Appendix A

Technical Memo #1 - Survey Scoping Report

Currituck Development Group

Mid-Currituck Bridge

Survey Scoping Report

ARUP

Currituck Development Group

Mid-Currituck Bridge

Survey Scoping Report

June 2009

This report takes into account the particular instructions and requirements of our client.
It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party

Job number

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Appendix A

Survey Specifications

1 Introduction

1.1 Overview

Arup have been appointed by the Currituck Development Group (CDG) to prepare an investment grade study for the proposed Mid-Currituck Bridge (the Project) in North Carolina. This report outlines the scoping and data requirements associated with this task, the methods for obtaining the required data, and the subsequent analysis to supplement the study.

The availability and reliability of data is critical to the investment grade study, as it will dictate the level of detail and quality of the traffic and revenue model. The unique project market and characteristics of the area mean that it is vital that the data collection is accurately specified. This will ensure that all market segments (including both visitors and residents) are captured in the study. The implication is that accurate and well defined survey specifications are required to obtain the data suitable for the investment grade study, ensuring that it will be sufficient to secure financing for the project and provide confidence to potential investors.

Four workstreams are outlined within this report which outlines the processes developed for recruiting sub-consultant teams to work with both Arup and CDG to conduct an assessment of the survey tools required for the investment grade study. The following key assignments are analysed:

- Land use / demographic survey;
- Willingness to pay (value of time) survey;
- Traffic count and journey time survey; and
- Realtors survey.

Note that the model specification is not included within this report. It constitutes a separate deliverable within a different milestone.

1.2 Report Structure

The report structure is as follows:

- Section 2 provides project background.
- Section 3 summarizes the development of the land use / demographic survey.
- Section 4 outlines the willingness to pay (value of time) survey.
- Section 5 presents the traffic count and journey time survey.
- Section 6 outlines the realtors survey.

The final survey specifications distributed to all pre-approved companies are included in Appendix A.

2 The Project

2.1 Project Background

The North Carolina Turnpike Authority (NCTA) is authorized to study, plan, develop and undertake preliminary design work on the Mid-Currituck Bridge, a proposed toll facility in the Outer Banks. The Mid-Currituck Bridge is located in northeastern NC and would connect the Currituck County mainland, to Currituck County on the Outer Banks (see Figure 1).

Figure 1: Study Area

The Outer Banks is a 200-mile (320-km) long string of narrow barrier islands off the coast of North Carolina. They cover approximately half the northern North Carolina coastline, separating the Albemarle Sound and Pamlico Sound from the Atlantic Ocean. The majority of the Outer Banks island communities, from Corolla to Hatteras Island, approximately 90 miles south, are prime summer vacation destinations. At the moment there are two crossing south of the Virginia border; the Wright Memorial Bridge (around 32 miles south of the Virginia border) and the Washington Baum Bridge further south. Both crossings are untolled facilities.

2.2 The Project and the wider area of influence

The proposed Mid-Currituck Bridge involves the construction of approximately seven miles of new road from US-158 on mainland Currituck County, to NC-12 on the Outer Banks. The exact designed is currently under development.

This area currently has very limited road access, and according to preliminary analysis, the new bridge will save approximately 35 miles and significant time for some journeys. It will also improve the evacuation time of the outer banks in the event of emergencies.

In the summer, the Outer Banks become heavily congested and the proposed bridge will significantly ease this congestion whilst facilitating continued growth within the area.

The Outer Banks attracts millions of vacationers throughout the year and significant growth has been observed in recent years. Traffic within the area is highly seasonal, with peak weekend flows between June and August about 125 percent higher on the existing Wright Memorial Bridge and the Outer Banks than traffic observed during the rest of the season. Similarly, weekend traffic is about seventy percent higher than weekday traffic.

The existing road infrastructure operates near or at capacity on NC12 between US158/NC12 and Corolla during summer weekends. The new bridge will relieve some of the traffic congestion providing a better environment for locals and visitors.

The new bridge will substantially improve traffic flow conditions on NC12 and US158 and, at the same time, reduce travel time between the mainland and the Outer Banks and improve the overall system efficiency with additional linkage. As a result, it will provide opportunities for sustainable additional development of the northern part of the Outer Banks and the mainland.

In this respect, the Project presents a unique marketing opportunity to leverage the existing Outer Banks travel/tourism industry with tailored marketing strategies to highlight substantial travel time savings, cost savings, and increased accessibility to this beautiful and unique destination.

3 Land Use / Demographic Survey

3.1 Introduction

The demographic, land use and long-term development potential for the Outer Banks will be of key importance to the traffic and revenue forecasts. The development of the Outer Banks will have a marked impact on the potential use of the Project, and the land use survey is required to highlight historical trends, and to produce both land use and socioeconomic projections for use within the forecasting process.

A wide range of data is publicly available, but due to the unique nature of the Outer Banks system and the current economic downturn, it was deemed necessary to obtain up-to-date information. In addition, the surveys will incorporate localised trends regarding the outlook for future rent increases, increasing maintenance and service costs, and financing availability, all of which may impact willingness to acquire residential property in the wider project area.

The outcomes of this survey will feed into all stages of the modelling process. Socioeconomic variables are known to impact on travel behaviour and, as a result, reliable projections are vital to accurately forecasting traffic and revenue associated with the project.

3.2 Survey Requirements

The survey must consider a wide area of influence to include the Outer Banks and mainland Currituck County. Neighboring states to the north and west will also be considered. These areas have been identified as primary sources of seasonal visitors and homeowners and, as such, are key markets which the Project may serve. Within this larger context, however, focus on the areas north of the existing Wright Memorial Bridge (i.e. Southern Shores, Duck, Corolla, Carova and the 4-wheel drive area) is essential.

The land-use and demographic forecasts will be used in the traffic modelling process and will influence the level of traffic forecasted within the area. This highlights the importance of evidentially-based projections.

To ensure that these are as accurate as possible given the available data, Arup requested that the contractor collate existing relevant data and reports from county planning authorities, economic development offices and tourism associations, and review the summary of meetings between the project team and real estate agents held in May 2009. It was also requested that they identify and conduct further interviews with major developers and land owners to establish the nature of potential developments in the Study Area and the likely characteristics and timing of such developments. To assist in this task, Arup will provide the appointed contractor the structured database currently being developed from information provided by major realtors.

The unique nature of the Outer Banks introduces a number of constraints which may not be applicable in other locations. Emerging findings from the realtors' survey highlighted the importance of environmental and infrastructure / utility restrictions, and Arup requested additional consideration of these factors in delivering the forecasts.

3.3 Scoping Methodology

The scoping of the land use survey followed the following process:

1. Arup developed a survey specification based on our experience in similar projects and studies to request all data which would be required for the development of the traffic and revenue forecasts.
2. With assistance from CDG and NCTA, suitable firms with known experience that were capable of conducting the survey were identified.

3. Following the approval of the specification from CDG and NCTA, the survey brief was circulated to all pre-approved sub-consultants.
4. Arup were then involved in a lengthy process responding to questions and clarifications raised by the potential consultants prior to receiving their proposals.

3.4 Deliverables

The following deliverables will be supplied to Arup by the appointed contractor:

- Land use and demographic forecasts representing 5, 10, 20 and 30 year horizons highlighting the development potential of the Outer Banks and mainland Currituck County. This will include forecasts of selected characteristics of seasonal renters from locations identified as principal sources of seasonal renters, and independent socioeconomic forecasts, (i.e. population, households, household income, at place employment and car ownership rates) for each of the defined horizons.
- GDP and GRP forecasts for 5, 10, 20 and 30 year horizons for the study area and the US.
- A final report, summarizing all parties interviewed, the survey methodology, and a summary of all land-use and demographic horizons.

3.5 Sub-Consultant Requirements

All pre-approved consultants were asked to provide capability statements outlining their experience in similar studies and locations. All capability statements were circulated internally to ensure that only those companies with the required experience and skills were invited to bid.

The following requirements were identified as key issues within the proposals:

- It is essential that the consultants demonstrate knowledge of the study area, including relevant issues and constraints which will impact on the long-term development of the area.
- A description of the methods for administering the surveys, including potential developers, realtors, public officials and planners which may be interviewed.
- Resumes of key staff expected to participate
- A proposed work schedule.
- Fee quotation, with direct expenses quoted separately.

3.6 Survey Specification

The land use and demographic survey specification can be found in Appendix A.

4 Willingness To Pay (Value of time) Survey

4.1 Introduction

For a large proportion of trips within the study area, the Project will offer a reduction in travel times. In order to produce traffic and revenue forecasts, it is necessary to estimate the value that travellers are willing to place on their time when deciding on their route choice. The value of time (VOT), expressed in dollars per hour, is used to compare the value of time saved using a toll road with the toll cost incurred and, in this context, is more correctly a measure of the value of travel time savings. VOT is an individual preference for spending money to save time and this information will be used to build toll diversion models for use within the traffic and revenue model. It is critical to the traffic and revenue forecasts for the Project.

The willingness to pay survey will be conducted through a Stated Preference (SP) survey. SP surveys are a form of attitudinal survey and are strongly recommended when a substantially new alternative is being introduced and there is little historical evidence of how people might respond to this alternative.

The willingness to pay survey is required to collect data on current travel behaviour, present respondents with information about the proposed toll road, and, with the use of stated preference experiments, collect information that can be used to estimate travellers' values of time and their propensity to use the proposed toll road under a range of possible future conditions.

4.2 Survey Requirements

The primary output of the willingness to pay will be the VOT for a variety of traveller segments. Several segments were specified to reflect the unique aspects of both the Project and the study area. Most notably, separate VOTs were specified for local residents, defined as those living in Pasquotank, Camden, Currituck and Dare Counties, and visitors to the area. By segmenting the sample population in this way, the hypothesis that use of the bridge and willingness to pay the toll will differ between local residents and tourists can be explored and, ultimately, modelled.

In a similar manner, household income and trip purpose have been identified as segmenting variable. There is a strong correlation between VOT and personal or household income and with trip purpose.

In order to ensure that reliable estimates of the VOT for each segment are produced, Arup have specified several quotas to be met within the surveys. These have been defined to ensure that the VOT have been based on a sufficiently large sample to minimise potential error.

In addition to VOT, the collection and calculation of supplementary information has been requested, including the socio-economic profile of respondents (to include vehicle type, place of residence (zip code), trip origin and destination, household size, gender, age, income bracket, journey distance, time of trip etc.) A range of additional questions covering aspects such as car occupancy, trip frequency, respondents' preferred method(s) of toll collection and responders' possession of ETC tag will also be asked. These data will provide important information which can be used both within the traffic and revenue models, and also in defining the tolling strategy.

It should be noted that at the time of writing this report it is not known if the above market segments will yield significant variations on the calculated values of time however they have been specified in the data collection based on our experience on similar projects and academic literature.

4.3 Scoping Methodology

The scoping of the willingness to pay survey followed the following process:

1. Arup developed a survey specification based on our experience in similar projects and studies to request all data which would be required for the development of the traffic and revenue forecasts.
2. With assistance from CDG and NCTA, suitable firms with known experience that were capable of conducting the survey were identified.
3. Following the approval of the specification from CDG and NCTA, the resulting document was circulated to all pre-approved sub-consultants.
4. Arup were then involved in a lengthy process responding to questions and clarifications raised by the potential consultants prior to receiving their proposals.

4.4 Deliverables

The following deliverables will be supplied to Arup by the appointed contractor:

- Arup will receive the complete tabulation of all survey results. The contractor is required to verify all the survey data, and to undertake checks such that only robust clean data is supplied to Arup.
- The contractor is also required to provide a 'Report of Surveys', covering all factual matters relating to the conduct of the survey, sampling, cross tabulations and results.
- A draft report is expected within one week of the final survey date.

4.5 Sub-Consultant and Proposal Requirements

All pre-approved consultants were asked to provide capability statements outlining their experience in similar studies and locations. Due to the unique nature of the study area, any previous work in touristic areas was specifically requested.

The following requirements were identified as key issues within the proposals:

- Brief methodology.
- A description of the methods for administering the surveys, including locations for the face to face surveys and a short description of the online surveys.
- Resumes of key staff expected to participate.
- A proposed work schedule.
- Fee quotation, with direct expenses quoted separately.

4.6 Survey Scope

The willingness to pay survey specification can be found in Appendix A.

5 Traffic Count and Journey Time Surveys

5.1 Introduction

A series of traffic surveys conducted within both Currituck and Dare Counties will be required in order to establish the existing traffic profile within the study area. The reliability of this data is critical to the traffic and revenue modelling as it will be used to produce a validated base year traffic model, and this will serve as the base for developing future year traffic forecasts.

Classified automatic traffic counts (ATC), turning movement manual classification counts (MCC) and journey time surveys, were included in the scope to establish the existing traffic profile within the study area, the nature of traffic growth and the current level of service on the existing untolled facilities.

This data will then be combined with data from the NCDOT permanent traffic monitoring stations to highlight monthly and seasonal traffic volumes for those periods when surveys are not conducted, and for calculated appropriate annualization factors for both traffic and revenue. Three permanent count locations exist in the vicinity of the project study area as follows:

1. US-158 at the east end of the Wright Memorial Bridge.
2. NC 12 at the north end of the Oregon Inlet Bridge.
3. US-64 at the east end of the Alligator Bridge.

5.2 Survey Requirements

5.2.1 Survey Periods

Arup requested surveys to be conducted over two periods as follows:

- Peak season – the week commencing July 23rd 2009; and
- Off-peak season – the week commencing September 17th 2009.

Two survey dates were defined as a solid understanding of how the traffic profile and level of service varies between the peak and off-peak seasons will be critical in developing the base year model and appropriate traffic and revenue annualization factors. The influx of tourists causes traffic volumes within the study area to peak from June through August, which corresponds with the traditional summer travel season on the Outer Banks. Traffic volumes on peak season weekends are typically 125 percent higher than off-peak weekends. As a result, tourists and visitors to the area will make a significant contribution of visitors to the overall revenue and it will be important to accurately capture this effect within the traffic and revenue model.

5.2.2 ATC Surveys

Arup requested ATC counts at 14 sites, with each site providing at least 2 weeks of continuous data. Allowances were made within the proposal such that, in the event of extreme weather conditions, the ATC equipment could be lifted and then resited at a later date until a total of 2 weeks of data had been collected.

This data will primarily be used to assess historical traffic growth, seasonal and hourly variations in traffic flow, and in the link-based validation of the base year traffic model.

5.2.3 MCC Surveys

One MCC count was requested, covering the two junctions of NC12 and US158 to the west of the Wright Memorial Bridge. This is the key intersection for all traffic heading north on NC12 to Duck, Sanderling and Corolla. To ensure this turning movement validates within the base year model, turning movement counts have been requested for four days (Friday to Monday), from 7AM to 7PM.

5.2.4 Journey Time Surveys

Three journey time routes were specified, covering the key sections of US158, NC12 and US64 within the study area. Arup defined quotas for the number of runs in each direction in each daily time period (AM peak, PM peak, off peak), such that reasonable conclusions could be determined about the journey time variability, and to minimise the effect of any stochastic events (such as accidents for example).

The speed and journey time surveys will be used to establish the level of service of the current untolled facilities, and to validate the base year model in terms of travel times and speeds.

5.2.5 Specific Survey Criteria

Details of the specific survey criteria can be found in Appendix A.

5.3 Scoping Methodology

The scoping of the traffic and journey time survey followed the following process:

1. Arup developed a survey specification based on our experience in similar projects and studies to request all data which would be required for the development of the traffic and revenue forecasts.
2. With assistance from CDG and NCTA, suitable firms with known experience that were capable of conducting the survey were identified. Initially, 3 firms were identified. However, this was expanded at a later date to 8 companies, all of whom were provided with the specification.
3. Following the approval of the specification from CDG and NCTA, the resulting document was circulated to all pre-approved sub-consultants.
4. Arup were then involved in a lengthy process responding to questions and clarifications raised by the potential consultants prior to receiving their proposals.

5.4 Deliverables

The following deliverables will be supplied to Arup by the appointed contractor:

- Arup should receive all survey results following the conclusion of each survey period (Peak and Off Peak season)
- The contractor is also required to provide a Report of Surveys which shall cover all factual matters relating to the conduct of the survey such as times, locations, dates, weather and particularly addressing any issues having a bearing on the data recorded including sample rates or accuracy (such as accidents and adverse weather).

