reduce Currituck by 5%; all other counties increased by 2% to 9% (larger adjustments are to smaller counties).

Pasquotank, Dare, and Currituck counties have more than 20,000 residents. There is some evidence that (Census) populations in some counties declined or experienced slower growth during the global pandemic (shaded area in Figure 3, below).







Figures 2a, 2b, and 2c. Population Change (2a/top) TDM Population 2021 to 2050; (2b/middle) NC State Demographer Population 2021 to 2050; and (2c/bottom) W&P Population 2021 to 2050.

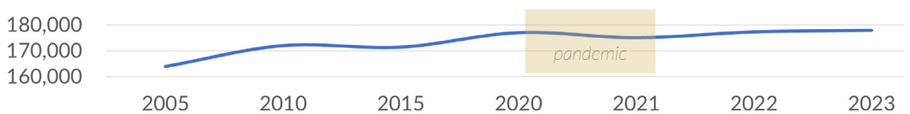
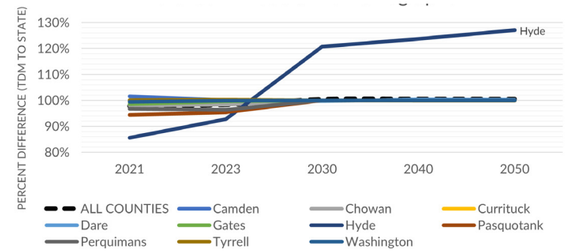
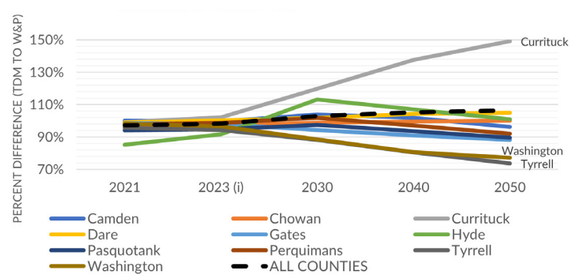


Figure 3: Population by Five-Year Increment for 10 Study Area Counties (US Census; 2023 extrapolated)





Figures 4a and 4b. Growth Comparison (3a/top) Comparison of TDM and NC State Demographer Population Data; and (3b/bottom) Comparison of TDM and W&P Population Data.

Figures 4a and 4b show the difference in population forecasts for 2021, 2023 (interpolated for TDM and NC State Demographer data), 2030, 2040, and 2050. In the top chart (4a) the TDM forecast value was divided by the NC State Demographer's value for the same year; the bottom chart (4b) does the same for the W&P data (TDM / W&P value). A value of greater than 100% indicates that the TDM value is higher than the comparator value.

Forecasts are similar except for Hyde County, where the NC State Demographer forecasts range from 15% lower to 28% higher than those shown for the TDM data. Currituck County's future forecasts are considerably higher than W&P but lower for Washington and Tyrrell counties.

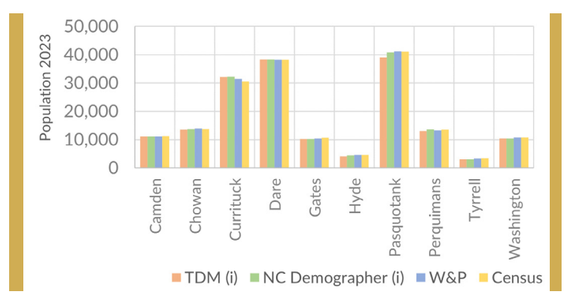


Figure 5. Comparison of 2023 Population Values, by Source

Figure 5 compares population for each county in the study area in 2023. With the exception of Pasquotank, the estimates are very similar for all three sources, on the order of 2% to 9%. As noted, Currituck County's TDM 2023 extrapolated population value is 5% higher than the 2023 Census value and 2.2% higher than W&P. Dare County's population is also higher than either of these two sources, but only slightly (0.2% to 0.3%).

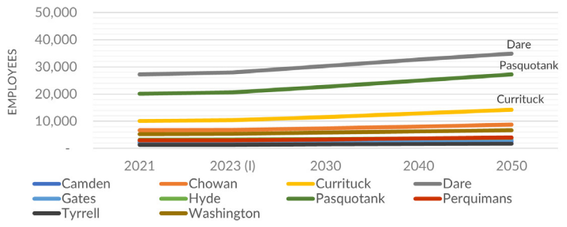
The annual growth in population for all counties is 1.36% for the TDM data between 2021 and 2030. In the NC State Demographer data the population in this same time period is slightly lower (1.3%), while the W&P data value is substantially lower (0.67%).

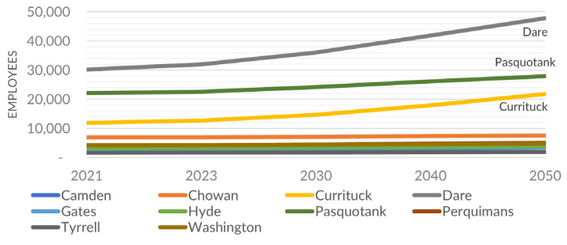
COUNTY ESTIMATES EMPLOYMENT

EMPLOYMENT. County forecasts for the study area's employment focus on the TDM data and comparing that to Woods & Poole, Inc. (Figures 6a and 6b) and U.S. Business Census (LODES, Figure 7) data sets. Employee data track much less well between the two data sets, although growth *trends* in the larger counties (Dare, Pasquotank, and Currituck) have similar properties.

While the W&P data can be compared to each TDM forecast year, the LODES data set only extends to 2020. For this assessment, the 2010 to 2020 annual data from LODES was extrapolated using the TREND function in MS-Excel to the year 2023. The differences in values between LODES and TDM 2023 employment are generally substantial (Figure 7), particularly in Dare and Pasquotank counties, but always the TDM values are higher than LODES. It is suggested that the seasonal employment and lack of capture of small businesses in the LODES data generates these differences, and that the Census/ LODES data is unsuitable as a comparator as a result.

The base year (2023) comparison between the employment values in the TDM and the W&P dataset indicate that the TDM data is mostly (with the exception of Washington and Hyde counties) lower than the W&P data. These differences in 2023 employment can be significant (e.g., 24% for Camden, 28% for Perquimans) in counties that have smaller employment figures (Figures 8 and 9, next page).





Figures 6a and 6b. (6a/top) TDM Employment 2021 to 2050, and (6b/ bottom) W&P Employment 2021 to 2050.