5.5 Sub-Consultant and Proposal Requirements

All pre-approved consultants were asked to provide capability statements outlining their experience in similar studies and locations. All capability statements were circulated internally to ensure that only those companies with the required experience and skills were invited to bid.

The following requirements were identified as key issues within the proposals:

- Resumes of key staff expected to participate
- A proposed work schedule.
- Fee quotation, with direct expenses quoted separately.

5.6 Survey Scope

The traffic count and journey time survey specification can be found in Appendix A.

6 Realtors Survey

6.1 Introduction

In addition to the land use surveys, a separate survey of the realtors based on the Outer Banks was commissioned. The realtors maintain detailed information regarding vacationers holidaying on the Outer Banks and, through a series of interviews and data requests, this will be available for integration within the traffic and revenue studies.

The realtors survey comprises of two separate phases. The first phase involved the collection and assessment of information and perspectives from leading realty firms in Currituck and Dare counties regarding general aspects of the rental market, historic and projected tourism, development and rental trends, issues and experience with owners and renters, as well as opinions on the proposed Mid-Currituck Bridge.

The second stage constituted a request for historical data, providing information including the city and state of origin of holidaymakers, the classification of properties, property incomes and occupancy rates.

The purpose of the above survey is more qualitative than quantitative.

6.2 Survey Requirements

The realtors survey specification incorporated a variety of research objectives. Phase 1 will provide key insights into the tourism industry from those who are most knowledgeable. It will highlight key growth areas, constraints and local issues regarding the tourist industry, insight into the rental market and local opinions on the Project.

Phase 1 will highlight key factors which will dictate traffic flows through the study area, including key aspects such as rental seasonality and occupancy rates, and highlight how the rental market responds to broader issues such as the current economic downturn. Whilst this data will not all feed directly into the traffic and revenue forecasts, it is useful qualitative information.

Phase 2 of the project will involve the collection and assessment of data regarding the firms' existing rental stock (location, number of units, type of unit, number of bedrooms and parking capacity). Additional data may include but is not limited to:

- Percentage of rental properties by type, size and location.
- Historic occupancy rates by season on the rental market.
- The number of families/groups in current rental properties annually, if available.
- Seasonal fluctuations in the rental market and rates.
- ZIP codes of origin for clients during the last five years, if available.

A pilot study has been incorporated into Phase 2, whereby data has been requested from three realtors to identify any potential issues with the process and deliverables required. The data request will then be revised subject to the outcomes of the pilot study prior to supplying the data request to the remaining companies.

The data collected from Phase 2 of the realtors survey will be made available to the appointed land use / demographic contractor for integration with their land use and planning horizons.

6.3 Deliverables

The following deliverables will be supplied to Arup by the appointed contractor:

- The contractor is also required to provide a Report of Surveys, covering all factual matters relating to the survey including details regarding interviewees and firms, their comments and opinions.

The contractor is also required to provide, in liaison with the realtors, a database including information regarding rental properties by type, size, location, occupancy rates, zip codes of origin for clients, seasonal fluctuations etc.

Appendix A

Survey Specifications

A1 Land-Use / Demographic Specification

A1.1 Introduction

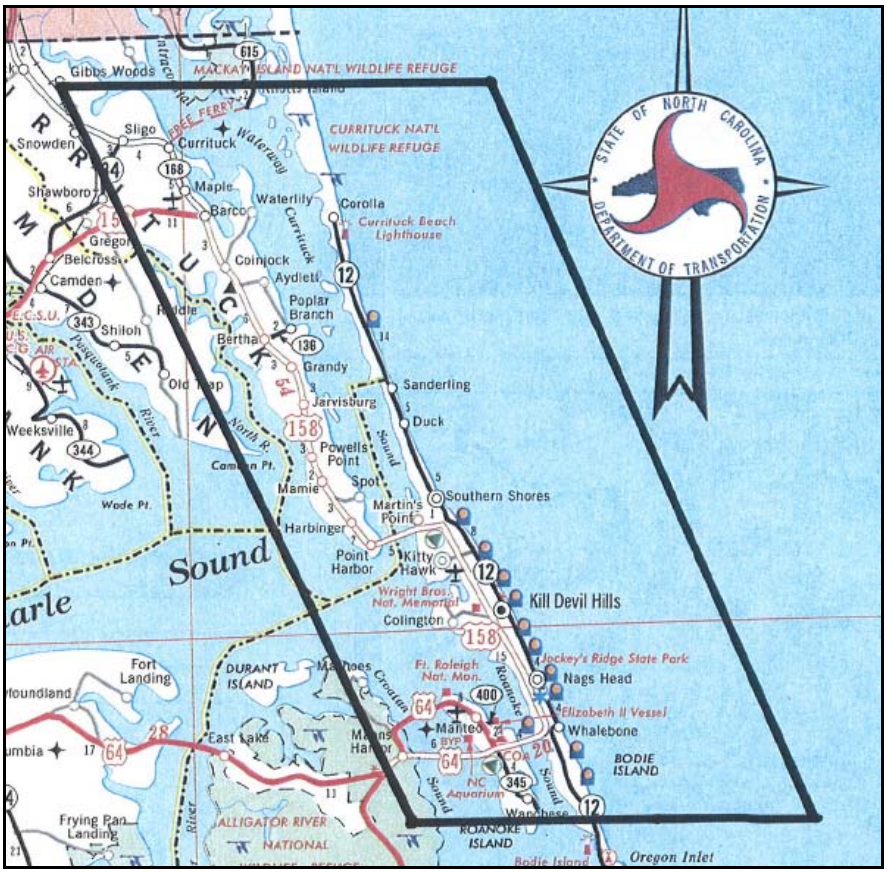
The North Carolina Turnpike Authority (NCTA) is authorized to study, plan, develop and undertake preliminary design work on the Mid-Currituck Bridge, a proposed toll facility in the Outer Banks. The Mid-Currituck Bridge is located in northeastern NC and would connect the Currituck County mainland, to Currituck County on the Outer Banks. While the exact design and location of the bridge is still under development, preliminary design assumes that the proposed bridge would connect NC12 (on the Currituck County Outer Banks) to US158 (in the mainland of Currituck County).

NCTA selected the Currituck Development Group to develop the project. Arup was appointed by the Currituck Development Group as traffic and revenue advisors for the project.

A preliminary analysis was conducted by Arup in 2008, with the current investment grade analysis being developed this year. As part of this investment grade analysis, Arup will be contracting the forecasting for demographics, land use, and long-term development potential for the Outer Banks. This should include consideration of mainland Currituck County and select locations in both North Carolina and the neighboring states to the north and west that have been identified as primary sources of seasonal visitors and homeowners.

Within this larger context, special attention should be focused on areas north of the existing Wright Memorial Bridge (i.e. Southern Shores, Duck, Corolla, Carova/four-wheel drive area – "Study Area".

Figure A5 - Study Area



Arup will provide the appointed contractor with any studies previously completed that provide relevant information and data.

We would be grateful if you could provide a quotation and details of your availability according to the specification outlined below.

A1.2 Specification

Arup require that the contractor:

- Collect existing relevant data, reports, studies, regulations, etc. from county planning authorities, economic development offices, tourism associations, etc.
- Review the summary of meetings between the project team and real estate agents held in May 2009. Thereafter, identify and conduct further interviews with major developers and land owners to establish the nature of potential developments in the Study Area and the likely characteristics and timing of such developments.
- Incorporate in land use and demographic forecasts, the changes in taxes (local, state and federal), financing availability and terms, costs of property maintenance and services, costs of rental, and the outlook for future rent increases that may impact willingness to acquire residential property in the Study Area.
- Identify and conduct interviews with major employers (including hotels and other transient accommodation) to size current and future markets for the Project through year round and seasonal employment on the Outer Banks.
- Interview key public officials in local, state and federal agencies and others who control or have influence over the long-term growth of the study area.
- Develop 5, 10, 20, and 30-year land use forecasts for development potential of the Outer Banks and mainland Currituck County, with specific focus on the areas north of the existing Wright Memorial Bridge. The exact years will be agreed in consultation with Arup.
- In consultation with Arup, develop demographic forecasts of selected characteristics of seasonal renters from locations identified as principal sources of seasonal renters. To facilitate this task, ARUP will provide a structured database currently being developed from information provided by major realtors.
- Develop independent socioeconomic forecasts, (i.e. population, households, household income, at place employment and car ownership rates) for each of the years defined above.

Please note that all forecasts will need to be produced in a zoning system agreed in consultation with Arup.

Three sets of forecasts are required; a base case, and two variations around the base depending on the likelihood of future development.

- In addition, Arup require a GDP forecast for 5, 10, 20 and 30 year horizons for the study area. Of particular importance will be the correlation of the GDP forecast with the socioeconomic and land use forecasts. This item should be quoted separately in the contractor's proposal.

It is essential that the consultants demonstrate knowledge of the area and incorporate accordingly the following restrictions that could affect future developments:

- Environmental restrictions; and
- Infrastructure / Utility restrictions.

A1.3 Deliverables

The following deliverables will be required:

- Proposed methodology for collecting and analyzing information.
- Proposed list of places/people from whom to collect information/interview.
- Summary of data/interviews.
- Land use and socioeconomic forecasts for the above horizons in a format to be agreed with Arup.
- Draft Final Report.
- An update of land use and socioeconomic forecasts (if required)
- Final Report

A1.4 Timescales

Assuming contracting is complete and work begins on or around July 1, 2009, land use and development forecasts and the Draft Final Report will be completed and delivered to Arup for comments within 60 days. The Draft Final Report will be revised accordingly by the consultant within 7 days.

Additional comments on the report and revision of forecasts (if required) will be incorporated prior to issuing the Final Report. The Final Report will be required within 7 days of receipt of comments.

A1.5 Proposal Requirements

Please provide details of the following by close of business on June 18, 2009:

- The proposed methodology for the above.
- A quotation for professional fees and direct expenses including all fees and expenses for all work up to and including delivery of a draft final report. A second budget for updates and preparation of a final report may be requested if required, assuming these occur within 9 months of notice to proceed. Please provide a separate quotation for deriving GDP forecasts.
- Capability and similar studies conducted.
- Knowledge of the study area.
- Resumes for key staff

A1.6 Contact Details

Please direct any questions to:

Ian McGookin

Email: Ian.McGookin@Arup.com

Tel: +44 (0)20 775 52286

A2 Willingness to Pay Specification

A2.1 Introduction

The North Carolina Turnpike Authority (NCTA) is authorized to study, plan, develop and undertake preliminary design work on the Mid-Currituck Bridge, a proposed toll facility in the Outer Banks. The Mid-Currituck Bridge is located in northeastern NC and would connect the Currituck County mainland, to Currituck County on the Outer Banks. While the exact design and location of the bridge is still under development, preliminary design assumes that the proposed bridge would connect NC12 (on the Currituck County Outer Banks) to US158 (in the mainland of Currituck County).

Arup has been appointed by ACS (the Sponsor) to undertake the Sponsor's traffic and revenue forecast. A preliminary analysis was conducted in 2008, with the current investment grade analysis being developed this year, as the Sponsor has since been appointed to develop the project. Arup require a stated preference survey to obtain detailed information that can be used to quantify how sensitive travellers would be to the tolling and travel-time changes in Currituck and Dare Counties, North Carolina in relation to the proposed Mid-Currituck bridge.

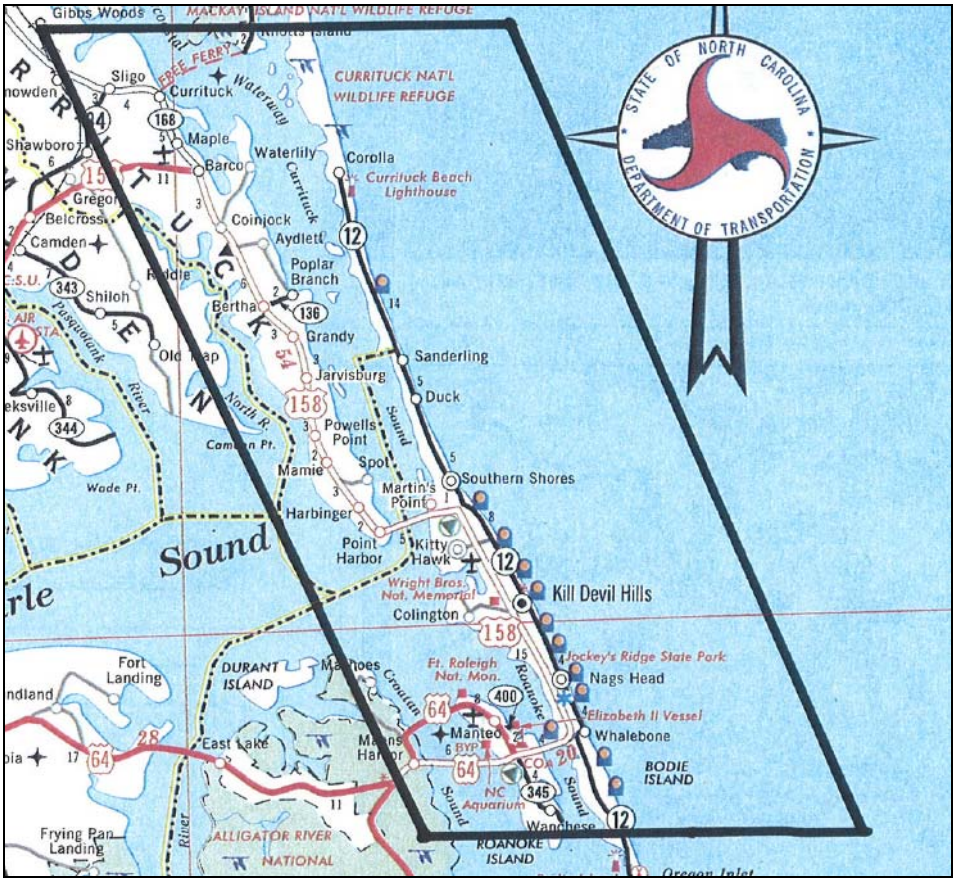
The survey is required to collect data on current travel behaviour, present respondents with information about the proposed toll road, and, with the use of stated preference experiments, collect information that can be used to estimate travellers' values of time and propensity to use the proposed toll road under a range of possible future conditions.

We would be grateful if you could provide a quotation and details of your availability according to the specification outlined below.

A2.2 Study area

The study area is shown below in Figure 4. It includes Currituck County, including the northern communities of North Carolina's Outer Banks, and Dare County. The area of specific interest is bounded by the black polygon.

Figure A4 – Study Area



The Outer Banks is part of the North Carolina barrier island system which maintains a vibrant tourist industry. In 2005, the population of Currituck County grew from 22,500 in the off-season to 97,000 in the peak season. To the north of Wright Memorial Bridge lie the settlements of Duck, Sanderling and Corolla. These settlements are sparsely populated, with just 1100 permanent residents in 2000. This area is dominated by cottage rentals and small-scale tourist facilities. The area to the south of Wright Memorial Bridge, including Kitty Hawk, Kill Devil Hills and Nags Head, is more developed. These centres include larger tourist attractions and centres of employment.

A2.3 Definitions

Where referenced below, the following definitions should be assumed:

- Local Residents – residents of Pasquotank, Camden, Currituck and Dare Counties.
- Visitors – all other respondents who are not permanent residents of the above named counties.

A2.4 Segmentation

The surveys should be segmented in a way that can provide information regarding the value of time for the following segments:

- Local Residents / Visitors
- Household Income
- Trip Purpose (Business, Commuting, Vacation Start / End, Other)

The number of respondents within each segment should fulfil predefined quotas (outlined in more detail below in Section A2.5).

A2.5 Quotas

A minimum sample of 1,600 respondents is required. The required segmentation attributes are outlined below in Table A1,

Table A1: Required Quotas by Segmentation Variable

Income Band / **Trip Purpose**	Band 1 (to be defined by contractor in consultation with Arup)	Band 2 (to be defined by contractor in consultation with Arup)	Band 3 (to be defined by contractor in consultation with Arup)	Band 4 (to be defined by contractor in consultation with Arup)	Total
Business	100	100	100	100	400
Commute	100	100	100	100	400
Vacation Start/End	100	100	100	100	400
Other	100	100	100	100	400
Total	400	400	400	400	1600

Income Band / **Respondent Type**	Band 1 (to be defined by contractor in consultation with Arup)	Band 2 (to be defined by contractor in consultation with Arup)	Band 3 (to be defined by contractor in consultation with Arup)	Band 4 (to be defined by contractor in consultation with Arup)	Total
Local Residents	200	200	200	200	800
Visitors	200	200	200	200	800
Total	400	400	400	400	1600

A2.6 Survey Administration

A2.6.1 Survey Methods

Arup request a combination of administration methods in order to minimise potential bias and sampling issues, including the following:

1. Face-to-face administration of the survey to respondents intercepted at key activity sites in Currituck and Dare Counties.
2. Online administration of the survey, potentially with assistance from realtors and other key businesses in the study area.

All surveys should be preceded by a series of screening questions to ensure that all respondents are 'in-scope' (i.e. that their responses are referring to journeys which may potentially use the new toll facility). The exact survey locations and design of surveys are to be agreed with Arup and ACS prior to commencing the surveys.

A2.6.2 Pilot Survey

A pilot survey consisting of 20 to 50 respondents will be conducted and the results supplied to Arup prior to commencing the remaining surveys. This is to enable any emerging issues to be assessed, and adjustments to be made where necessary.

A2.7 Analysis

Arup require the Contractor to provide the following analysis for each traveller segment (as outlined above in Section A2.4):

- Reliable estimates of the behavioural value of time (VOT) by market segment as defined above.
- Reliable estimates of a toll road constant where significant to represent improved journey quality, increased reliability etc. in comparison to the existing untolled facility.
- Estimates of a penalty constant for stop/start conditions on the existing highway network.

In addition, Arup require the collection of supporting data on:

- The socio-economic profile of respondents (to include vehicle type, place of residence (zip code), trip origin and destination, household size, gender, age, income bracket, journey distance, time of trip etc.).
- Car occupancy
- Frequency of trips.
- Respondents' preferred method(s) of toll collection.
- Responders' possession of ETC tag

A2.8 Deliverables

Arup should receive the complete tabulation of all survey results within 5 working days after the last survey date. We require the Contractor verify all the survey data, and to undertake checks such that only robust clean data is supplied to Arup.

The Contractor shall also provide a Report of Surveys which shall cover all factual matters relating to the conduct of the survey, sampling, cross tabulations and results.

A draft report is expected within one week of the final survey date..

A2.9 Proposal requirements

Please submit a proposal outlining the following by close of business on Wednesday 24th June:

- Company experience in similar studies
- Resumes of key staff expected to participate
- Comments and suggestions on the above scope of work and on the suggested sampling
- Methods for administering the surveys, including locations for the face to face surveys and a short description of the online surveys.
- Proposed work schedule
- Fee quotation, with direct expenses quoted separately.

A3 Traffic and Journey Time Survey

A3.1 Introduction

Arup require a series of traffic surveys conducted in Currituck and Dare counties in North Carolina (Figure 1), including:

- Classified automatic traffic counts (ATC);
- Turning Movement Manual Classification Count (MCC); and
- Journey time surveys.

All surveys are required to be conducted over two periods as follows:

- Peak season – the week commencing July 23rd 2009; and
- Off-peak season – the week commencing September 17th 2009.

The general locations of the sites are outlined in the figures within this document. The precise locations will be determined by site inspection by the Contractor in correspondence with Arup.

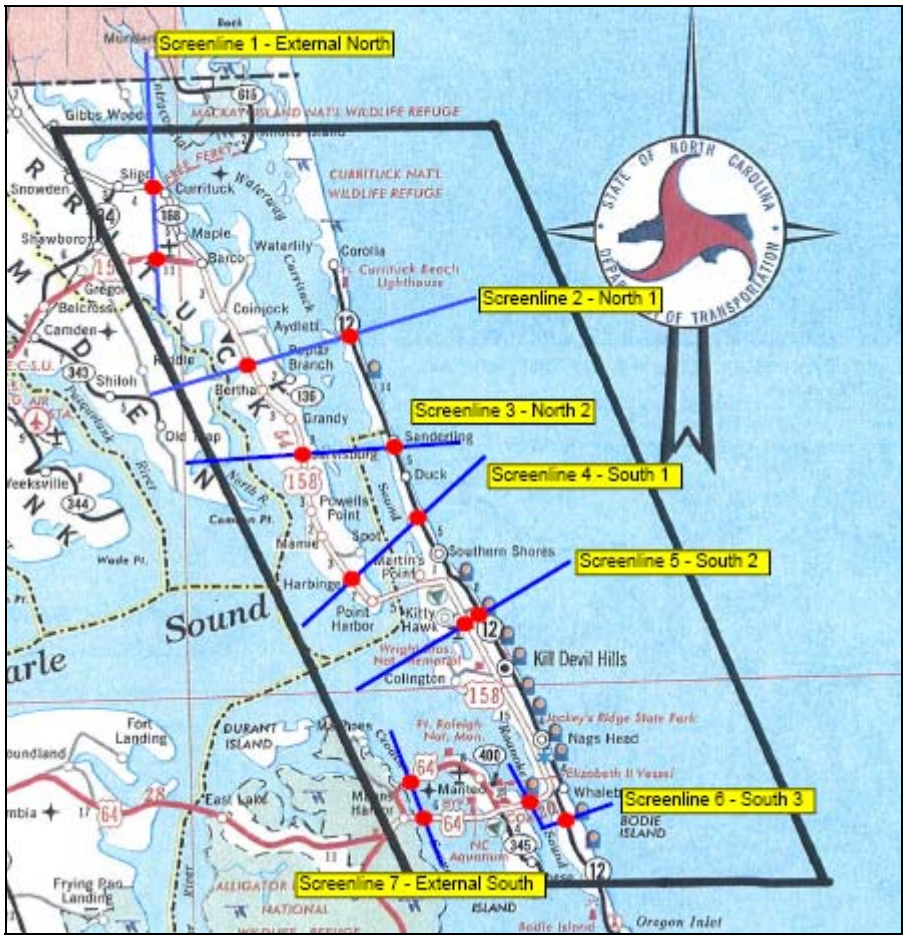
We would be grateful if you could provide a quotation and details of your availability according to the specification outlined below.

A3.2 Survey Specification

A3.2.1 Classified ATCs

Classified ATC counts are required at all locations highlighted in Figure A1:

Figure A1: ATC Locations



Classified automatic traffic counts (ATC's) are required at all locations in both directions of flow. Each ATC site must provide at least 2 weeks of clean, continuous data. In the event of extreme weather or hurricane activity, we would request that the counters be lifted and then re-sited until a total of 2 weeks of data has been obtained.

ATC's shall be placed to record from before 00.01hrs on the first day and shall be lifted not earlier than 23.59 on the last day. We request that the Contractor shall visit each ATC site regularly during the survey period o ensure calibration of the count, and to verify operation for at least a 15-minute period.

A3.2.2 Turning Movement Manual Classified Counts

Manual classification counts are need at the junctions of US-158 with Route 12, as shown on Figures A2 and A3.

Figure A2: MCC Location

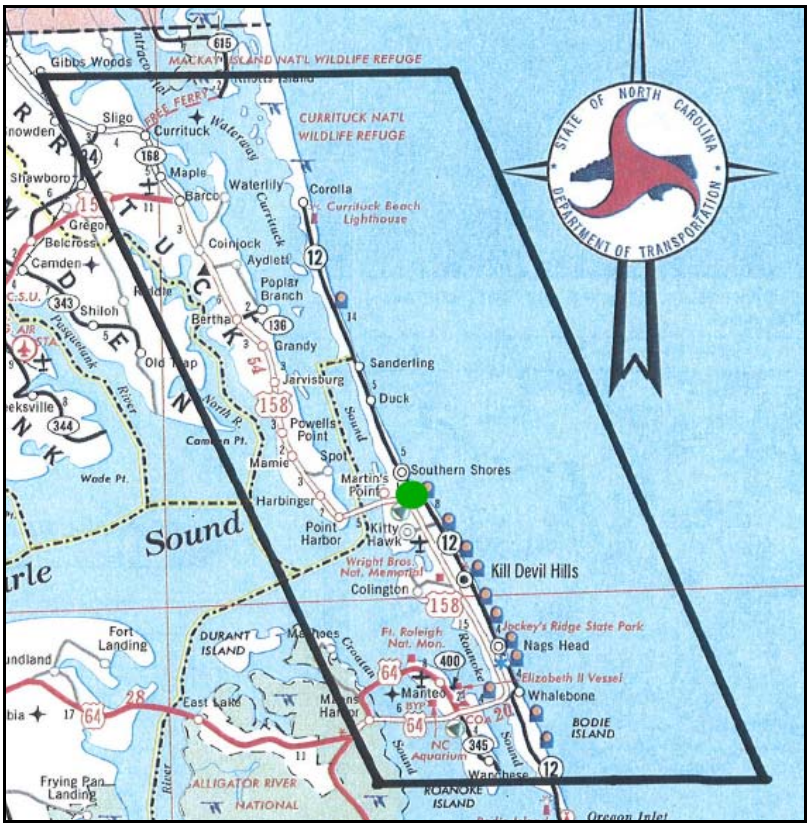
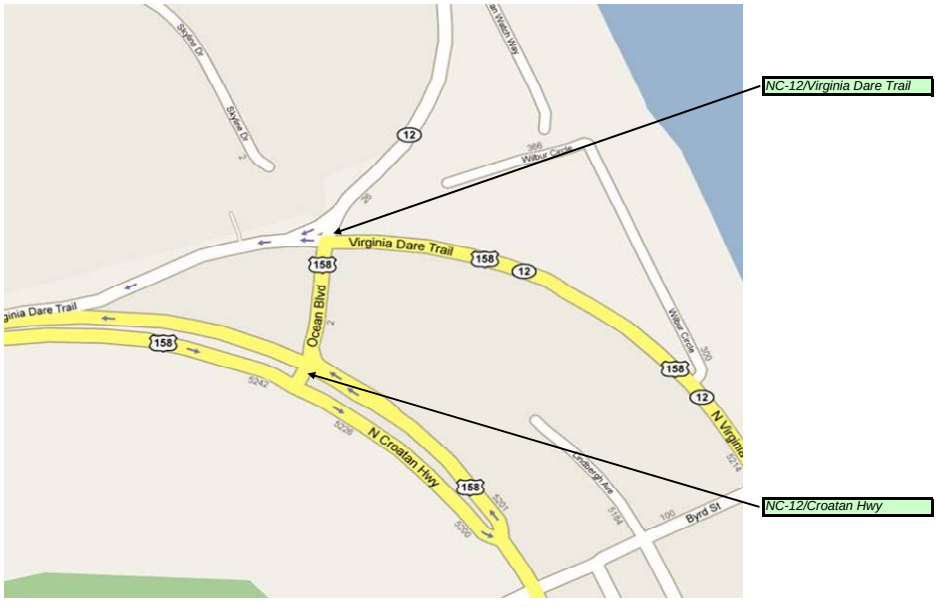


Figure A3: MCC Location



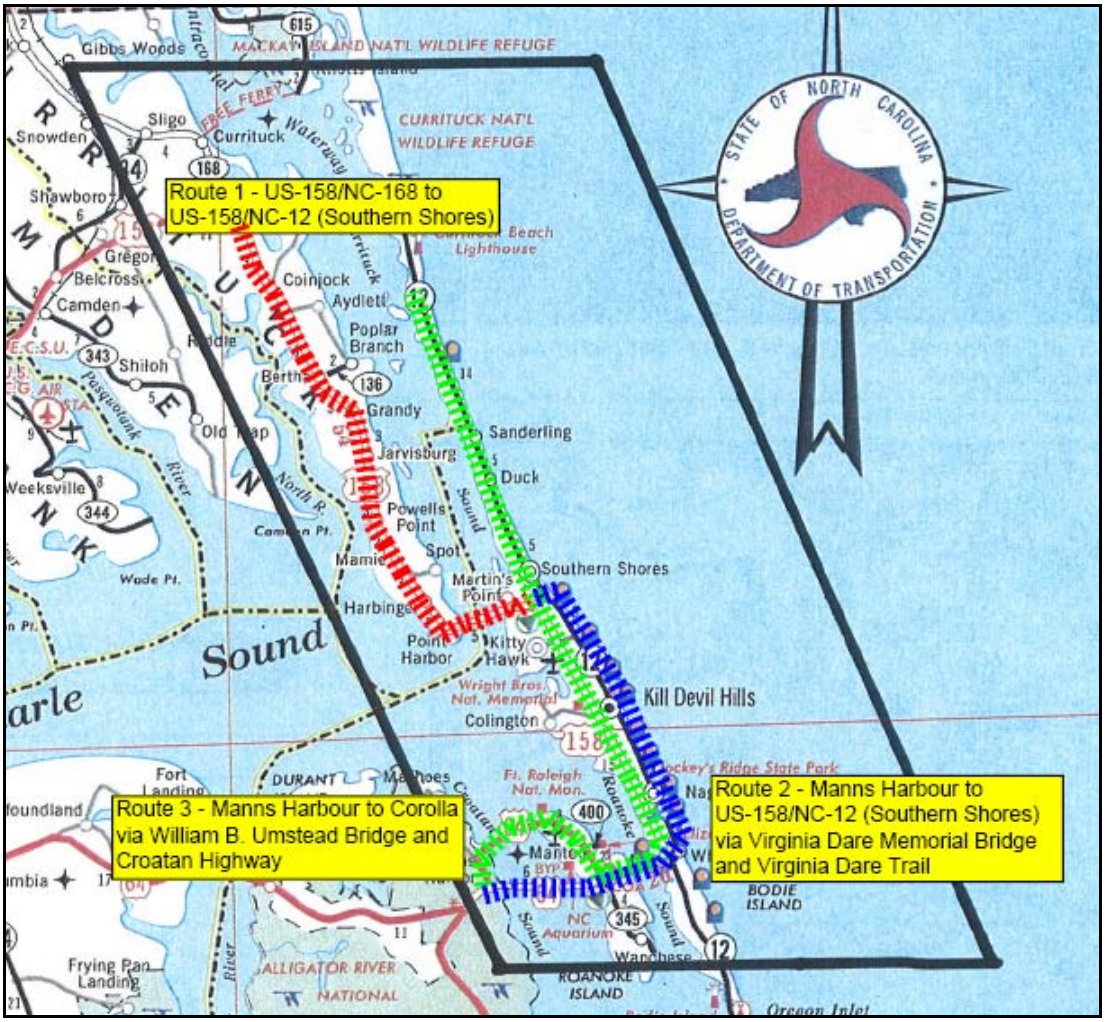
Classified counts are required for all turning movements at the two junctions, and schematics are to be provided with the results. The surveys need to be conducted on a Friday, Saturday, Sunday and Monday from 7am to 7pm. The surveys are required within the same period as the ATC surveys.

In parallel, the surveyors should record the number of cars that display an electronic toll collection (ETC) tag on the windscreen if possible.

A3.2.3 Journey Time Surveys

Journey time surveys are required along the routes outlined in Figure A4.

Figure A4: Journey Time Routes:



Journey time surveys need to be conducted on two typical weekdays (Tue, Wed or Thu) during each of the peak and off-peak seasons, over two weekends (Sat and Sun) during the peak season, and one weekend during the off-peak season.

During weekdays, a survey must be conducted in each direction on each route during each of the following time periods during:

a. AM peak - between 8am and 10am;

b. Inter-peak – between 10am and 4pm; and

c. PM peak – between 4pm and 6pm.

During weekends, we require surveys to correspond to the following time periods:

a. Weekend AM peak - between 9am and 11am;

b. Weekend PM peak – between 3pm and 6pm; and

c. Weekend Inter-peak – between 11am and 3pm.

A minimum of six runs must be conducted per time period and direction during the Peak season, and three runs per time period and direction during the Off-Peak season.

A3.3 Data Analysis and deliverables

Arup should receive the complete tabulation of all survey results within 5 working days after the last survey date. The results should be tabulated in 15 minute and hourly intervals by vehicle type.