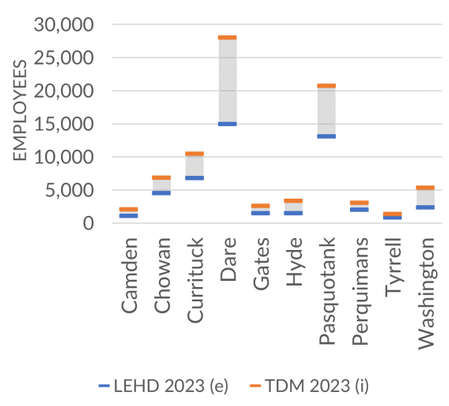
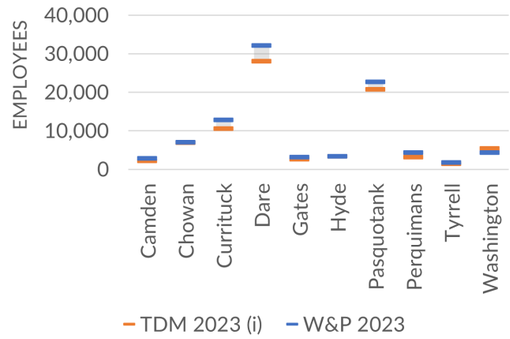


Figure 7. Comparison of the 2023 (interpolated) TDM Employment Data to the 2023 (extrapolated) LODES/US Census Data (all workers).



County	TDM 2023 (i)	W&P 2023	Diff (%)
Camden	2,052	2,707	-24.2%
Chowan	6,824	6,947	-1.8%
Currituck	10,427	12,671	-17.7%
Dare	27,965	32,006	-12.6%
Gates	2,548	3,033	-16.0%
Hyde	3,293	3,266	0.8%
Pasquotank	20,677	22,614	-8.6%
Perquimans	3,017	4,225	-28.6%
Tyrrell	1,358	1,645	-17.5%
Washington	5,366	4,294	25.0%
ALL COUNTIES	**83,528**	**93,408**	**-10.6%**

Figure 8. 2023 Employment by County, TDM (interpolated) and W&P (graph and chart).

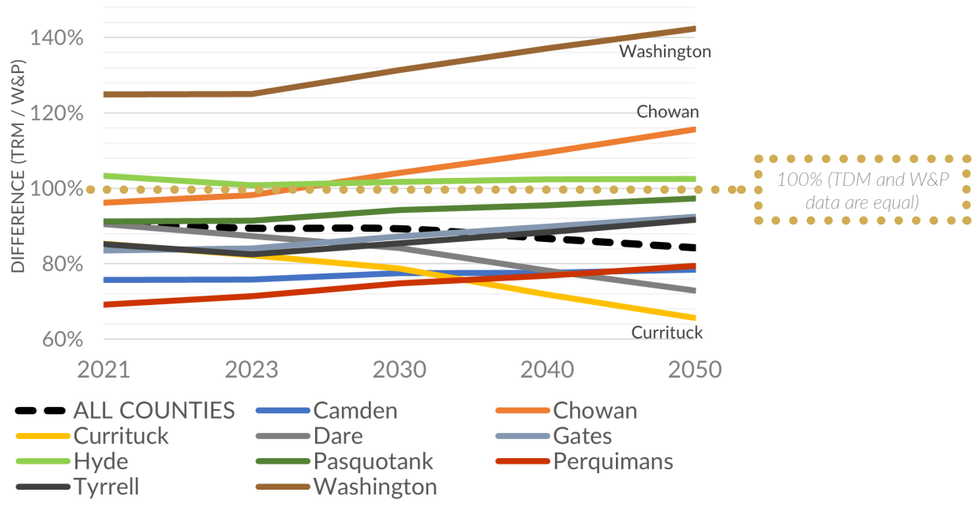


Figure 9. Comparison of TDM and W&P Employment by Year (TDM / W&P)

Proposed 2023 County Control Totals. After reviewing the base year 2021; interpolated or extrapolated 2023 data; and Woods & Poole county-level forecasts growth rates, it was determined that the following methodologies would be applied to create the 2023 control totals for the counties in the study area. Figures 10a and 10b show the comparison data and the proposed totals of population, base employment, and seasonal employment for three counties; the proposed control totals for all ten counties are provided in Appendix B.

Population. The Census extrapolated values were the preferred method for adjustment of population figures to 2023 values. The extrapolation data available in the recency of the 2022 American Community Survey (ACS) sample was a factor in its usage.

Employment. The W&P annual growth rate from 2010 to 2023 was applied to the TDM 2021 values to reach the 2023 year. The directionality (some counties were not growing) was consistent with recent trends and the long time frame available with the W&P growth (for only two years from the 2021 TDM base year) identified this as the best option. The W&P data also seems to be catching more workers than some other sources (e.g., Bureau of Labor Statistics, Business Census/LODES), likely an important factor in the employment profile of places that tend to favor smaller, non-franchised retailers and service providers.

POPULATION

COUNTY	2021 TDM	2023 TDM (i)	21-23 TDM CAGR	2023 Proposed	21-23 CAGR
Camden	*10,830*	*11,146*	*1.4%*	*11,216*	*1.8%*
Currituck	*29,489*	*32,126*	*4.4%*	*30,590*	*1.8%*
Dare	*37,492*	*38,370*	*1.2%*	*38,239*	*1.0%*
Total	**77,811**	**81,642**	**2.4%**	**80,045**	**1.4%**

EMPLOYMENT

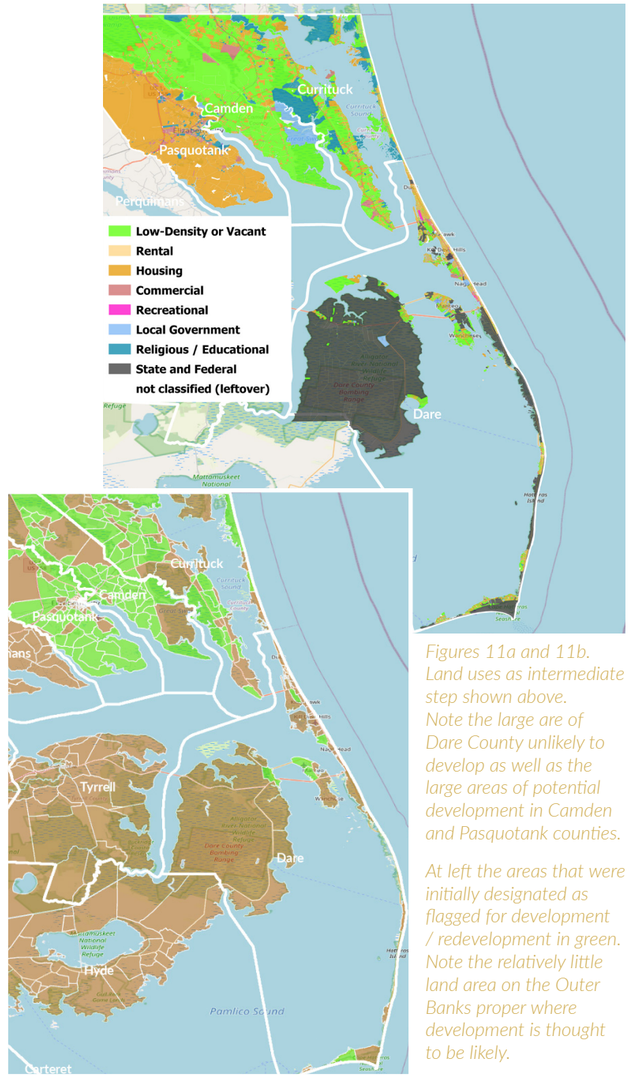
COUNTY	2021 TDM	2023 TDM (i)	21-23 CAGR	Base (permanent) 2023 Proposed	Annual Growth Rate	Seasonal 2023 Proposed	Total (base+seasonal) 2023 Proposed
Camden	*2,001*	*2,052*	*1.3%*	*1,950*	*-1.3%*	*0*	*1,950*
Currituck	*10,103*	*10,427*	*1.6%*	*10,729*	*3.0%*	*598*	*11,327*
Dare	*27,286*	*27,965*	*1.2%*	*27,980*	*1.3%*	*10,319*	*38,300*
Total	**39,390**	**40,444**	**1.3%**	**40,659**	**1.6%**	**10,917**	**49,626**