We require the Contractor to verify all ATC data, and to undertake range checks such that only robust clean data is supplied to Arup. A separate file is to be provided for each survey site.

At the conclusion of the contract, and together with the provision of the data, the Contractor shall provide a Report of Surveys which shall cover all factual matters relating to the conduct of the survey such as times, locations, dates, weather and particularly addressing any issues having a bearing on the data recorded including sample rates or accuracy (such as accidents and adverse weather).

A3.4 Proposal requirements

Please provide a quotation and details of your credentials for the above scope of work by the end of Wednesday June 17, 2009. The quotation should be presented separately for each activity described above with a unit cost and total cost where applicable.

A3.5 Contacts

Please direct any questions to:

Ian McGookin

Email: Ian.McGookin@Arup.com

Tel: +44 (0)20 775 52286

Appendix B

Technical Memo #2 - Real Estate Market Assessment Report

N.C. TURNPIKE AUTHORITY, THE MID-CURRITUCK DEVELOPMENT GROUP AND ARUP

Mid-Currituck Sound Bridge
Phase I Research Study

July 10, 2009

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Raleigh, NC 27604

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Raleigh
Washington, D.C.
Dubai

"Without the bridge we will steadily choke."

Currituck County realtor

Executive Summary

The proposed Mid-Currituck Sound Bridge (MCB) has been discussed for the better part of the last 20 years in the Currituck County community. In partnership with the Currituck Development Group (CDG), the N.C. Turnpike Authority ("the Authority") is exploring the potential and feasibility of toll financing to build and operate the bridge. The Authority authorized CDG and its subcontractors, Arup and The Catevo Group, to conduct an integrated qualitative/quantitative study about the project with realty firms in the community. This document summarizes the results of the first phase comprising informal discussions held in May 2009 designed to gather qualitative data from 12 of the area's leading realtors. While the impressions drawn from these conversations are not suitable input for a quantitative planning model, they do indicate strong support for the MCB among realtors and a willingness to help move the project forward as quickly as possible.

Historically strong, the Currituck Outer Banks rental market continues to be healthy with 2009 occupancy rates in peak season projected to keep pace with recent years even in the midst of a recession. With an average rental unit size of six bedrooms, the area attracts a large number of families and multiple families with children; a sizable portion of those families are repeat visitors. The average group size is estimated to be between 10 and 15 individuals, though groups of 20 to 30 are not uncommon. The majority of visitors come from states in the Mid-Atlantic and Northeastern regions of the U.S., so drives of six to eight hours or more are typical.

While definitions differ among realty firms, peak season generally begins in mid- to late-June and ends in late August, consistent with the school calendars in the vacationers' home districts. Shoulder seasons are most often defined as the three weeks prior to and following the peak season (in general, May and September). Frustration with traffic congestion during peak season is growing and rental firms are exploring strategies to help alleviate the problem (including fee-based early check-in times). Virtually all leases are Saturday to Saturday or Sunday to Sunday, though some realtors are experimenting with Friday-to-Friday leases to help guests avoid weekend traffic jams.

Development is underway in the county on both the mainland and island though it is proceeding slowly in the current economic climate. While there is some available land for development in Corolla (and several developments underway), the potential for residential growth is greatest in the Carova area north of Highway 12. This community, accessible now only by four-wheel drive, has 3,000 platted lots of which only 300 have been developed. In addition, local officials expect many of the homes in Duck to be replaced by larger structures within the next decade. And while most guests leave the island only at the end of their vacations, local officials and some private groups are seeking to expand tourism options on the mainland.

The majority of realtors are willing to explore opportunities to bundle tolls as part of the rental contracts and all are willing to include links on their sites to the Authority's Web site. Some are willing to manage distribution of toll materials, such as transponders or bar codes, and offer toll passes as guest incentives while others do not want to be involved in this process at all. The Authority would do well to develop a range of options from which realtors could select based on their comfort level. In addition, the realtors urged the Authority to offer a range of payment options at the MCB, including cash lanes. In addition, realtors are willing to purchase toll passes at bulk rates for their office employees and housekeeping staff members who commute to and from the island on weekend ends. Traffic congestion is a major concern for these individuals, many of whom live as far as two hours away from the island.

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Key Findings

- "Peak season" is late June/early July through the end of August, with occupancy rates between 90-100 percent. Shoulder season lasts about a month on either side of the peak season. Holiday traffic (e.g., Thanksgiving, Christmas and New Year's) is rising.
- During the peak season, the average group size is 10 to 15 people and 90 percent or more of rentals are to multiple families with children.
- A high percentage of visitors come from the mid-Atlantic and northeastern states
- While the recession affected early reservations and prompted many firms to offer incentives, bookings have picked up recently and the firms are optimistic about the summer 2009 season.
- The majority of rental units in Currituck County have four to eight bedrooms, and the average free-standing rental unit has six bedrooms.
- Although there is no agreed-upon formula, a reasonable estimate of the number of vehicles per rental unit may be the number of bedrooms minus one.
- Most rentals last for seven days, with the majority occurring Saturday to Saturday; the remainder are Sunday to Sunday with a handful of Friday-to-Friday rentals. Virtually all firms have a 10 a.m. check-out and 4 p.m. check-in times, though some offer early check-in for a fee.
- All firms communicate with clients via e-mail and online bookings have increased dramatically in recent years. When finalizing the lease, a majority sends agreements electronically, although only a few firms accept electronic signatures.
- Growth in rental property development is expected to continue in Corolla over the next several years, and properties in Duck are projected to be replaced by larger structures over the next decade. Participants believe the Mid-Currituck Bridge (MCB) will help accelerate that growth.
- While infrastructure limitations have thus far curtailed development in Carova and other four-wheel drive areas, virtually all participants expect the 3,000 platted lots in the area to be developed over the next decade (there are only about 300 units currently).
- There is little reason for visitors to cross the Wright Memorial Bridge (WMB) other than at the beginning and end of their vacation. Realtors noted county officials and some private development groups are seeking to increase attractions on the mainland over the next several years.
- Virtually all firms employ their own housekeeping staffs and reported that weekend traffic presents major logistical challenges for them. Nearly all firms expressed interest in purchasing bulk rate toll passes for their employees.
- The number of day-trippers visiting the 4WD area in Carova is increasing.
- The realty community strongly supports the toll bridge, although there is some concern about the long-term economic and environmental impacts on both sides and the potential for increased property crime on the Outer Banks due to easier access.
- The majority of realtors said they would consider bundling tolls into their rental contracts. Some expressed strong interest in moving forward on this and using passes as incentives, while others said they did not want to be involved in managing toll passes or transponders for guests. Several realtors suggested the N.C. Turnpike Authority present a range of options for realtors to consider as well as more specific information on potential compensation arrangements.
- Most felt that, given the high number of new visitors, a range of payment options was necessary at the toll plazas. All participants agreed to include a link to the Authority's Web site on their sites.

II. Methodology

This first phase of the study comprised individual interviews with senior executives at 12 realty firms that manage rental properties in Currituck and Dare counties, with an emphasis on the area north of Southern Shores. Representatives of Arup and The Catevo Group conducted informal interviews over the course of six days in May 2009 in the realtors' offices. A consultant to the N.C. Turnpike Authority attended several of the interviews, as well. A common discussion agenda (see Appendix A) was used to collect data and guide the interviews, which lasted approximately 60 to 90 minutes each.

The interviews' goal was to collect qualitative information from a selected group of area realtors to help understand better their perspectives on various aspects of the tourism and rental market, visitor profiles, local issues and the MCB project. As such, empirical conclusions cannot be drawn from the discussions and the data are not suitable as quantitative planning model input.

The second phase of the project comprises a quantitative analysis of data gathered from realty firms' databases regarding aggregate rental property characteristics, seasonal occupancy rates and visitors' ZIP codes of origins.

III. Research Objectives

Primary research objectives include:

- Collect and assess information and perspectives from leading realty firms in Currituck and Dare counties regarding general aspects of the rental market, historic and projected tourism, development and rental trends, issues and experience with owners and renters, as well as opinions on the proposed Mid-Currituck Bridge (MCB).
- Collect and assess data on the firms' existing rental stock (e.g., location, number of units, type of unit, number of bedrooms, parking capacity, etc.).

IV. Target Research Market

The primary target geographic area for research is the northern region of Bodie Island (in particular, the communities of Duck, Sanderling, Carova and Corolla) that would be served by the proposed bridge. Secondary target regions include the remainder of Currituck and Dare counties and communities on the Currituck County mainland.

V. Interviewees

Senior managers representing 12 of the largest property rental agencies in the area were interviewed. These companies manage 3,708 properties north of the Wright Memorial Bridge, or approximately 82 percent of the estimated 4,500 rental properties in the target area. These same firms manage an additional 2,535 other properties in other areas throughout the Outer Banks.

Realty Firm	**Properties Represented North of Wright Memorial Bridge**	**Total Properties throughout Outer Banks**
Firm 1	470	510
Firm 2	220	364
Firm 3	90	280
Firm 4	90	120
Firm 5	180	180
Firm 6	185	197
Firm 7	250	452
Firm 8	253	400 (includes Southern Shores)
Firm 9	380	780
Firm 10	560	1400
Firm 11	800	1000
Firm 12	230	560
	3,708	**6,243**

In addition, the team interviewed a representative of BAC Infrastructure Management and Development, which is developing North River Resort, a destination resort on the mainland of Currituck County.

VI. Market Profile and Dynamics

Key Findings:

- *Historically high occupancy rates during peak summer season*
- *Limited effect of recession on 2009 reservations*

The primary target market comprises some 4,500 rental properties north of the Wright Memorial Bridge. The majority of these units are located in Duck and Corolla, though some additional properties also are located in Southern Shores and Carova (four-wheel drive area with no public roads or facilities). Despite the lack of convenient access for most travelers and significant traffic congestion during the peak summer months, the Outer Banks is a popular destination for vacationers – especially families with children – from across the East Coast and beyond (most firms report that 90 percent or more of their clients are families with children).

The market has a history of high occupancy rates – between 90 and 100 percent – during the peak vacation summer months of June, July and August – and most firms do 85 to 90 percent of their business during that time. Occupancy during the shoulder seasons (defined generally as the three weeks on either side of peak) also is historically strong: a majority of firms reported that bookings on average totaled 40 to 80 percent. In addition, occupancy rates during holidays (e.g., Thanksgiving, Christmas, New Year's and Easter) are strong often ranging from 25 to 50 percent.[1]

Primary competitors for the Currituck Outer Banks include the New Jersey shore, Ocean City, Md., Rehoboth and other Delaware beaches, and Myrtle Beach, S.C.

Based on recent reservations, it appears the current recession has had a limited effect on projected 2009 rental and occupancy rates. Rental rates for July and August are essentially unchanged, though many realtors did offer incentives (e.g., a 10 percent discount) to spur June bookings.

VII. Rental Seasons, Contracts and Practices

Key Findings:

- *Peak season is mid- to late-June to mid- to late-August*
- *Shoulder seasons are generally three weeks on either side of the peak season*
- *Rental agreements are mostly for seven days*
- *Firms communicating with guests electronically more and more*

[1] These figures represent top-of-mind estimates shared by the realtors during the interviews. The second phase of this research will collect occupancy data from the firms' databases for a retrospective quantitative analysis.

- *The vast majority (approximately 70 to 80 percent) of check-ins/check-outs occur on Saturdays; the bulk of the rest occur on Sundays with a very small percentage of Friday check-ins/check-outs*
- *Virtually all firms have check-in/check-out times are 4 p.m. and 10 a.m. (only one firm offers 3 p.m./9.a.m.); some firms are experimenting with alternate times and early check-in to alleviate traffic*

Consistent with other summer vacation destinations, the peak and shoulder seasons generally track the calendar school year for students in the Mid-Atlantic and Northeastern states (i.e., school begins after Labor Day and ends in mid-June). Although there is no uniform definition, peak season is generally identified as mid- to late-June to mid- to late-August with the "peak of peaks" identified as late-July through mid-August. Shoulder seasons vary considerably among realty firms, as well, though most include the three weeks on the either side of the peak season (i.e., May/early-June and September/early-October). Off-peak seasons (which include holidays) comprise anything outside of the peak and shoulder seasons (i.e., early-to mid-October through the first of May).

Almost all rental agreements are for seven-day periods (Saturday to Saturday or Sunday to Sunday) with the majority being Saturday-to-Saturday contracts (roughly 70 to 80 percent). Sunday-to-Sunday contracts represent on average about 20 to 25 percent of the market and a handful of firms are experimenting with Friday-to-Friday rentals, but the percentage is negligible. In recent seasons, the number of "walk-in" visitors who arrive mid-week seeking short-term rentals is increasing.

All firms communicate with guests electronically (e.g., send leases and information via e-mail), though many still require signed hard copies to be returned via mail or fax. Check-in and check-out days are almost exclusively on Saturdays and Sundays with the majority on Saturday. While most clients and owners prefer Saturday rentals, many realtors have shifted to Sunday check-in/check-out to help alleviate traffic congestion.

Nearly all realty firms use a 4 p.m. check-in time and a 10 a.m. check-out time (one firm uses a 3 p.m./10 a.m. schedule). Many firms offer early check-in (e.g., 1 p.m.)for an additional fee (such as $75 or $100). Realtors report that the early check-in option is very popular among guests; in fact, these firms have had to limit the number of early check-ins to avoid overloading housekeeping staffs.

VIII. Rental Group Profile

Key Findings:

- *Multiple families with children comprise the vast majority of guests*
- *Average group size is between 10 and 15 individuals*
- *Majority of guests drive from the Mid-Atlantic and Northeastern states*

Reflecting the family-oriented brand of the Outer Banks in general, firms rent almost exclusively to families (estimated at 90 percent and above) and family groups. While one family is signatory for the rental contract, typically there are multiple family units (either related or not) staying on the property (e.g., a six-bedroom property very likely might house four to six family units with multiple family members for the week). The realtors emphasized that their experience indicates it is incorrect to assume that a single family (including the signatory) is solely responsible for the rental payment (i.e., multiple families or family units contribute). In general, firms refuse to rent properties to groups such as college students or groups of friends. Singles and couples rent more during the shoulder-and off-season months.

Most properties can sleep from two to 30 or more persons, and the average group size ranges from 10 to 15 individuals. Local zoning ordinances and infrastructure capacity dictate maximum occupancies.

The vast majority of visitors come from the Mid-Atlantic and Northeastern state with high concentrations from northern Virginia, Maryland, Delaware, Pennsylvania, Ohio, New York, New Jersey. The area enjoys a strong history of repeat visitors (estimated between 25 and 50 percent on an annual basis). Although the realtors do not track this variable formally, virtually all reported that they have been serving several families – and, in some cases, several generations of families – for multiple years.

IX. Rental Properties and Parking Capacity

Key Findings:

- *Average home in northern Bodie Island has six bedrooms*
- *While there is no agreed-upon formula, a reasonable estimate of the ratio of vehicles per rental unit likely ranges from .75 to 1.0*

While house sizes range from two to 18 bedrooms or more, the average free-standing home in northern Bodie Island has six bedrooms.

There is no agreed-upon method to accurately estimate the number of vehicles guests bring to the island and Currituck County does not collect this data. Many realtors said, however, that subtracting one from the number of bedrooms might yield a reasonable estimate (e.g., five cars for a six-bedroom house) while others believed a 1:1 ratio would be appropriate. Hence, a reasonable estimate of the ratio of vehicles per unit likely ranges from .75 to 1.0. Parking capacities at rental units are limited by a county ordinance requiring that there must be a dedicated, unblocked parking space in the driveway for every bedroom. Local ordinances prohibit parking on the street or natural areas on the property (though some realtors report guests sometimes disregard that rule because they bring so many vehicles with them).

X. Travel to and from the Outer Banks

Key Findings:

- *Travel by guests back to the mainland is extremely limited – most guests cross the WMB only when returning home*
- *Few guests have visitors join them during their vacations*
- *Number of day-trippers driving from the mainland to the Carova area is increasing*
- *Thousands of housekeepers who service the properties travel across the WMB on weekends*

The vast majority of guests rarely leave the Outer Banks except when returning home. When guests travel to the mainland during the week, they are likely driving either to the Norfolk Airport or to specific activities on the mainland such as antiquing or golfing, though this is perceived as uncommon. It is rare for guests to have visitors join them on the island, though there are exceptions (e.g., when individuals come for a specific event such as a wedding).

The number of day-trippers visiting the Carova and four-wheel drive area is increasing, though a lack of public facilities and traffic congestion on the island limit that population.

Other than guests, the largest group of individuals traveling to the Outer Banks regularly comprises the workers and housekeeping staffs who support the island's tourism industry. Though the number of housekeeping staff members varies during the seasons according to occupancy, it is safe to assume at least 1,000 individuals commute each Saturday and Sunday during peak season (many of whom drive between two and three hours each morning and afternoon). Many housekeeping crews must arrive well before 8 a.m. on weekends due to traffic congestion on NC 158, NC 12 and the WMB.

XI. Projected Growth

Key Findings:

- *Highest areas for potential growth are in the Corolla and Carova communities, though many homes in Duck are expected to be replaced by larger units over the next decade*
- *Some commercial and tourism development anticipated for the mainland to boost visitor traffic*

Additional growth in the Duck Community is unlikely in the short-term as undeveloped land is scarce and there are strict zoning requirements and limited infrastructure capacity. Over the next 15 to 20 years, though, it is expected that a majority of aging rental properties in Duck, Southern Shores and Corolla will be replaced with larger, more modern units. The largest tract of undeveloped land is a 14-acre lot (Ocean Sands) zoned for high-density residential development, but reports indicate the owner, James Johnson, has expressed little interest in moving forward soon.

There are a number of developments underway in Corolla, but most have stalled or are proceeding slowly due to infrastructure limitations and the economic downturn.

While additional development is considered inevitable in Carova (there are 3,000 platted lots and only about 300 homes have been built), such development will likely proceed slowly over the next 25 to 30 years. The area – accessible only by four-wheel drive– has virtually no public infrastructure, but homes often rent for $8,000 to $10,000 per week.

The Audubon Society, which owns large tracts of land on the island west of NC 12, is expected to sell portions for development in the coming years to raise funds for use by the organization elsewhere. (Please note that The Audubon Society was not interviewed to verify this assessment).

Currituck County is seeking to stimulate visitor traffic on the mainland and is ramping up efforts to promote attractions such as the Cotton Gin brewery, local wineries and the historic Jarvisburg Colored School. In addition, BAC Infrastructure Management and Development is planning North River Resort, a 242-acre mixed-use development in Jarvisburg along Route 158 (see Appendix C). The project, envisioned as a destination resort for eco-conscious tourists, is located on the North River and is planned to comprise a marina, light-impact retail, a hotel, residential units and other features. One participant said the project is currently in negotiations with an anchor tenant. North River Resort expects to open by 2016.

XII. Rental Firms and the Toll Process

Key Findings:

- *Widespread support among the realtors for the MCB project and for using tolls to help finance it*
- *Support among the realtors to help promote the MCB*
- *Mixed support among realtors for bundling tolls*
- *Mixed support among realtors about having a "hands-on" role in managing toll collection methods*
- *Support for the Authority to develop a range of options*

There is widespread support among the realty community for the MCB project and for using tolls to help finance its development. There also is strong support for the bridge to offer a range of payment options for visitors, residents, employees and day-trippers (including cash, E-ZPass, printable bar codes, etc.).

With regards to rental firms' participation in the toll process, opinions are decidedly mixed. While all firms said they would help promote the bridge and distribute information and links to renters, there was disagreement about whether tolls should be bundled into guests' leases. About two-thirds of the realtors are willing to discuss how tolls could be included in rental fees and offered as guest incentives. Several noted that such a process could be virtually seamless since N.C. Real Estate Commission regulations now encourage "all-inclusive" contracts that do not itemize traditional "add-on" charges such as linens and cleaning fees.

About one-third eschewed a hands-on role in the process, preferring that the Authority manage the purchase and processing of toll passes or transponders. The firms do not want to be responsible for distributing toll passes or transponders directly to clients. As many process their contracts via e-mail almost exclusively, they expressed concern about having to "burden" their staffs with the requirement of ensuring guests receive a tangible item such as a transponder (one said "I am absolutely not sending transponders out.").

Many firms requested the Authority provide a range of options for them, from simply providing a link to the Authority's page to offering passes as guest incentives or mailing transponders to clients. Firms interested in partnering with the Authority on bundling tolls said they expected fair compensation for their work (such as a handling fee per transaction and discounts on toll packages for their employees).

A majority of respondents said they would like to purchase toll passes in bulk at discount rates for employees (perhaps monthly or annually).

XIII. Issues and Concerns Regarding the Project

Key Findings:

- *Locals are concerned that MCB may spur increased property crime*
- *Economic development from MCB may tax already strained infrastructure*

Many local residents are concerned the MCB will lead to increased property crime by providing quick and easy access to rental homes, particularly during the off-season. In addition, there is a concern that crime and misbehavior associated with day-trippers may increase once the MCB makes access to Carova more feasible and attractive.

There is also a concern that the accelerated economic development associated with the MCB will increase the strain on local infrastructure, including roads, sewer and water treatment, waste management and public services. Some realtors expressed concern also about the MCB's potential environmental impacts on both the mainland and island.

Also, some county residents are concerned about the MCB's proposed access point on the mainland side. According to a news report in *The Virginian-Pilot*, "State plans that would block left turns in to and out of Waterlily Road and require U-turns on U.S. 158 to make way for the proposed mid-Currituck bridge have drawn early opposition."

Appendix A
Realtor Survey and Discussion Guide

Realtor Questionnaire

General Interview Questions

1. Name of Interviewee:

_____

2. Date of Interview:

_____

3. Realtor Company:

_____

Rental Information

4. What are the check in / out days and times for your rentals?

_____

_____

5. For your firm, how many rental seasons do you have? Please define by beginning and end (i.e., peak: Memorial Day – Labor Day, shoulder, off-peak, holiday, winter, etc.).

Season	Definition
Peak	
Shoulder	
Holiday	
Off-Peak	
Please describe others:	

6. How many units do you have available to rent? Does this vary at all per season?

7. What is the occupancy rate for your firm's units by season? Please place an 'X' under the percentage per season.

Season	0-20%	21-40%	41-60%	61-80%	81-100%
Peak					
Shoulder					
Holiday					
Off-Peak					

8. Have you adjusted your rates in view of the economic downturn? If yes, please explain.

_____

_____

_____

9. Additional comments from this section:

_____

_____

_____

_____

_____

_____

Clientele Profiles

10. What percentage of your firm's 2009 clients were repeat clients (i.e. were clients in a previous year)? Please estimate a percentage for each category for a total of 100%:

0-20%	21-40%	41-60%	61-80%	81-100%

11. What percentage of your clientele comes from the following states? Please estimate a percentage for each category for a total of 100%:

NC	VA DC MD	PA NY NJ and CT	South of NC

12. Please provide the percentage of your firm's clientele as they fit into the below categories. Please estimate a percentage for each category for a total of 100%:

Families with children	Couples, no children	Singles/Individuals	Groups (i.e. friends, reunions)

13. What is the average size of your firm's typical client group? Please place an 'X' under your answer.

<4 people	5-9 people	10 – 15 people	More than 15

14. How many bedrooms in your properties by percentage? Please estimate a percentage for each category for a total of 100%:

<2 bedrooms	3-4 bedrooms	5-8 bedrooms	8-10 bedrooms	>10 bedrooms

15. What is average number of cars per bedroom?

16. Of your rentals, what percentage fall into the below weekly rental rates? Please estimate a percentage for each category for a total of 100%.

<$1250/week	$1251-$2500/week	$2501 - $5000/week	$5001-$7500/week	>$7501/week

17. When you rent, what percentage of your business is conducted:

Electronically (Email)	Regular Mail	Fax

18. Additional comments from this section:

_____

_____

_____

_____

Travel Across the Mid-Currituck Bridge

19. How often do your renters leave the Outer Banks to return to the mainland? Please place an 'X' under your answer.

Twice - Only for arrival and departure	Three times in a week	Four times in a week	> Five times per week

20. How likely is it for day trippers to visit renters in your properties? Please place an 'X' under your answer.

Highly Likely	Very Likely	Likely	Somewhat Likely	Never

21. How often do employees associated with your rental properties (contract and full-time) cross the Wright Memorial Bridge? Please estimate a percentage for each category for a total of 100%:

Daily	Weekends Only	Saturday Only	Sunday Only	Three Times a Week

22. Additional comments from this section:

_____

_____

_____

_____

Potential Benefits and Concerns

23. Please select your top three selections for what the biggest benefits would be of building the Mid-Currituck Bridge. (1=highest, = 2 moderately important, 3 = lowest)

Reduce traffic congestion on key arteries	_____
Reduce car operating cost (Fuel efficiency and maintenance savings)	_____
Enhance rental rates and property values due to better access	_____
Reduced travel time	_____
Increase emergency access/egress	_____
Economic development on mainland	_____
Economic development on Outer Banks	_____
Other (please list)	
_____	

Please explain:

_____

_____

24. Please select your top three selections for what you believe to be the biggest potential impacts of building the Mid-Currituck Bridge. (1=highest, 2 = moderately important, 3 = lowest)

Economic development on the Outer Banks	_____
Economic development on the mainland	_____
Environmental impacts on the Outer Banks	_____
Environmental impacts on the mainland	_____
Increased traffic on the Outer Banks (i.e. Corolla)	_____
Increased day trippers	_____
Other (please list)	
_____	

Please explain:

_____

_____

Other

25. What other Middle-Atlantic destinations do you consider your largest competitors for tourism?

_____

_____

_____

26. Is there anything that worries you about the future of tourism in the Outer Banks? If so, please explain.

_____

_____

_____

27. What else would you like us to know about the Mid Currituck Bridge Project?

_____

_____

_____

28. Would you be willing to bundle tolls into rental packages to enable crossing the Mid-Currituck Bridge for arrival and departure?

_____

_____

_____

Thank you for participating in this survey!

Appendix B

Aggregated Questionnaire Responses and Participant Comments

Question 4

What are the check in/out days and times for your rentals?

Friday	Saturday	Sunday	Check-in time	Check-out time	Comments
0%	98%	2%	4:00 pm	10:00 am	
0%	70%	30%	4:00 pm	N/A	
3%	60%	40%	4:00 pm	10:00 am	
5%	80-85%	10-15%	4:00 pm	10:00 am	
0%	80%	20%	4:00 pm	10:00 am	Allowing check-in 3-6 pm; pay early check-in fee of $65 to get in at 1 pm; "value of time", "best $65 I ever spent"; Limit on number due to housekeeping inconvenience
0%	66%	33%	4:00 pm	10:00 am	Some Fri, very few
20%	40%	40%	4:00 pm	10:00 am	Last year big push to move to Sun
5%	60%	40%	3:00 pm	9:00 am	Sat renters – drive all night, rude; start releasing keys 12-1 pm
0%	50%	50%	4:00 pm	10:00 am	
0%	65-70%	30-35%	4:00 pm	10:00 am	Homeowners resist changing to Sat
1%	70%	29%	4:00 pm	10:00 am	Early arrival program ($100) to arrive by 1 pm; started 10 years ago, only a handful of counties don't have a program; check-in by e-mail, keyless entry to avoid traffic at office
	70% (Corolla)	60% (Duck)	4:00 pm	10:00 am	Changed a lot of rentals to Sun to get away from Sat traffic; people prefer Sat to Sat rentals but not much difference between rentability

Question 5

For your firm, how many rental seasons do you have?

Peak	Shoulder	Holiday	Off-peak	Comments
Memorial Day - Labor Day	May, Sep - Oct	Thanksgiving, Easter, week between Xmas and New Year's	Remainder: end of Oct - beginning of May	"Peak of peak" is last week in Jul and first week in Aug
Jun 20 - Sep 15 (8-10 weeks total)	2-3 weeks outside of the peak	Thanksgiving, Xmas	Remainder:	"Peak of peak" is 1-2 weeks in Aug, 4th of Jul, seeing more activity in Sep
N/A	N/A	More owners, Thanksgiving most popular	N/A	
Memorial Day - 2nd week of Aug	Jan - May; 3rd week of Aug - Oct	Xmas, Easter, Thanksgiving - owners and guests	Remainder	
Jul 10 - Aug 15	May, Jun, mid-Aug - end of Sep	Thanksgiving - popular, Xmas/NYE, 4th of Jul soft for years	Remainder	May - 60%, June - 90-100%, July 4th used to 100% now weak; different crowd after 8/15
11 weeks to the week of Labor Day (end of Jun - Beg of Sep)	3 weeks on either side of peak	Part of off-peak season; no special pricing	Remainder of the time, including holidays	87% of business done in Jun/Jul/Aug
Jun 20 - Aug 15	1st 3 weeks of Jun (different rates), last 2 weeks of Aug (different rates), May, Sep (busier)		Sept - May	"Peak of peak" - Jul 4- Aug 15; Allow owners to have up to 15 rates
Jun 29 - Aug 22	May 20 - Jun 22; Aug 29 - Sep 20	Same as off-season rates, no extra	75% stay open for rental; Sep 20 - May 20	Discounted in-season: Jun 22 - Jun 29, Aug 22 - Aug 29; 75% stay open in off-season

Jun 27 - Aug 29	May 9 - Jun 20 and Sep 1 - Oct 1	Adjustments 2008 Xmas/Easter, none in 2009	October 7 - May 2	Restructuring of rates/seasons this year
Mid-Jun - mid-Sep	3-4 weeks on either side of peak	Holidays differ	Remainder	11 different rate periods
Jun 20 - Aug 15	3 weeks on either side of peak	Thanksgiving - rental bump; 8 days for price of 7 days	Remainder	Pool season - 4 weeks on either side of shoulders, using yield management software to maximize over peak seasons; 14 weeks make 80% of income
Jun 15 - Aug 15	May 15 - Jun 15; Aug 15 - Sep 15	Thanksgiving (15% full), Xmas, Easter - lots of owners	Sep - Nov	Middle of Jul 95% full; 50-60% occupancy in shoulder; 8% full in off-peak; Sep/Oct stronger than it used to be; late Sep/early May = 40%

Question 6

How many units do you have available to rent?

Total	Breakdown and Comments
180	Corolla only
780	380 - Duck and Corolla; 400 - South of Wright Memorial Bridge
560	230 - Corolla; 330 - Nags Head
452	100 - Duck and Southern Shores; 150 - Corolla; 202 - Kill Devil Hills and Nags Head
280	70 - Corolla (want to grow); 20 – Duck
510	220 - Brindley Beach; Corolla/Currituck; 40 in Dare
653	400 - Southern Shores and South (Kill Devil Hills, Nags Head, Kitty Hawk); 253 - Corolla and Duck, 0 - Carova
210	120 - South Nags Head to Corolla; 90 - 75% of them are North of WMB
364	South Nags Head to Ocean Hill (right before 4WD area); <1/3 units are North of Duck town line; 220 - North of Wright Memorial Bridge; increased concentration in Duck (high percentage of homes), Kill Devil Hills, Southern Shores
1400	275 - Corolla; 240 - Duck; 25-30 - 4WD area (Carova); 12-15 - Southern Shores; 240 - Hatteras Island
197	185 North of WMB (10 - Southern Shores; 70 - Duck; 105 - Currituck City/Corolla, none in 4WD area)
1000	800 - Corolla and Duck; Estimate there are 4500 units available to rent across all real estate agencies from South Duck to the Va. line; future unknown is the 4WD area, estimated capacity of additional 2800 homes that have been platted and purchased; no existing utilities and roads so can't be built up now

Question 8

Have you adjusted your rates in view of the economic downturn?