Figures 10a and 10b. Recommended Population (top) and Employment Control Totals for 2023
Sources: American Community Survey (ACS) 2022, Woods & Poole, Inc. (W&P) 2023 data set, and Region 17 Travel Demand Model (TDM)

TAZ 2023 ESTIMATES

Population and Employment. An important part of the study was to suggest 2023 adjustments at the TAZ level, a much smaller geography than the county level discussed in the previous section. The county totals for 2023 were used as control totals in the development of the 2023 TAZ-level estimates. The method used to sub-allocate population and employment followed several steps.

1. Since Currituck, Dare, and (to a lesser extent) Camden and Pasquotank counties may have future development potentially altered by new infrastructure, the TAZs in these counties were closely examined according to an aggregated land use classification system and building improvement value (source: adapted from NC OneMap).
2. The TAZs in these four primary counties were marked with an “adjust” notation, or “flag,” to denote that they have the potential for growth or redevelopment. The initial judgment was based on a zero land value and falling outside of a conserved area, such as the Dare County bombing range or national parks. Interviews with local planning staff were conducted to refine the judgment of which TAZs might be flagged for development, as well as which ones contain projects known to be in or approaching an active development status.
3. The 2021 to 2023 differential was sub-allocated to each TAZ based on its 2021 share of county development, including employment subcategories. Note that seasonal employees were estimated in a similar fashion. TAZs that were not flagged for adjustment retained their 2021 TDM values (Figures 11a/11b).



Figures 11a and 11b. Land uses as intermediate step shown above. Note the large are of Dare County unlikely to develop as well as the large areas of potential development in Camden and Pasquotank counties.

At left the areas that were initially designated as flagged for development / redevelopment in green. Note the relatively little land area on the Outer Banks proper where development is thought to be likely.

Hotels and Seasonality. Several counties in the 10-county region are notable as tourist destinations, a characteristic that affects travel demand directly through increased visitation to/from and movement within the counties. Tourism also indirectly effects increases in seasonal employment which, in turn, further increases home-to-work and other trip types.

To assess the magnitude and location of these effects a telephone survey of hotels was conducted for hotel and motel properties located in Currituck, Dare, and Pasquotank counties (3,041 rental rooms in 47 properties; see Figure 12). Data collected included seasonal months (peak, off-peak, and shoulder, if available/applicable), number of rooms, and typical peak occupancy. This data set was developed specifically for this project.

This information was compared to (a) the hotel / rental data in the TDM, and (b) used to help define the magnitude of seasonal effects.

The results and observations from this assessment of seasonality are described on the next page.

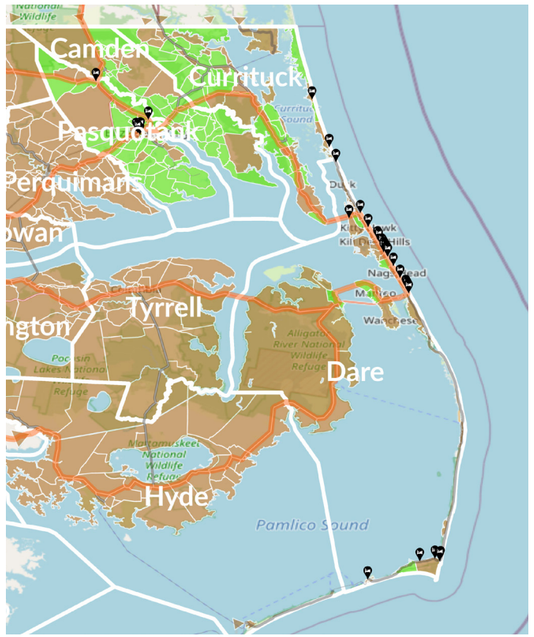


Figure 12. Location of Hotels in Telephone Survey (conducted August 1-2, 2023)

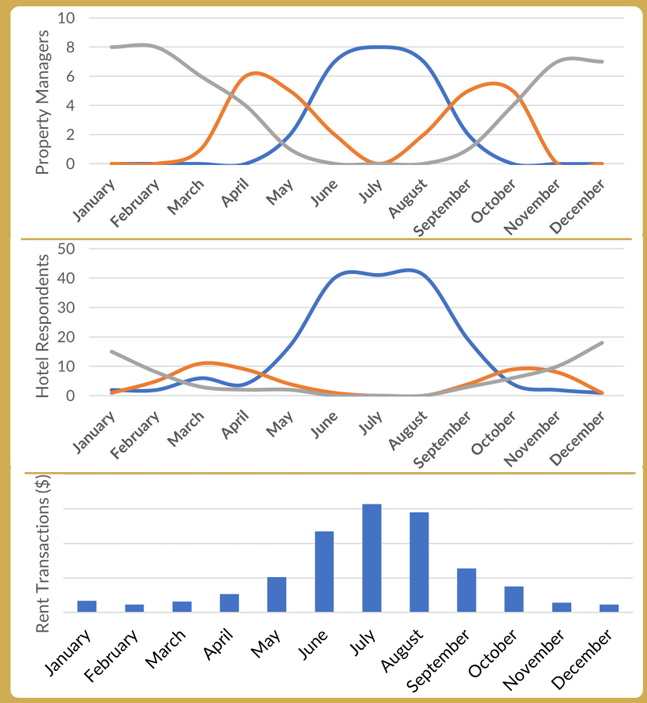
DISCUSSION OF SEASONALITY

The following observations on seasonal variations were derived from the rental unit and hotel data collected for this project.