10% off; free pet fee; different specials

Numerous specials

Significantly more specials/negotiations; offered layaway plan; asked owners for specials earlier; rentals are down 16% ; 96% of bookings are weekly

Started 10% discount for peak season then considered increasing to to 20%, but owners preferred 10%; off-peak - allowed to reduce up to 20% without calling (in contract)

Up to 20% off rentals currently through June; July is now 10% off ; Jan 09 - 22% off rentals; May 09 - 15% off rentals; "everyone wants a deal"

20% off on all properties

More specials this year; encourage owners to discount rate, not doing gift certificates anymore; bookings only down 7-8%

Some specials; last Nov offered payment plan (only $500 down to reserve rental instead of 50% down)

More negotiation this year; not discounting yet weeks past early July (focus on May/Jun/early July); looking to maintain revenues from last year; people started trend in "looking for bargains"; hope to stay even with last year (more difficult last year with gas prices); comparison shopping via Web sites; many this year are first-timers

Specials, not unique to this year; more concerted effort to fill holes; rates stayed flat from 2008; only run specials a month out; discounts 10-20% (some are up to 25%) or value-added - gift cards; rent this week, get free off-peak weekend

Discounting up to 20%; specials, have started since Internet boom; 6% off weeks booked, 2% off '08 revenue; owner-driven decision for specials

Discounts; people coming down 10% +/-; currently seeing 2.5% price erosion this year (first time in 31 years); lots of pre-bookings from 2008 where rate locked in a year in advance

Question 10

What percentage of your firm's 2009 clients were repeat clients?

Percentage	Comments
65-70%	
70%	
60%	Was ~70% 3.5 years ago
N/A	Unsure - Seems to be repeats but not at same houses
30%	Year-to-year
25%, 50%	25% every time they go to the beach (every other year), 50% annually; 25% are new
50%	Hard to ascertain due to online bookings - comes in as "online booking"; used to be 66%; "shopping cart" to compare properties
30-35%	On the increase; gift bags worth $80 containing private label snacks, toilet paper, paper towels, etc.; BBQ customer eventappreciation
20-25%	Many clients come every 2-3 years; return consecutive years, local to Currituck County
40-60%	Difficult to narrow down
50%	Traditional family vacation; lots of family reunions
55-60%	

Question 12

Please provide the percentage of your firm's clientele as they fit into the below categories.

Families with children	Couples, no children	Singles/ Individuals	Groups (i.e. friends, reunions)	Special events	Comments
95-100%	Off-shoulder season				
80%			5-10%		
90% in summer			Mostly during shoulder seasons		
90%				5-10%	
All			0.50%		Off-season - preschool families, empty nesters
90%+					
75% (peak)	25% (shoulder)				
95%	5% (shared with groups)		5% (shared with couples)	Many weddings	Leaseholder at least 25, one adult for everyone under 25
95% consistent across OBX			Don't do groups - problems often associated with college or HS grads (not a big problem)		Lease calls for families
90%+	Some		Not permitted to rent to non-families	No weddings	Typically reunions; must be families
90%	10%; Probably more for hotels, not rentals	Probably more for hotels, not rental	10%	~ 40 special events per year	

Question 13

What is the average size of your firm's typical client group?

<4 people	5-9 people	10-15 people	>15 people	Comments
		X		
		X		
		X		
		X		
	X			8 is avg
		X		14 is avg; have occupancy limits
		X		10-15 is avg group size; we ask # in house, neighbors call if too many or something funny
		X		
		X		10-15 is avg group size; maintenance notices some overloading (sleeping bags, air mattresses) - some owners will allow a view over but not a lot (violates the lease agreement)
		X		10 is avg over entire year, 12-13 in-season/peak
			X	16-20 is avg group size; some sleep more than 30
	X	X	X	(7-12 people, >12); occupancy of the home is ~12 based on the # of bdrms, but not sure how many the renters actually squeeze in the home

Question 15

What is the average number of cars per bedroom?	
Number	**Comments**
1 car to 1 bdrm	Most houses had 4-8 cars last year
1 car to 2-3 bdrms	Lots of carpooling last year due to gas prices; partnered with Enterprise (they dropped off a car for a week at the rental properties)
1 car to 1 bdrm	Most driveways had 4-5 cars last year
1 car to 1.5-2 bdrms	
1 car to 1 bdrm	Nags Head passed controversial parking ordinance a couple years back; avg is 4 cars
1 car to 1.75-2 bdrms	(as of 2002) Currituck City requires 1 dedicated, unblocked parking space per bdrm, unless under house
1 car to 1 bdrm	OR 1 vehicle fewer than the number of bdrms (4 bdrm = 3 cars)
1 - 1.5 cars to 1 bdrm	Didn't notice as much of a difference last year when gas prices were higher
1 car to 1 bdrm	Some houses have more spaces per bdrm; started advertising spaces because too many big cars coming down
1 car to 1 bdrm	(# ofbdrms - 1) = # of cars (most reasonable estimate); advertise 1 car to 1 bdrm in property summary
1.5 cars to 1 bdrm	With a max of 5 cars
1 car to 2 bdrms	1-4 bdrm home = 1 car; most of their houses are 6 bdrms (2+ cars)

Question 17

When you rent, what percentage of your business is conducted:

Electronically (e-mail)	Regular Mail	Fax	Comments
95%+			Try as hard as possible to communicate via e-mail; some book online or call
100%			Unless otherwise required
95%	5%		Electronically - as many as possible
90%	10%		>50% reservations made online; 20-30% call
Send out leases		Fax signature back	Over 90% using Web site at some point in process; 35% completely unassisted; most leases are e-mail and then mailed or faxed back; planning on using DocuSign in 2010
Allow to sign and fax back	Outside 45 days; contract lease by mail	Fax back	Don't have DocuSign - very expensive ($4/signature); communicate by e-mail;
90%	Mail back	Fax back	noDocuSign; some e-mail
Starting for 2010 (85-90%)	Predominantly	Minimal	End of season will do electronic leases; virtual tours; VRM (virtual resort manager) - export to Excel
Can view lease online - payment	Majority		Mostly mail now, lease online within 15 minutes; eventually will move to electronic, don't require signature (payment constitutes acceptance)
70%+ using DocuSign; 60-65% reservations online	Remainder		Those not done online: mail out and get back via mail or fax
Majority with electronic signature since 2006	Few and far between		Getting away from mail; check-in by e-mail, electronic lease for 3 yrs; eliminated brochure because >90% going to Web site

Question 19

How often do your renters leave the Outer Banks to return to the mainland?

Twice - only for arrival and departure	Three times a week	Comments
X		A small percentage go to the airport; no real reason to go to mainland
X		No reason to cross bridge now; 5 golf courses - 3 you would want to play
X		Only to Va. Beach, etc. if going back for a meeting; some vineyards, golf on mainland but really nothing there
X		Majority - some do day trips to Williamsburg, etc, but not many.
	X	"Probably more than we (realtors) realize."
X		
X		
X		Unless coming to golf (<1%); none visiting guests; day trippers come during week to avoid traffic
X		Really nothing on mainland, only golf; mainly entry/exit
X		Most only arrival/departure; Tourism Advisory Board wanting to include travel back and forth; Currituck - create good list of things to do on mainland (golf, historical buildings, wineries, farmers market, new YMCA, welcome center, etc.)
X		Few other than hard-core golfers; people are scarred from traffic on arrival; guests rarely leave
X		Vacationers come and stay; there's nothing to back over the bridge for except to leave; the Norfolk crowd comes for the day for the 4WD area

Question 20

How likely is it for day trippers to visit renters in your properties?

Highly likely	Very likely	Likely	Somewhat likely	Never
			Few day trippers, no infrastructure; only 4WD in the area; mainly weekends, they come early	
Many people walk in and ask for a place to stay for 2-3 days; Many condos/2-3 bedroom houses				
			Somewhat likely	
			If from Va.	
			X - 4WD area - lots of day trippers (rednecks)	
			X - weekend warriors using 4WDs	
			When bridge goes in, a lot more day trippers; no public access in Duck and Southern Shores	
			X	
Many day trippers on weekends, especially July 4; within 100 mi to Nags Head, Kitty Hawk, etc. Elizabeth City and surrounding counties; Chesapeake			X - not much	
			X - beyond Saturday and Sunday, not much traffic other than stragglers	

Question 21

How often do employees associated with your rental properties (contract and full-time) cross the Wright Memorial Bridge?

Daily	**Weekends only**
	Cleaning
	Cleaning
	Cleaning - Sat/Sun; 2 hours before check-out (8-ish)
	Fri, Sat, Sun - Majority on Sat, try to be here by 8am
Maintenance	Cleaning
	Seasonal workers would cross; maintenance - live South on OBX (Kill Devil Hills, Corolla); contract for housekeeping
Maintenance	Cleaning Fri/Sat/Sun
Maintenance	Cleaning
Maintenance	Cleaning
Maintenance - 12 technicians, would use MCB to get to Corolla	Cleaning
5 work daily	75 cleaning crew members on Sat and Sun
	Sat and Sun, 7:30am to 2pm

Question 22

Cleaning crew information

Some drive 3 hours to clean; in-house cleaners

Takes too long, would gladly pay bulk toll to get better staff in Corolla; too hard to get to, too much gas

Most cleaners coming from Elizabeth City

2 people/cleaning crew, 1 car/crew, 4 units cleaned/day/crew

Contract cleaning; maintenance from Corolla, Kill Devil Hills, Nags Head

In-house crews, ~2 cleaners/crew, 2-3 houses/day, 1 car/crew, mainly from Elizabeth City, 65-70 crews across Fri/Sat/Sun

All maintenance and cleaning crews are in-house; 1-4 hours for most crews

1/3 of office staff is maintenance; in-house employees; facility is in Harbinger (constantly crossing WMB); 350 cleaning staff, 5 maintenance technicians; avg 1 crew/car, 2 people/crew; some commute 1.5 hrs daily

500 cleaning crew; virtually all come from off the beach, on the weekends; carpool; 8 hours/day = avg
Cleaning crew 2 people crew - 1 crew per vehicle, employ 80 people, ~ 3 houses/crew/day;

Most crews are from Elizabeth City and West or Tidewater area; travel in their own car, no public transport; have to drive themselves because they need to go between houses; come as a crew in one car, avg crew does 2-3 houses/day; $150/day/person; pool vendor, bed-makers, cleaning crew, lawn; seasonal only

Question 25

What other Middle-Atlantic destinations do you consider your largest competitors for tourism?

Don't really see any - once people come they won't go to other beaches

OBX is unique; Topsail - family-oriented places, other S.C. places; Wild Dunes, Isle of Palms; any place easily reachable from I-95 that is high-end, good beaches, family-friendly

Ocean City, Md.; Bethany; Jersey Shore

Myrtle Beach; Ocean City, Md.; Delaware beaches; Jersey Shore

Myrtle Beach; Emerald Isle, Md. and Delaware beaches

Whole east coast; Jersey Shore, Myrtle Beach (variety of activities), some Hilton Head; OBX is the number one family destination on the east coast

Crystal Coast (where most N.C. residents vacation), Ocean City, Md, Rehoboth, Virginia Beach, Myrtle Beach, Jersey Shore

Myrtle Beach, Hilton Head, Rehoboth Beach, not Jersey shore - different crowd

Emerald Isle, Atlantic Beach (Crystal Cove), maybe Myrtle Beach, not Virginia Beach

Cruises, Myrtle Beach, Williamsburg, Crystal Coast

Crystal Coast (marketing as Southern OBX), Myrtle Beach, Ocean City, Md.

Jersey Shore; Rehoboth, Dela.; Ocean City, Md.; Myrtle Beach, some from Hilton Head (although very few renters from N.C. and the South); new clients: is there marketing - how are they hearing about OBX?; word-of-mouth - want a beach, want something nice, something new; public sector is marketing OBX vs. Maryland, Delaware, Cape Cod, etc.; drive to destination that is kid-centric

Question 28

Would you be willing to bundle tolls into rental packages to enable crossing the Mid-Currituck Bridge for arrival and departure?

Not that amenable; feel that people (renters) would come to agents to complain; But willing to provide a link to purchase ahead of time; Easier for real estate agents not to collect money; willing to provide info

Owners might see it as a way to set selves apart; not opposed to participating just not sure how; E-mail - guest Web site, enter reservation number and zip code, pull up lease, e-sign and pick payment plan; could give a link to the NCTA web site to buy pass; could include as optional fee; could wrap into fee...need buy-in from owners

It is possible - depending on rates; add as an optional fee; could be added as a special (last year was a $100 gas card); could include link with contract to NCTA
Having the option to bundle, run specials, give away to VIPs; specials when owners want; unless we could pre-buy a certain number of cars across the bridge; lukewarm about across-the-board thing; needs to be a business case for realtors; concern about booth-less toll plazas - with real estate people sending out transponders - people forget things, don't open mail – that is not going to work; "It's got to be easy on both sides. We can't rely on guests to remember something to give it to family members in other cars."
Yes but how? Transponder given to guests in advance - happy to bundle into contract

Feel like a road is necessary for safety reasons, similar to what happened in Corolla; Really depends on where we stand in 2013, would like to make it optional in the lease; make sure it doesn't get tangled in owner's details ("mess")

Not open to being a collection agency; bad enough collecting sales tax, occupancy tax; can e-mail a link, mail a brochure
Seems feasible, only concern is fee although don't know if renters would even notice assuming it isn't broken out; all in presentation - i.e. "bridge passes are included in your rental"
Don't see it feasible to have bridge be completely electronic (no manned booths); Not preferred to roll this into the rent - see it being more of an option; very willing to provide links, just don't want to be in the middle of payment/collecting; don't want to be sending transponders out; mid-week - could be discounted tolls to encourage back and forth and help with debt service; maybe $60 to by year-long pass across bridge, limit to Currituck County residents

Management of operations is the concern; Open to bundling, bundles all fees in already

Maybe, but they don't want to do anything that would interfere with the rental process. Also, what is in it for them?

Appendix C
North River Resort (company brochure)

Appendix C

Technical Memo #3 - Willingness to Pay Survey Instrument and Approach

Currituck Development Group

Mid-Currituck Bridge

Technical Memo #3 - Willingness to Pay Survey Instrument, Locations and Schedule

FINAL

Currituck Development Group

Mid-Currituck Bridge

Technical Memo #3 - Willingness to Pay Survey Instrument, Locations and Schedule

August 2009

This report takes into account the particular instructions and requirements of our client.
It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party

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Job number 209783

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Appendix A

Willingness to Pay Memorandum

Appendix B

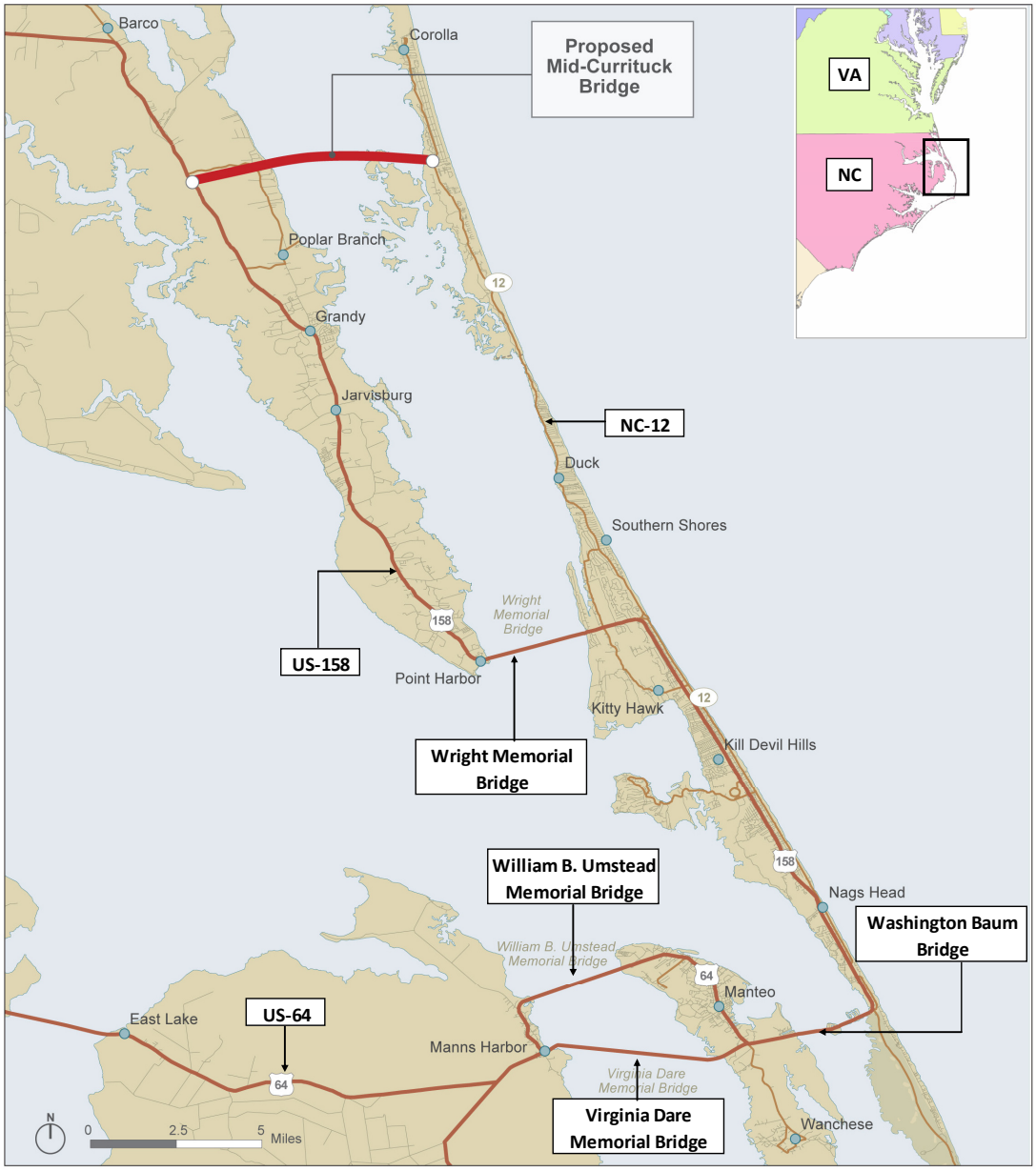
Willingness to Pay Survey Instrument

1 Introduction

1.1 Project Background

The North Carolina Turnpike Authority (NCTA) is authorized to study, plan, develop and undertake preliminary design work on the Mid-Currituck Bridge, a proposed toll facility in the Outer Banks. The Mid-Currituck Bridge is located in northeastern NC and would connect the Currituck County mainland, to Currituck County on the Outer Banks (see Figure 1).