1. **Hotels specifically and individual rental units (e.g., privately-owned units typically marketed through AirBnB and/or VRBO platforms) generally are predominantly located in Currituck and Dare counties and the Outer Banks, both on the Sound and Ocean "sides" of the barrier islands.**
2. **Based on the hotel survey conducted, there were some inconsistencies compared to the TDM 2021 data that were verified on the ground or visually through Google maps to find the best probable value. In this way (2021 TDM enhanced with August 2023 hotel survey data) the 2023 estimate of hotel rooms was completed.**
3. **Seasonality plays a major role in the transportation demand, especially in Dare and Currituck counties (Figures 13 and 14). The Bodie Lighthouse is closed from November through March, for example, and other attractions or retail operations are closed, have reduced hours of operation, and consequently have fewer visitors and employees making trips. Interviewees noted a surge of renters during Covid-19, the Dare County OBX Visitor's Bureau annual report supports that assertion for 2021. Tax collections have increased but at a pre-pandemic pace, according to the OBX 2023 Tourism Annual Report.**
4. **Other findings include rough agreement of typical seasonal variations between various types of rental units (sales from Dare County OBX Visitor's Bureau agrees with this assessment) and property management companies (8) that responded to requests for input (Figures 14a, 14b, and 14c).**
5. **About 70% of the rental transactions happen in the peak period (June, July, and August). Rentals are down from 2021's Covid-era peak (20%) but are in alignment with pre-pandemic figures.** *(sources: Outer Banks Visitor's Bureau, "Long-Range Tourism Management Plan, 2023 – 2033" and "2023 State of Dare County Tourism")*

HOTELS *(data from telephone survey, n~45)*			
Season	**Start**	**End**	
Typical Peak Season	*June*	*September*	
Typical Shoulder Season	*April-May*	*October-November*	
Typical Off Season	*December*	*March*	
STATISTIC	**AVERAGE**	**MINIMUM**	**MAXIMUM**
No. of Rooms	*68*	*3*	*180*
Peak Occupancy	*85%*	*25%*	*100%*

Figure 13. Hotel Survey Results (note that seasons vary by entity surveyed)



Figures 14a, 14b, 14c. (top to bottom) Hotel, Property Management, and OBX/Dare County Visitor's Bureau Data on Seasonality Trends. *(sources: 11a/11b survey data; 11c OBX Visitor's Bureau data from 2019 to 2022)*

TAZ FORECASTS

Using Local Insights. As noted, the initial TAZ-level 2023 adjustments were developed by labeling each TAZ in four primary study area counties (Dare, Camden, Currituck, and Pasquotank) as being "flagged" for its likelihood to change over time. The adjustment "flag" was initially assigned based on each TAZ's land use characteristics (obtained from NCOneMap data) that were aggregated into fewer, consistent land use codes. TAZs that are in protected or restricted areas, such as Dare County military uses or preserved parklands, were not flagged for adjustment, for example, as were TAZs that were thought to have achieved full build-out potential.

Interviews with each of the four county planning directors were conducted in August 2023, and they were asked to review the initial map of "flagged" TAZs and offer adjustments. The resulting second-pass growth "flag" map is shown in Figure 15.

Once the "flagged" for growth TAZs were determined, growth was allocated to each one based on its 2021 share of development. Note that hotel properties were also reviewed, and informed by the hotel management survey discussed in the previous section to arrive at current (2023) hotel rooms.

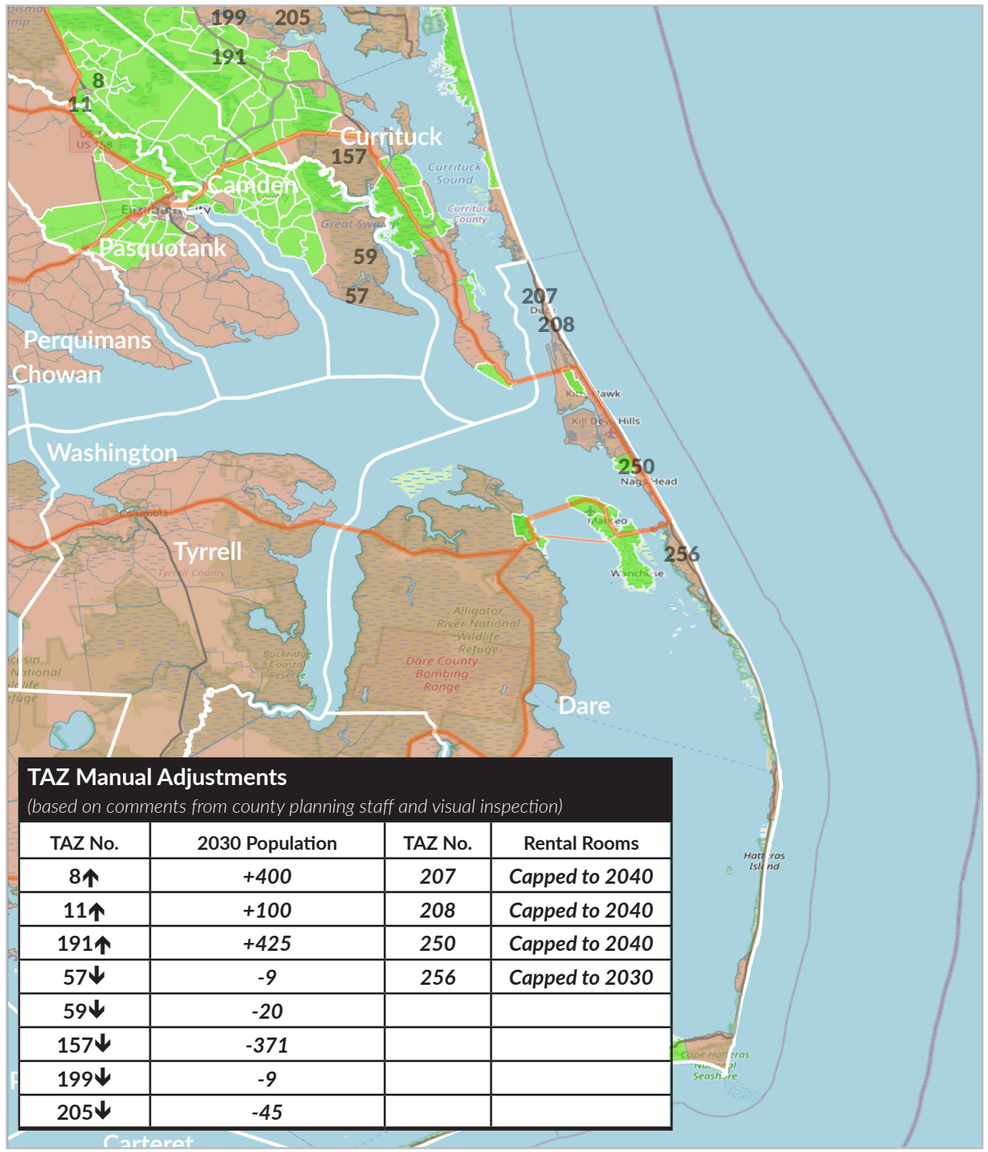
Growth (or declines) were based on Census 1995-2022 trends for population, and Woods & Poole growth rates from 2010 to 2023 for employment (no TAZ was allowed to decline in population or employment for any future year value).

Three TAZs (nos. 8 and 11 in Camden's South Mills area, and TAZ no. 191 in Currituck) had populations adjusted upwards and five TAZs (nos. 57 and 59 in Camden and 157, 299, and 205 in Currituck) were adjusted downwards in the 2030 forecast to reflect comments received by county planning directors (see also notes in Figure 15). The adjustments offset in Currituck but the number of "no adjustment" TAZs in Camden did not allow a full offset in that county, resulting in a net Camden County population increase of 471. Growth adjustments were applied normally to these TAZs in 2040 and 2050.

Rental Rooms. Other manual TAZ adjustments were made to rental rooms in horizon years (2040, 2045, and 2050, primarily) after a visual inspection of the potential for growth in rental units. Several factors were considered in visual inspections of 13 of the TAZs in Dare and Currituck with the most 2023 rental units:

- Amount of vacant land;
- Land that is in conservation; and
- Value of developed residential properties (and potential for tear-down and rebuilds to homes that are larger and more bedrooms).

Employment growth rates were applied to rental rooms outside of Currituck and Dare (very few). For the TAZs inside Dare and Currituck counties, data from county tax assessors was acquired and used to designate parcels (and their associated number of bedrooms) as being rental properties; these were then aggregated spatially to the TAZ to produce the 2023 values. A five-year history (2018 to 2022) of permits applied for new residential construction (generally around 120/year/county) was used to add new rental rooms to the Dare and Currituck county TAZs from 2030 to 2050 (except for those TAZs/years listed in Figure 15).



TAZ Manual Adjustments
(based on comments from county planning staff and visual inspection)

TAZ No.	2030 Population	TAZ No.	Rental Rooms
8↑	+400	207	Capped to 2040
11↑	+100	208	Capped to 2040
191↑	+425	250	Capped to 2040
57↓	-9	256	Capped to 2030
59↓	-20		
157↓	-371		
199↓	-9		
205↓	-45		

Figure 15. Growth "Flag" TAZs (green shading) in Second Pass, after Local Expert Reviews / Comments.

Notes: (1) TAZ nos. 8, 11 (Camden) and 191 Currituck were adjusted upward in 2030 population forecast. Other TAZs (157, 199, 205 in Currituck and 57, 59 in Camden) were adjusted downward to reflect comments by county planning directors.

DISCUSSION OF OCCUPANCY

Occupancy rates have a variable definition to the people involved in this study, and are changing as the country emerges from the pandemic and its positive effects on OBX visitation. A summary of the salient points encountered during discussions with four county planning directors, rental property managers, and subsequent research are discussed below.

Definition(s). The term "occupancy" will mean the number of rooms that are booked compared to the total number of available rooms to the manager of a hotel or the manager/owner of rental properties. However, this definition does not reflect the actual number of persons staying in a rental property. For example, a five-bedroom house may be booked for a week by a group who, in total, only use four of the five bedrooms. In the paradigm of someone interested in the total people using the space we would say that the unit is only 80% occupied for the week, while the manager of the property would say that the unit is 100% occupied for that week. Hence, there is a potential difference between booking occupancies and person occupancies, with the latter having no tangible data that is historically tracked. (*Note: The OBX Visitor's Bureau in Dare County described occupancy in a still different way: by the number of dollars expended monthly.*)

Changes. Changes brought about by the Covid-19 pandemic inflated bookings, according to both the OBX Visitor's Bureau Data as well as conversations with property managers. These changes are not durable, however, and actual occupancies are expected to return to 2019 levels and are already doing so. Revenue growth slowed from about 34% YoY (year-over-year) in 2021 to 5.6% in 2022, returning to a pre-pandemic rate. Growth is expected to remain slow in the Virginia, North Carolina, and Pennsylvania source markets, which collectively account for 60% of OBX visitor bookings.

Recommended Occupancy in Rental Rooms. The following are suggested values for room occupancy rates, here defined as the total occupancy of rooms for weeks by three seasonal periods. Low and high values are tighter (5%) in peak season, whereas shoulder and low seasons are recommended to have 10% variation.

In-Season (mid-June to mid-September): Recommend using 90% occupancy value which includes vacancies attributable to over-programming (e.g., the example stated previously where a booking for a five-bedroom house only uses four bedrooms), maintenance outages, and standard marketplace vacancy rates.

Shoulder Season (mid-May to mid-June and mid-September through mid-October): Recommend 60% room occupancy rates, based on within-year variations in seasonal and survey data). Shoulder season occupancy has grown in recent years as people seek lower rents and less crowding.

Low Season (mid-October to mid-May): 20% is recommended, but there is some evidence that more people are coming in the off-season than was formerly the case. More business operations are staying open in the off-season, for example - and even more would do so if employees could be located for year-round work.

"Almost 60% of paid accommodations revenue was earned during peak season; shoulder season showed the strongest growth."

- Tourism Economics for The Outer Banks Visitor's Bureau, "Long-Range Tourism Management Plan, 2023 - 2033"

DISCUSSION OF NC-VA BORDER TRAFFIC

The border of North Carolina and Virginia is important in the discussion of travel demand in the Outer Banks and nearby counties. While obtaining data specific to growth in the northern reaches of the study area was not a part of the original scope of this study, there was a desire expressed to see how traditional data sources and local interviews might inform these border effects, summarized below.

Coming from Virginia. It would be easy to overlook that the large (1.8 million people, the 37th-largest metro area in the United States) Virginia Beach–Norfolk–Newport News, VA–NC Metropolitan Statistical Area is only about an hour from the Outer Banks. This proximity has translated not only to more visitors but also to more people relocating to the region. In the words of the Camden County Planning Director, people are relocating in smaller (20-50 units) subdivisions, often wanting more-urban amenities but getting more wildlife than they had bargained for prior to moving. The large South Mills development impacted the total residents and (slightly) residential control totals in Camden County. Growth in housing in the OBX area (Currituck and Dare counties) has been relatively slow; the OBX Visitor's Bureau suggests that there are only 3.6% more housing units in 2022 than in 2010. Pricing in the inland counties has made these more attractive options for long-term residency.

Traffic. Air travel remains a minor component of travel (about 117 daily operations, often charters, happen in the Dare and Currituck regional airports). Most visitors travel into the study area by private car, especially from the nearby Hampton Roads metropolitan area of Virginia. Figure 16 shows the most-recent ten year's of data for the four major roadways crossing the state line (US Highway 17, SR 1218 (NW Backwoods Road), NC 168, and NC 615 (Marsh Causeway in Currituck County). The trend data suggest that cross-border traffic is increasing by about 476 vehicles per year, although there are variations between years. If the pandemic-generated uptick in 2021 data is excluded, the trend suggests 414 trips, or about 13% less. The increase amounts to 1% each year.

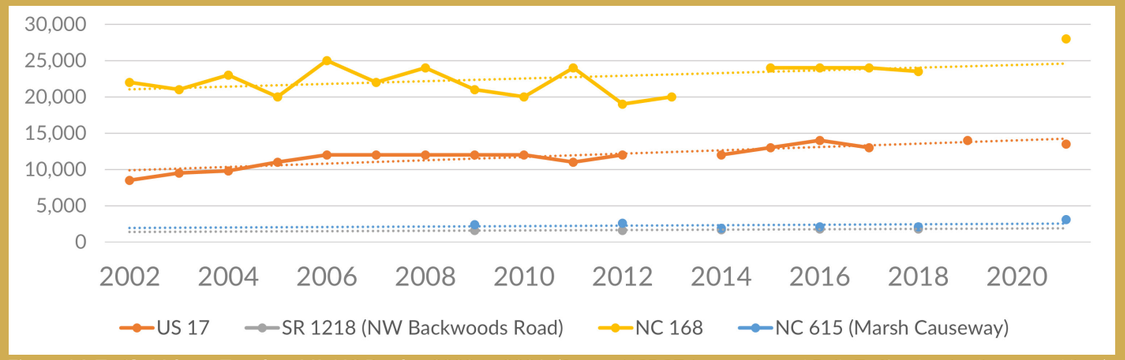


Figure 16. Traffic Volume Trends at VA-NC Border, 2002 to 2021. *(Source: NCDOT Average Annual Daily Traffic, showing linear trend lines)*

County and TAZ Forecasts for Population, Total Employment, and Seasonal Employment.