Figure 1: Study Area



The Outer Banks is a 200-mile (320-km) long string of narrow barrier islands off the coast of North Carolina. They cover approximately half the northern North Carolina coastline, separating the Albemarle Sound and Pamlico Sound from the Atlantic Ocean. The majority of the Outer Banks island communities, from Corolla to Nags Head, are prime summer vacation destinations. At the moment there are two crossing south of the Virginia border; the Wright Memorial Bridge (around 32 miles south of the Virginia border) and the Washington Baum Bridge further south. Both crossings are untolled facilities.

NCTA appointed the Currituck Development Group (CDG) to develop the Mid-Currituck toll bridge (the Project) and, subsequently, Arup were appointed by CDG as Traffic and Revenue Advisors.

This report outlines the willingness-to-pay (WTP) survey instrument, locations, and survey schedule. The survey involves the collection of data on current travel behaviour, and ultimately presents respondents with information about the proposed toll road. Using stated preference experiments, information is collected that can be used to estimate travellers' values of time and propensity to use the proposed toll road under a range of possible future conditions.

The WTP survey is critical to the study, as it will highlight the willingness of travellers (based on their value of time) to pay the toll and utilise the Project within the traffic model. Arup developed a survey specification based on our experience in similar projects and studies to request all data which would be required for the development of the traffic and revenue forecasts.

In consultation and with consent from CDG and NCTA, Arup appointed NuStats to design and execute the surveys and analyse the outputs. NuStats are a research firm based in Austin, Texas that specialise in complex and typically large-scale transportation surveys within the United States. NuStats have widespread experience in travel behaviour surveys, having worked with the majority of mid-and large-size public transit agencies in the U.S. NuStats are also involved in extensive surveys regarding tolling, road pricing and public transit market demand.

The attached memo, produced by NuStats in collaboration with Arup, summarises the development of the WTP survey instrument, the locations in which the survey will be administered, and the instrument itself. It should be noted that further revisions to the survey questionnaire may be required following testing of the instrument in the field. Details of any such changes will be included in the technical memo summarising the WTP results.

1.2 Report Structure

The structure of this report is as follows:

- Appendix A summarises the development of the survey instrument, the survey locations and schedule.
- Appendix B includes the survey instrument to be administered.

Appendix A

Willingness to Pay Memorandum

Draft

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Memorandum

To: ARUP

From: NuStats

CC: DataSource; GeoStats

Date: 8/27/2009

Re: Mid Currituck Bridge Stated Preference Survey Technical Memorandum on Sampling

---

The purpose of this memorandum is to outline the sample design for the Mid Currituck Bridge Stated Preference (SP) Survey. The following topics are described within this memorandum; project objectives, population of inference, data collection sites, proposed sample sizes, interview protocols, reporting and schedule.

Project Objectives

The North Carolina Turnpike Authority (NCTA) is planning to construct a toll bridge that will connect US 158 to NC 12 and span Currituck Sound. See Figure 1 below.

Figure 1: Proposed Facility Location

Prior to development of the facility, NCTA is interested in identifying how area residents and visitors perceive regional traffic congestion and how they value their time (VOT). These VOT estimates will then be used to establish a reasonable toll that can be charged by users of the new facility, which has been estimated to reduce travel time by up to 45-minutes, in addition to improving travel time reliability.

ARUP, on behalf of NCTA, has contracted with NuStats to collect a total of 1,600 stated preference surveys from area residents (800) and visitors (800). Data collection will be a combination of intercept, web and CATI. The data will be used to estimate potential toll charges.

One hundred percent of the visitor data will be colleted via intercepts. Residential data collection will be a combination of surveys collected in the field (via intercept) and from a web survey. If needed, telephone surveys will be conducted to complete residential data collection.

Population of Inference

The population of inference (or population under study) consists of area residents (residents of Camden, Currituck, Dare and Pasquotank Counties) and visitors at least 16 years of age who have taken a trip across Wright Memorial Bridge in the past 3 months. The residential survey instrument will be identical to the visitor survey with respect to content and data structure (thus allowing the project team to survey visitors as well as local residents during the field collection at key activity sites).

Proposed Sample Size

The sample size for this study is 1,600 surveys, half of which will come from visitors and the other half coming from residents. Tables 1 and 2 below provide details about sample strata. Please note that the income strata will not be defined until after data collection has started.

TABLE 1: SAMPLE STRATIFICATION BY TRIP PURPOSE AND INCOME STRATIFICATION

Trip Purpose	Income Stratification				Total
	Income Strata 1	Income Strata 2	Income Strata 3	Income Strata 4	
Business	100	100	100	100	400
Commute	100	100	100	100	400
Vacation Start/End	100	100	100	100	400
Other	100	100	100	100	400
Total	400	400	400	400	1,600

TABLE 2: SAMPLE STRATIFICATION BY RESPONDENT TYPE AND INCOME STRATIFICATION

Respondent Type	Income Stratification				Total
	Income Strata 1	Income Strata 2	Income Strata 3	Income Strata 4	
Resident	200	200	200	200	800
Visitor	200	200	200	200	800
Total	400	400	400	400	1,600

Intercept Data Collection Sites

Site visits were conducted July 19, 2009 - July 22, 2009. During this time, a NuStats field coordinator traveled to many potential survey sites in the region, meeting with facility personnel and providing project details, prior to asking for permission to survey at each location. The site visits were also used to identify the best days of week for surveying, the best times of day for surveying, and the best interview locations.

Very few sites provided immediate permission. Rather, the vast majority requested to be contacted later over the next week, giving the site contact sufficient time to check with the facility management regarding permission. Furthermore, some sites asked that they be provided with a copy of the final report (after NCTA approval) or a copy of the survey instrument, in return for permission to survey. Table 3 below provides a list of all facilities that were originally identified as potential sites. As of the date of this memo, a total of eight sites had granted the project team permission to interview (identified as those sites with a "Yes" in the "Permission" field). Follow up calls continue to be made to pending facilities, and these calls will continue until the project team is granted or denied permission.[1]

Web Surveys

As a supplement to the intercept residential data collection, a web survey is being developed for the collection of residential surveys via the Internet. The survey will be accessible via a web link that can be copied and pasted into a web browser. The web survey itself will be a structurally and programmatically similar to the interviewer administered version used for the visitor study, but will be reworded such that it can be conducted as a self-administered web survey. This will facilitate identical data structures for both the visitor and residential data set.

The respondent will then be prompted through the survey so that they provide the details necessary to complete the interview. Once the program is complete (having been tested thoroughly), the link and supporting information will be sent to the Outer Banks Chamber of Commerce, the Currituck County Chamber of Commerce, and the Greater Elizabeth County Chamber of Commerce. These chambers have agreed to then send the link and supporting information to members on their respective list serves, which are comprised of local businesses. In the message that is sent to each business, we will request that they forward the message to their employees, and encourage them to participate as an opportunity to make their voice heard.

Telephone Surveys

Listed telephone samples can be purchased from census tracts in the study area that will provide the highest possible rate of contact with households characterized by demographics of interest (such as specific income ranges). In the event that telephone surveys are deemed necessary to complete the residential data collection, NuStats will submit a telephone specific sample plan for review and approval.

Intercept Survey Staff

NuStats has already obtained a firm commitment from Coastal Staffing, a temporary staffing firm based in Kitty Hawk, NC, for surveyor recruitment. A team of fifteen surveyors will be recruited and trained for intercept interviewing. Prior to recruitment, NuStats will provide a list of skills/abilities to ensure that our staff is well positioned for the high level of professionalism that is required of our intercept surveyors.

A mandatory interviewer training session will be held on August 10, 2009, from 12pm to 5pm, at which time surveyors will be educated on a number of pertinent topics, including:

- Introduction to Study / Study Goals / Background
- Site Locations / Work Schedule
- Dress Code
- Supplies
- Study Design
- Work Tasks
- Questionnaire
- Tallying Refusals
- Reporting Time
- Contact Information
- Technology

[1] We will continue calling during the field period.

The survey training will conclude with a question and answer session during which interviewers will be encouraged to ask questions clarifying any outstanding issues they may have regarding their task.

Actual intercept surveying will begin August 11, 2009. Surveyors will be stationed at locations which will maximize their exposure to potential respondents. Our sampling methodology assumes that only one person, age 16 or older (preferably the driver), within a traveling party will be eligible to participate in the study. Each intercepted respondent will first be queried for eligibility, then, if eligibility is determined, willingness to participate. If they are willing, then they will be surveyed. If not, they will be tallied and thanked for their time.

Reporting
Throughout the survey process, NuStats will extract the data from the field collection, the web surveys, and, if need be, the telephone surveying, and provide NCTA with timely updates regarding progress toward the sample targets.

Data Collection Schedule
Intercept data collection will take place the weeks of August 10 and August 17, 2009. The web survey will "go live" the week of August 10, 2009. A decision about the telephone surveys will be made toward the end of August.

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Table 3: Intercept Site Locations

Type	Site	City	Permission	Survey Hours	Survey Days	Notes
Visitor	Hilton Garden Inn	Southern Shores	Yes	7am-5pm	7 days/week	
Visitor	Aycock Brown Visitor Center	Kitty Hawk	Yes	9am-5pm	7 days/week	
Visitor	Currituck Beach Lighthouse	Corolla	Yes	9am-5pm	7 days/week	
Visitor	Holiday Inn Express	Kitty Hawk	Yes	11am-5pm	Monday - Friday	
Visitor	Currituck County Rest Area	Barco	Yes	7am-7pm	7 days/week	
Visitor	Tanger Outlet	Nags Head	Yes	*TBD	7 days/week	Working with staff to identify best survey hours
Visitor	Brindley	Corolla	Yes	*TBD	*TBD	Working with staff to identify best survey hours
Visitor	Twiddy	Duck & Corolla	Yes	*TBD	*TBD	Working with staff to identify best survey hours
Visitor	Visitor Center	Manteo	No	N/A	N/A	Wished not to participate
Visitor	Duck Research Pier	Duck	No	N/A	N/A	Deemed that this was not a good site due to hours of operation are minimal
Visitor	Sea Kove Motel	Kitty Hawk	No	N/A	N/A	Declined
Visitor	Currituck County Visitor Center	Corolla	Pending	TBD	TBD	Scheduled callback
Visitor	Currituck County Welcome Center	Moyock	Pending	TBD	TBD	Scheduled callback
Visitor	Monument to a Century of Flight	Kitty Hawk	Pending	TBD	TBD	Have not returned call
Visitor	Wright Brothers National Memorial	Kill Devil Hills	Pending	TBD	TBD	Scheduled callback
Visitor	Hampton Inn & Suites	Corolla	Pending	TBD	TBD	Scheduled callback
Visitor	The Sanderling	Duck	Pending	TBD	TBD	Scheduled callback
Visitor	Realtor – Krista Templeton	Corolla	Pending	TBD	TBD	Scheduled callback

Visitor	Realtor – Tim Cafferty	Kitty Hawk	Pending	TBD	TBD	Scheduled callback
Visitor	Realtor – Norman Bibeau	Kitty Hawk	Pending	TBD	TBD	Scheduled callback
Visitor	Realtor – Janice Farr	Kill Devil Hills	Pending	TBD	TBD	Scheduled callback
Resident	Food Lion (all sites)	Corolla, Kitty Hawk	No	N/A	N/A	Corporate policy prohibits surveying
Resident	Wal-Mart (all sites)	Kitty Hawk, Elizabeth City	No	N/A	N/A	Corporate policy prohibits surveying
Resident	Harris Teeter (all sites)	Corolla	No	N/A	N/A	Corporate policy prohibits surveying
Resident	Sea Mark Foods	Kitty Hawk	Pending	TBD	TBD	Scheduled callback
Resident	Food-A-Rama	Manteo	Pending	TBD	TBD	Scheduled callback
Both	Public Beaches	Kill Devil Hills	Yes	7am-7pm	7 days/week	
Both	Tim-Buk-Tu	Corolla	Yes	7am-7pm	7 days/week	
Both	R/C Movie Theater	Kill Devil Hills	Pending	TBD	TBD	Scheduled callback
Both	R/C Movie Theater	Corolla	Pending	TBD	TBD	Scheduled callback
Both	Duck's Cottage	Duck	Pending	TBD	TBD	Scheduled callback
Both	Scarborough Faire	Duck	Pending	TBD	TBD	Scheduled callback
Both	Public Beaches	Corolla	Pending	TBD	TBD	Scheduled callback
Both	I Scream Ice Cream	Duck	Pending	TBD	TBD	Scheduled callback
Both	Tommy's Market	Duck	Pending	TBD	TBD	Scheduled callback
Both	Starbuck's	Kitty Hawk	Pending	TBD	TBD	Scheduled callback

*Working with facility staff to determine best times of day.

Appendix B

Willingness to Pay Survey Instrument

Draft

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APPENDIX 1 – MID SURVEY INSTRUMENT

Note: This questionnaire has been constructed using the following convention – text presented in upper and lower case is read by the interviewer; text in ALL CAPS is not.

Hello, my name is _____. I'm here today on behalf of the North Carolina Turnpike Authority. We're conducting a short survey with residents and visitors regarding a yet to be constructed toll bridge that will span Currituck Sound, connecting the mainland to the Outer Banks. We would very much like to include your opinions in the survey. It will take only a few minutes of your time.

SUGGESTED: The Mid Currituck Bridge will be approximately seven miles in length and will connect US 158 with NC 12 south of Corolla. It will be built as a tolled facility, but the toll has not yet been determined. The bridge should be open to traffic by mid 2013. The Wright Memorial Bridge will remain open as a free alternative. The amount of travel time saved by paying the toll will depend mainly on the levels of traffic congestion on the two bridges.

P0. May we begin the survey?

YES	1
NO (TERMINATE)	2
DK/RF (TERMINATE)	9

SCREENING QUESTIONS

S0. Are you a resident of the region (defined as Dare, Currituck, Camden and Pasquotank counties) or a visitor to the region?

RESIDENT	1
VISITOR	2
DK/RF (TERMINATE)	9

NOTE: CREATE VARIABLE CALLED RTYPE

RTYPE1 = RESIDENTS

RTYPE2 = VISITORS

S00. IF RTYPE1 ASK Have you taken a trip across the Wright Memorial Bridge in the last 3 months?