Forecasts. County forecast values for population, employment, and seasonal employment are presented in Figures 17a, 17b, and 17c. Due to legibility and report volume concerns, individual TAZ-level forecast values are included as a digital appendix only (MS-Excel format).

Low and High Range Values. Ranges around the forecast value were prepared to suggest reasonable expectations of variation in growth based on observed past county trends from 2010 to 2023 (est. from Woods & Poole data). Confidence intervals were developed for each county to represent this range, with the result being used to create "Low" and "High" estimates for the 2030, 2040, and 2050 central forecast values for each county. To reflect the increased degree of uncertainty in more-distant forecast periods, a greater confidence interval was used in 2030 (10%) compared to 2040 (8%) and 2050 (5%). This method produced some "Low" values less than the forecast estimate of the preceding forecast year in those counties where growth rates were low or negative. This met the purpose of the ranges, which was to provide a bracket around the forecast reflecting normal degrees of uncertainty, and not to be compared across time horizons with other values.

Individual TAZ-level range values were developed by applying the share of each TAZ's growth to the total county change between horizon years, then applying that share to the difference between the Low or High values and subtracting (Low) or adding (High) to the forecast value. Individual TAZ values are included only as a digital appendix (MS-Excel format).

POPULATION FORECAST AND RANGE VALUES

COUNTY	2023	2030 LOW	2030 FORECAST	2030 HIGH	2040 LOW	2040 FORECAST	2040 HIGH	2050 LOW	2050 FORECAST	2050 HIGH
Camden	11,216	*12,318*	12,802	*13,287*	*12,758*	13,545	*14,333*	*12,907*	13,826	*14,746*
Chowan	13,765	*13,475*	13,778	*14,082*	*13,331*	13,798	*14,264*	*13,280*	13,815	*14,349*
Currituck	30,590	*37,419*	39,258	*41,179*	*47,922*	51,637	*55,353*	*58,749*	64,018	*69,286*
Dare	38,239	*41,036*	41,417	*41,799*	*45,308*	45,958	*46,608*	*49,681*	50,498	*51,315*
Gates	10,713	*10,259*	10,504	*10,749*	*10,084*	10,458	*10,832*	*10,026*	10,454	*10,882*
Hyde	4,554	*3,980*	4,174	*4,368*	*3,403*	3,664	*3,926*	*2,936*	3,197	*3,459*
Pasquotank	41,043	*40,513*	41,482	*42,451*	*40,126*	41,619	*43,111*	*39,930*	41,638	*43,345*
Perquimans	13,554	*13,703*	14,018	*14,333*	*13,629*	14,116	*14,603*	*13,570*	14,128	*14,686*
Tyrrell	3,404	*2,943*	3,168	*3,393*	*2,553*	2,865	*3,178*	*2,271*	2,594	*2,918*
Washington	10,807	*9,522*	9,674	*9,826*	*8,324*	8,529	*8,735*	*7,659*	7,876	*8,094*

YEAR-ROUND EMPLOYMENT FORECAST AND RANGE VALUES

COUNTY	2023	2030 LOW	2030 FORECAST	2030 HIGH	2040 LOW	2040 FORECAST	2040 HIGH	2050 LOW	2050 FORECAST	2050 HIGH
Camden	1,950	*1,919*	2,076	*2,233*	*1,982*	2,244	*2,505*	*2,083*	2,403	*2,723*
Chowan	6,670	*6,685*	6,867	*7,049*	*6,790*	7,079	*7,367*	*6,899*	7,236	*7,573*
Currituck	10,729	*11,798*	12,436	*13,155*	*13,982*	15,177	*16,372*	*16,774*	18,434	*20,093*
Dare	27,980	*30,139*	31,528	*32,917*	*34,083*	36,556	*39,028*	*38,592*	41,828	*45,064*
Gates	2,537	*2,529*	2,648	*2,767*	*2,591*	2,783	*2,975*	*2,679*	2,908	*3,137*
Hyde	3,257	*3,189*	3,429	*3,669*	*3,234*	3,624	*4,013*	*3,350*	3,819	*4,289*
Pasquotank	20,157	*20,725*	21,483	*22,241*	*21,997*	23,257	*24,518*	*23,363*	24,906	*26,450*
Perquimans	2,999	*3,113*	3,158	*3,203*	*3,325*	3,400	*3,474*	*3,533*	3,623	*3,714*
Tyrrell	1,308	*1,286*	1,377	*1,468*	*1,296*	1,443	*1,590*	*1,329*	1,504	*1,680*
Washington	5,141	*5,122*	5,307	*5,492*	*5,196*	5,489	*5,783*	*5,311*	5,657	*6,003*

SEASONAL EMPLOYMENT FORECAST AND RANGE VALUES

COUNTY	2023	2030 LOW	2030 FORECAST	2030 HIGH	2040 LOW	2040 FORECAST	2040 HIGH	2050 LOW	2050 FORECAST	2050 HIGH
Currituck	598	*657*	693	*729*	*779*	846	*913*	*935*	1,028	*1,120*
Dare	10,319	*11,115*	11,627	*12,139*	*12,570*	13,482	*14,393*	*14,233*	15,426	*16,619*

Figure 17a, 17b, and 17c. Forecast Population, Base Employment, and Seasonal Employment Forecasts and Ranges.

**Population "High" Value for 2030 in Currituck County was adjusted slightly as a result of collaborations with local planning staff.*

APPENDICES

A. Source Descriptions

Region 17 Travel Demand Model (NCDOT via Stantec Consulting Services Inc.). The data provided included a mapped file and tabular data for 2021, 2030, 2040, and 2050 data sets. Each year of data included population, employment by type, seasonal employment by type (only for two counties: Dare and Currituck), hotel rooms, and other information not generally used in this assessment such as parking information.

U.S. Bureau of the Census (via Esri BAO). Census population data was accessed from the Esri Business Analyst Online (Esri BAO) data platform for counties and subareas. Major US Census counts are conducted decennially, 2010 and 2020, while annual sampling refreshes these estimates (the most-recent year used in this assessment and available was 2022). Census data is typically viewed as a "gold standard" for socioeconomic data, but no data source is perfect or perfectly up to date: the global pandemic may have influenced the 2020 collection in unspecified ways, for example, and small geographies may be less accurate.

U.S. Business Census / LODES (Longitudinal-Employer Household Dynamic (LEHD) Origin-Destination Employment Statistics). This employment data has annual updates from 2002 to 2020. This data relies on insurance reporting, so it typically under-reports small businesses and their employees.

Woods & Poole, Inc. (W&P). The private for-sale W&P data was used at the county level (although metropolitan statistical and state levels are also available) for employment and population projections, which this dataset reports every year through the year 2060; the 2023 dataset was used in this report. The W&P forecasts are often fairly aggressive, straight-line projections with the unique aspect that control totals exist at the national and state level, and lower levels of geography are rebalanced to ensure that these state and national controls never vary (e.g., if a county in one part of the country has a population increase in a new update of the data set, then another county or counties have to be reduced by the same amount). New datasets adjust prior years to match with US Census data, as they become available.

NCDOT: The North Carolina Department of Transportation collects and maintains semi-annual (every two years) traffic counts of average annual daily traffic at thousands of stations around the State. This data was accessed to describe North Carolina-Virginia traffic growth at the border of the two states.

Other Notes:

AirDNA. A third-party vendor that collects information from Airbnb and VRBO platform listings was the AirDNA data, used primarily to examine relationships for occupancy and comparison to tax data on rental properties.

Collected Data. Interviews were conducted with county planning directors (four), managers of companies that platform rental homes (eight), and hotel operators (47). A second round of calls, as well as a website search, was used to generate total properties managed from those property managers that were interviewed and for those responding to calls (5) the numbers of listings on or not on VRBO or Airbnb. This information was used directly in the estimates of rental bedrooms and hotel rooms by TAZ. The data collected also informed the discussion of seasonal variability, as did data provided by the Outer Banks Visitors Bureau for monthly totals of dollars expended in Dare County for a four-year period. Tax data was collected from the Dare and Currituck county's tax assessors' offices to generate total rental rooms; residential permit data was also collected to assess growth in housing for use in "growing" the number of rental rooms. Lastly, The Outer Banks Visitors Bureau, and their publication "Long-Range Tourism Management Plan 2023–2033," were very useful in providing local market insights.

B. County Population and Employment

The following tables show the county-level proposed population, base (year-round) employment, and seasonal employment 2023 base year and forecast year estimates. These totals include the several TAZ-level population adjustments made in Camden and Currituck counties, although those changes were relatively small compared to the overall size of the county populations. Refer to the discussion on seasonal variations for additional insights into temporary (seasonal) employment.

POPULATION				
COUNTY	2023 (base)	2030	2040	2050
Camden	11,216	12,802	13,545	13,826
Chowan	13,765	13,778	13,798	13,815
Currituck	30,590	39,258	51,637	64,018
Dare	38,239	41,417	45,958	50,498
Gates	10,713	10,504	10,458	10,454
Hyde	4,554	4,174	3,664	3,197
Pasquotank	41,043	41,482	41,619	41,638
Perquimans	13,554	14,018	14,116	14,128
Tyrrell	3,404	3,168	2,865	2,594
Washington	10,807	9,674	8,529	7,876
Total	**177,885**	**190,277**	**206,190**	**222,044**

	EMPLOYMENT (year-round)				EMPLOYMENT (seasonal additions)			
COUNTY	2023 (base)	2030	2040	2050	2023 (base)	2030	2040	2050
Camden	1,950	2,076	2,244	2,403	0	0	0	0
Chowan	6,670	6,867	7,079	7,236	0	0	0	0
Currituck	10,729	12,436	15,177	18,434	598	693	846	1,028
Dare	27,980	31,528	36,556	41,828	10,319	11,627	13,482	15,426
Gates	2,537	2,648	2,783	2,908	0	0	0	0
Hyde	3,257	3,429	3,624	3,819	0	0	0	0
Pasquotank	20,157	21,483	23,257	24,906	0	0	0	0
Perquimans	2,999	3,158	3,400	3,623	0	0	0	0
Tyrrell	1,308	1,377	1,443	1,504	0	0	0	0
Washington	5,141	5,307	5,489	5,657	0	0	0	0
Total	**82,729**	**90,309**	**101,051**	**112,318**	**10,917**	**12,321**	**14,328**	**16,454**

C. Planning Staff Interviews

The following summarizes the comments received during the interviews with county planning directors (four) and one additional interview with a staff person of the Outer Banks Visitor's Bureau (of Dare County).

Noah Gilliam, Planning Director, Dare County (8/9/2023/9am in person meeting)

c: noah.gillam@darenc.gov t: 252.475.5873

There is little multi-family; monies to assist development are available from a state/federal grant but locating a suitable place has been challenging due to zoning and pushback from established residents. There has been some redevelopment, but mostly single-family to single-family (larger houses, often for rent). When multi-family does happen it is typically 4-6 units. Dare saw a building surge post towards the latter half of the Covid pandemic (50-60 units, about double previous levels); leveling off now. A new bridge connection to the north may influence traffic and some business operations but not influence new development. (Note: Building permit data is on-line.)

Kevin Kemp, Development Services Director,Currituck County (8/9/2023/11:15am in person meeting)

c: Kevin.Kemp@CurrituckCountyNC.gov t: 252.232.6075

Pressure from the north (Hampton Roads commuters/relocatees) has helped drive housing prices much higher ($150,000+) and a push for multi-family. Further signs of pressure are formerly hard-to-develop lots are now being developed, and there are more tear-downs being converted to large and rent-able homes. The pandemic did not affect the pace of development (refer to data provided). A new bridge connection would foster more commercial development in the vicinity of the bridge landing but also north and south along the Intercoastal Waterway on the mainland side.

Shelley Cox, Planning & Inspections Director,Pasquotank County (8/8/2023/10am in person meeting)

c: coxs@co.pasquotank.nc.us t: 252.335.1891

Telephonics adding 150 employees (Elizabeth City); the residential focus is in Elizabeth City and spreading north to the Virginia state line (Hampton Roads pressures). Two schools are converting to apartments (Weatherly-done; high-school will add 120 units). Note relocation of hospital to North Road Street. The pandemic had little or no effect on development. A new bridge connection would have little effect on new development; possibly better connections to some workers on the OBX and may increase some overnight stays in Pasquotank County. Steering people away from southern part of the county.

Amber Curling, Director, Planning, Zoning, & Floodplain Management, Camden County (8/8/2023/10am in person meeting)

c: acurling@camdencountync.gov t: 252.338.1919x232

She has not seen a major push yet for larger subdivisions (typ. 20-50 units). Commuters from Norfolk are noticeable - people want to live in country but are disturbed by the presence of wild animals and lack of amenities in many cases. The pandemic effects were insignificant. A new bridge connection might change traffic patterns, including avoidance of US 158 toll, but not anticipated change to development patterns or pace.

Lee Nettles, Outer Banks Visitors Bureau (8/7/2023 telephone conversation)

e: information@outerbanks.org t: 252.473.2138

Defined "gross occupancy" (total dollars spent on rental units in Dare County) and "short-term" (90 days or less) rental terminology. Mr. Nettles noted that rental occupancies had increased during Covid-19 but were starting to resume pre-pandemic levels; more rentals were becoming short-term again, reversing a trend towards long-term rentals seen during the pandemic. More-urban destinations in other parts of the state, where densities compounded Covid-19 concerns, were hit hard and have only recently started to rebound. Suggested that there was additional sample data for Dare County (all data from this source is for Dare) and may send it; was not willing to send survey link to realty agencies.

D. Rental Property Manager Survey Summary

Note that some questions were abbreviated to fit the format of the following table. “N/A” indicates the participant did not answer that survey element.

Company	Beach Realty	Tim Cafferty	Sun Realty	Brindley Beach	Carolina Designs	Twiddy Realty	Joe Lamb Jr & Assoc.	Twiddy & Company
In which county are the majority of your properties?	*Dare and Currituck*	*Currituck*	*Dare*	*Currituck*	*Mostly Dare, but also Currituck*	*Currituck and Dare*	*Dare*	*Currituck*
Peak Season	*Jun - Aug*	*Jun - Aug*	*Jun - Aug*	*Jul*	*Jun - Aug*	*May - Sep*	*Jun - Aug*	*May - Sep*
Shoulder Season	*Aug - Oct*	*May; Sep*	*May; Sep; Oct*	*Jun; Aug*	*Apr; May; Sep; Oct*	*Mar; Apr; Oct*	*Apr; May; Sep; Oct*	*Apr*
Typical minimum stay	*Usually 4 or more nights*	*2-3 nights or longer*	*4 or more nights*	*4 or more nights*	*4 or more nights*	*4 or more nights*	*4 or more nights*	*4 or more nights*
Friday Start	*0%*	*20%*	*0%*	*N/A*	*10%*	*10%*	*0%*	*N/A*
Saturday Start	*70%*	*60%*	*60%*	*70%*	*40%*	*40%*	*60%*	*50%*
Sunday Start	*25%*	*20%*	*40%*	*30%*	*50%*	*40%*	*40%*	*50%*
Weekday Start	*5%*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
Peak Occupancy	*85%*	*90%*	*95%*	*100%*	*100%*	*90%*	*95%*	*90%*
Shoulder Occupancy	*60%*	*70%*	*75%*	*75%*	*70%*	*50%*	*85%*	*60%*
Off-Season Occupancy	*25%*	*40%*	*30%*	*30%*	*20%*	*20%*	*10%*	*10%*
Typical stays in your properties?	*Longer than 6 nights*	*Longer than 6 nights*	*Longer than 6 nights*	*7 nights*	*Longer than 6 nights*	*Longer than 6 nights*	*Longer than 6 nights*	*Longer than 6 nights*
Would you say that there are more rental properties being constructed in _____?								
Camden?	*N/A*	*No*	*N/A*	*I Don't know*	*I Don't know*	*I Don't know*	*Probably No*	*Probably No*
Currituck?	*Yes*	*Yes*	*Probably Yes*	*Probably Yes*	*Yes*	*I Don't know*	*Yes*	*Probably No*
Dare?	*Yes*	*Yes*	*Probably Yes*	*Probably Yes*	*Probably No*	*I Don't know*	*Yes*	*Probably No*
Pasquotank?	*N/A*	*Probably No*	*N/A*	*I Don't know*	*I Don't know*	*I Don't know*	*Probably No*	*Probably Yes*
Has your business changed since the Covid-19 pandemic?	*Boom during pandemic. Leveling to historic numbers now.*	*My business thrived during the pandemic. Best years ever.*	*It went UP during COVID now leveled down to pre-Covid normals*	*was very up during pandemic, now back to normal*	*It went up and started to stabilize back down*	*It went up during the pandemic and is starting to revert back to pre-pandemic levels (all 3 w/same response)*		

E. Hotel Operator Survey Summary

Note that some hotel names were modified to fit the format of the following tables. “N/A” indicates the participant did not answer that survey element.

Hotel	Number of Rooms	Occupancy in August (%)	In TAZ
Outer Banks Inn	*40*	*70*	*233*
Inn at Corolla	*42*	*65*	*131*
Inn at Corolla	*42*	*75*	*131*
Wingate by Wyndham Kill Devil Hills NC	*70*	*90*	*234*
Whistling Pines Motel - Daily & Extended Stay	*12*	*25*	*502*
Cypress Moon Inn	*3*	*100*	*220*
Travelers Inn of Elizabeth City, North Carolina	*40*	*90*	*494*
See Sea Motel	*23*	*?*	*232*
Sanderling Resort	*129*	*70*	*207*
Outer Banks Motor Lodge	*38*	*50*	*232*
Comfort Inn On the Ocean	*105*	*100*	*232*
Fairfield Inn & Suites by Marriott Elizabeth City	*97*	*75*	*485*
Ramada Plaza by Wyndham Nags Head Oceanfront	*171*	*100*	*232*
The Sea Ranch Resort	*78*	*100*	*237*
Driftin Sands Motel	*12*	*100*	*237*
Days Inn by Wyndham Kill Devil Hills - Wilbur	*54*	*100*	*236*
TownePlace Suites Kill Devil Hills	*151*	*100*	*231*
Comfort Inn Elizabeth City near University	*79*	*Varies*	*417*
Days Inn by Wyndham Elizabeth City	*46*	*50*	*417*
Colonial Inn	*39*	*60*	*248*
Hampton Inn & Suites Dare	*123*	*99*	*128*
Hampton Inn & Suites Currituck	*123*	*85*	*128*
Holiday Inn Express Kitty Hawk	*98*	*100*	*242*

Hotel	Number of Rooms	Occupancy in August (%)	In TAZ
Quality Inn Carolina Oceanfront	*118*	*75*	*236*
Hampton Inn Elizabeth City	*101*	*90*	*418*
Shuters on the Banks	*86*	*100*	*234*
Tower Circle OBX	*11*	*85*	*259*
Cape Hatteras Motel	*N/A*	*N/A*	*259*
Lighthouse View Oceanfront Lodging	*100*	*100*	*259*
Hatteras Island Inn	*60*	*100*	*259*
Swell Motel	*32*	*100*	*259*
Holiday Inn Express Nags Head Oceanfront	*100*	*100*	*250*
Cape Pines Motel	*28*	*Varies*	*259*
The Inn on Pamlico Sound	*13*	*100*	*259*
Econo Lodge	*38*	*100*	*483*
Quality Inn Elizabeth City near University	*98*	*50*	*483*
Hilton Garden Inn Outer Banks/Kitty Hawk	*180*	*100*	*245*
Village Marina Motel	*12*	*85*	*261*
Cavalier by the Sea	*55*	*80*	*234*
Sandspur Motel & Cottage Court	*20*	*80*	*256*
Surf Side Hotel	*68*	*100*	*256*
Blue Heron Motel	*36*	*100*	*256*
Tar Heel Motel	*32*	*100*	*256*
Seahorse Inn and Cottages	*36*	*Varies*	*256*
Comfort Inn South Oceanfront	*105*	*50*	*256*
Travelodge by Wyndham Outer Banks/Kill Devil Hills	*97*	*100*	*236*
SureStay Plus by Best Western Elizabeth City	*N/A*	*N/A*	*426*

CONTACT

J. S. Lane Company, LLC

1167 Harp Street

Raleigh, NC 27604

t: 919.601.9098

w: www.jslanecompany.com

e: jslanempo@gmail.com