YES (S1)	1
NO (TERMINATE)	2
DK/RF (TERMINATE)	9

S000. IF RTYPE2 ASK Have you used the Wright Memorial Bridge to travel to the Outer Banks? IF NEEDED The Wright Memorial Bridge is the bridge that connects mainland North Carolina (at Point Harbor, NC) to the Outer Banks (at Kitty Hawk, NC and Southern Shores, NC) via US 158 (also known as North Croatan Highway).

YES (S1)	1
NO (TERMINATE)	2

DK/RF (TERMINATE)	9

S1. Think about the most recent trip you took using the Wright Memorial Bridge across Currituck Sound. What was the purpose of that trip? Was it for: . . .

Business (non commute related such as delivery or attend meeting)	1
Commuting to / from regular workplace	2
Vacation Start/End (i.e. to / from their home residence to / from residence on Outer Banks)	3
Other (all other purposes which don't fit into the above categories)	4
DK/RF (TERMINATE)	9

S2. And to ensure that our survey responses are representative of the wide variety of RTYPE that are found in the region, could you please tell me into which of the following categories your household income falls.

Less than $14,999	1
$15,000 to $24,999	2
$25,000 to $34,999	3
$35,000 to $49,999	4
$50,000 to $74,999	5
$75,000 to $99,999	6
$100,000 to $149,999	7
$150,000 to $199,999	8
$200,000 to $249,999	9
$250,000 and above	10
DK/RF (TERMINATE)	99

REFERENCE TRIP DETAILS

R1. Including yourself, how many persons were in the vehicle?

ONE	1
TWO	2
THREE	3
FOUR	4
FIVE OR MORE	5
DK/RF	9

R2. What type of vehicle were you driving when you made this trip?

PASSENGER CAR, SUV OR PICKUP TRUCK	1
2-AXLE, 6 TYRE TRUCK OR BUS	2
3-AXLE TRUCK OR BUS	3

4-AXLE TRUCK	4
TRUCK WITH 6 OR MORE AXLES	5
MOTORCYCLE	6
DK/RF	9

R3. What day of the week was it?

MONDAY	1
TUESDAY	2
WEDNESDAY	3
THURSDAY	4
FRIDAY	5
SATURDAY	6
SUNDAY	7
DK/RF	9

R4. What time did you start this trip?

RECORD IN MILITARY TIME	1
DK/RF	9

R5. Where did you start this trip?

COLLECT TOWN/CITY, STATE AND ZIP CODE	1
DK/RF	9

NOTE: AT A MINIMUM, YOU MUST COLLECT CITY/TOWN, IF NOT, TERMINATE.

R6. Where did you end this trip?

Corolla	1
Sanderling	2
Duck	3
Southern Shores	4
Kitty Hawk	5
Kill Devil Hills	6
Collington	7
Nags Head	8

Whale Bone 9

Other > exclude from sample

R7. What time did you arrive at this end location?

RECORD IN MILITARY TIME 1

DK/RF 9

COMPUTE NEW VARIABLE, TRAVEL TIME = R7– R4 [# minutes]

R8. This means that your trip took about [TRAVEL TIME] minutes from start to end. Is this about right?

YES 1

IF NECESSARY COLLECT NEW START / END TIMES<-----NO 2

DK/RF 9

R9: Were you delayed by congestion on this trip when approaching or crossing the Wright Memorial Bridge?

YES 1

NO (SP EXPERIMENT) 2

DK/RF 9

R11. How much extra travel time do you think the congestion at the Wright Memorial Bridge added to your trip? A guess is OK.

ENTER TIME 1

DK/RF 9

MAKE SURE THE ANSWER TO R11 IS LESS THAN TRAVEL TIME

SP TRADE-OFF QUESTIONS

SP TRADE-OFF QUESTIONS: There are four SP questions, with two versions of the wording and response order – Half of the sample will get Version A and half of the sample gets Version B. The difference is the order of the response categories. For each respondent regardless of whether they are given SP Set A or B, there are three random draws- RANDZ = 1 through 3, RANDX = 1 through 4, and RANDY = 1 through 5 for each of the five questions in the set (see the tables below).

Values to use in SP scenarios

Scenario	SP1	SP 2	SP 3	SP 4	SP 5
Toll cost	**(TOLL) from Table C**	**(TOLL) from Table C**	**(TOLL) from Table C**	**(TOLL) from Table C**	**(TOLL) from Table C**
Distance saved	**(DSAVED) from Table A**	**(DSAVED) from Table A**	**(DSAVED) from Table A**	**(DSAVED) from Table A**	**(DSAVED) from Table A**

Time via existing bridge	**Actual (R7 – R4)**	**Free flow (R7 – R4 – R11)**	**Random extra (R7 – R4 – R11 + TEXTRA from Table B)**	**Random extra (R7 – R4 – R11 + TEXTRA from Table B)**	**Random extra (R7 – R4 – R11 + TEXTRA from Table B)**
Time via new bridge	**Free flow (R7 – R4 – R11 - TSAVED) from Table A**	**Free flow (R7 – R4 – R11 - TSAVED) from Table A**	**Free flow (R7 – R4 – R11 - TSAVED) from Table A**	**Free flow (R7 – R4 – R11 - TSAVED) from Table A**	**Free flow (R7 – R4 – R11 - TSAVED) from Table A**
Total time saved	**TSAVED + R11**	**TSAVED**	**TSAVED + TEXTRA**	**TSAVED + TEXTRA**	**TSAVED + TEXTRA**

Table A1: Derivation for base levels of DSAVED and TSAVED as a function of R6

Destination	**Corolla**	**Sander-ling**	**Duck**	**Southern Shores**	**South of 158**
Coinjock-Point Harbor on 158	21 miles, 26 min.	21 miles, 26 min.	21 miles, 26 min.	21 miles, 26 min.	21 miles, 26 min.
Wright Memorial Bridge	5 miles, 6 min	5 miles, 6 min	5 miles, 6 min	5 miles, 6 min	5 miles, 6 min
North on Rte. 12	17 miles, 30 min	9 miles, 18 min	4 miles, 7 min	1 mile, 2 min	0
Total via Wright Bridge	**43 miles, 62 min**	**35 miles, 50 min**	**30 miles, 39 min**	**27 miles, 34 min**	**26 miles, 32 min**
Mid-Cuttrick Bridge	8 miles, 9 min	8 miles, 9 min	8 miles, 9 min	8 miles, 9 min	8 miles, 9 min
South on Rte 12	0	8 miles, 12 min	13 miles, 23 min	16 miles, 28 min	17 miles, 30 min
Total via New Bridge	**8 miles, 9 min**	**16 miles, 21 min**	**21 miles, 32 min**	**24 miles, 37 min**	**25 miles, 39 min**
Distance Savings	**35 miles**	**19 miles**	**9 miles**	**3 miles**	**1 mile**
Time Savings	**53 min**	**29 min**	**7 min**	**(3 min)**	**(7 min)**

Table A2: Values for DSAVED and TSAVED as a function of R6 and RANDZ:

Destination	Distance Saved	Time Saved, RANDZ = 1	Time Saved, RANDZ = 2	Time Saved, RANDZ = 3
Corolla	35 miles	50 min	55 min	60 min
Sanderling	20 miles	25 min	30 min	35 min
Duck	10 miles	5 min	10 min	15 min
Southern Shores	3 miles	0 min	5 min	5 min
Kitty Hawk	1 mile	0 min	0 min	5 min
Kill Devil Hills	1 mile	0 min	0 min	5 min
Collington	1 mile	0 min	0 min	5 min
Nags Head	1 mile	0 min	0 min	5 min
Whale Bone	1 mile	0 min	0 min	5 min

Table B: Values for TEXTRA as a function of RANDX

RANDX	SP 1	SP 2	SP 3	SP 4	SP 5
1	0	0	20	10	40
2	0	0	30	40	10
3	0	0	10	20	30
4	0	0	40	30	20

Table C: Values of TOLL as a function of RANDY

RANDY	SP 1	SP 2	SP 3	SP 4	SP 5
1	5	20	15	10	30
2	16	8	4	24	12
3	9	21	15	3	6
4	12	18	30	24	6
5	25	5	10	15	20

Example

Now assume you're making a future trip just like the one that you just told me about. It's a trip on the same day, at the same time of day, for the same purpose, and you're under the same time pressures. When traveling over Currituck Sound, you have the option of using the new Mid Currituck Toll Bridge if you want to. Compared to the existing Wright Memorial Bridge, the new toll bridge would save you a certain amount of driving distance and travel time, depending on your destination on the Outer Banks. In some of the scenarios that follow, you can imagine that there will be additional traffic congestion on the current bridge, in which case the new toll bridge would save you even more time. Let's start with the first choice scenario….

SP1 Trade-off Version A: If you were to use the Wright Memorial Bridge, your trip would take ..... minutes and be free. If you used the new Mid Currituck Bridge you would pay $Y and your trip would take .....

minutes, saving ..... minutes. The journey via the new bridge would be ..... miles shorter avoiding Route 158 through the Currituck peninsula.
Now under these conditions, would you choose to:

Use the new Mid Currituck Bridge, pay [**$Y**] and save [X] minutes	1
Use the Wright Memorial Bridge for free	2
DK	9

SP 1Trade-off Version B: If you were to use the new Mid Currituck Bridge you would pay $Y and your trip would take ..... minutes. If you used the Wright Memorial Bridge, your trip would take ..... minutes, ... minutes longer than the toll bridge, but it would be free. The journey via the Wright Memorial Bridge would be ..... miles longer using Route 158 through the Currituck peninsula.

Now, under these conditions, would you choose to:

Use the Wright Memorial Bridge for free	2
Use the new Mid Currituck Bridge, pay [**$Y**] and save [X] minutes	1
DK	9

[Repeat 4 times values changing]

DEMOGRAPHICS MODULE

Just a few more questions, and we will be done . . . .

T1. What is your preferred method of toll collection?

Cash Pay (Stopping to pay at booth)	1
Electronic Toll Collection (Toll Tag)	2
Mail in Payment Upon Receiving Bill in Mail	3
RF	9

T2. Do you own an electronic toll tag?

YES	1
NO	2
DK/RF	9

T4. –IF RTYPE1 ASK How many times per week do you usually cross the Wright Memorial Bridge?

NONE	1
RECORD INTEGER	2
DK/RF	9

–T5. IF RTYPE2 ASK How many times per week do you think you will cross the Wright Memorial Bridge during your stay on the Outer Banks?

NONE	1
RECORD INTEGER	2
DK/RF	9

T6. The new Mid Currituck Bridge will most likely have a toll payment system that requires you to stop and pay at a toll booth. Would this alter your decision to use the bridge?

YES	1
NO	2
DK/RF	9

T7. IF YES Using a scale of 1 to 5 where 1 is Very Unlikely and 5 is Very Likely, how likely would you be to use the new Mid Currituck Bridge, knowing that you would have to stop and pay at a toll booth?

VERY UNLIKELY	1
UNLIKELY	2
NEITHER LIKELY OR UNLIKELY	3
LIKELY	4
VERY LIKELY	5
DK/RF	9

D1. What is your age?

18 - 24	1
25 - 34	2
35 - 44	3
45 -54	4
55 - 64	5
65 OR OLDER	6
RF	9

D2. How many people, including yourself, currently live in your household?

ONE	1
TWO	2
THREE	3
FOUR OR MORE	4
DK/RF	9

D3. What is your home zip code?

ZIP CODE	1
RF	9

D4. RECORD GENDER (BY OBSERVATION).

MALE	1
FEMALE	2

Thank you very much for your time.

Appendix D

Technical Memo #4 - Realtors Database Report

N.C. TURNPIKE AUTHORITY,
THE MID-CURRITUCK DEVELOPMENT
GROUP AND ARUP

Mid-Currituck Sound Bridge
Phase 2 Research Study

October 12, 2009

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Raleigh
Washington, D.C.
Dubai

“Without the bridge we will steadily choke.”

Currituck County realtor

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I. Key Findings

- Extrapolations based on the sample of realtor data analyzed suggest that between 330,900 and 441,200 tourist vehicles travel to the Currituck Outer Banks rental properties each year. These figures do not include estimates for local residents, Outer Banks employees or day-trippers to the area.
- The vast majority of individuals who signed rental contracts for Currituck County rental units managed by the realtors in the sample from 2004 to 2009 were from Virginia with a concentration in the northern Virginia area. Pennsylvania and Maryland ZIP codes also were prevalent over the period. This suggests that a significant proportion of visitors to the Currituck Outer Banks travel a minimum of five hours by car and pay some tolls along the way.
- Between 2005 and 2008, occupancy rates for the rental units in the sample during height of peak (mid-July to mid-August) have consistently been 100 percent. The average occupancy rates for peak season (early June to mid-July and mid-August to the end of August) during that same time period was 85 percent
- Projected occupancy rates for those units during the peak and height-of-peak seasons in 2009 are slightly lower than prior years (85 to 100 percent, respectively). Anecdotally, however, realtors said they expected occupancy rates during the 2009 season to equal previous years as individuals who delayed making decisions early in the summer move forward with their vacation plans.
- Occupancy rates during the spring shoulder season have consistently ranged between about 50 percent and 60 percent for the past five years
- Occupancy during the fall shoulder season has historically been stronger than the spring season with average rates ranging between 65 percent and 70 percent.
- While the realtors in the sample reported that off-peak occupancy rates are negligible, holiday occupancy rates have remained steady with most years averaging about 50 percent.
- 67 percent of all units (2,193) managed by the realtors in the sample have between four and six bedrooms of which 77 percent (1,680) are located north of the Wright Memorial Bridge.
- 65 percent of all rental properties managed by the realtors in the sample have Saturday check-in/check-out times; 60 percent of those properties are located north of the Wright Memorial Bridge.

II. Methodology

This phase comprised a quantitative analysis of data gathered from the databases of seven of the larger Currituck County Outer Banks realty firms regarding aggregate rental property characteristics, seasonal occupancy rates and tourists' ZIP codes of origin.

III. Research Objective

The primary research objective was to collect and assess historical data from 2004 to 2009 on the rental market, including the ZIP codes of origin for the rental unit signatories; the sizes and locations of existing inventory of rental units; and annual occupancy rates. This report is intended to supplement traffic and revenue forecasts and allied qualitative analyses for the project; it is not intended nor is it suitable as model input.

IV. Target Research Market

The primary target geographic area for this research is the northern region of Bodie Island including Currituck County and the northern part of Dare County, which would be served by the proposed bridge. This includes the communities of Carova, Corolla, Duck and Southern Shores.

V. Respondents

Of the original 12 firms interviewed in Phase 1 of this project, seven provided partial or complete sets of data to the research team by July 22, 2009. These companies manage 2,269 properties north of the Wright Memorial Bridge (or approximately 50 percent of the estimated 4,500 rental properties in the target area). These firms manage a total of 3,261 properties throughout the Outer Banks (including Kill Devil Hills, Kitty Hawk and Nags Head).

VI. ZIP Codes of Origin

Key findings:

- *Between 2004 and 2009, Virginia accounted for 88 percent of the ZIP codes in the top 10 percent of the individuals who signed the rental agreements (i.e., "signatories"). Sixty percent of those ZIP codes were located in northern Virginia.*
- *This pattern has remained consistent over the time period suggesting that a large portion of visitors to the Currituck Outer Banks travels a minimum of five hours by car and are accustomed to paying highway/bridge tolls.*
- *The top 20 percent of ZIP codes of origin from 2004 to 2009 for the sample are located in Virginia (88 percent), Maryland (8 percent) and Pennsylvania (4 percent).*

Data[1] were aggregated by firm, by year and in total for the entire time period and frequencies were calculated. Each ZIP code entry was treated as a unique visit. It should be emphasized that the data only reflect the ZIP codes of origin for the rental unit signatories; there are no data available from realty firms that capture the ZIP codes of origin for other individuals who are staying in the properties. In addition, the ZIP code data comprise rentals in Carova, Corolla, Duck, Kill Devil Hills, Kitty Hawk, Nags Head and Southern Shores, though approximately 70 percent of the properties represented are located north of the Wright Memorial Bridge.

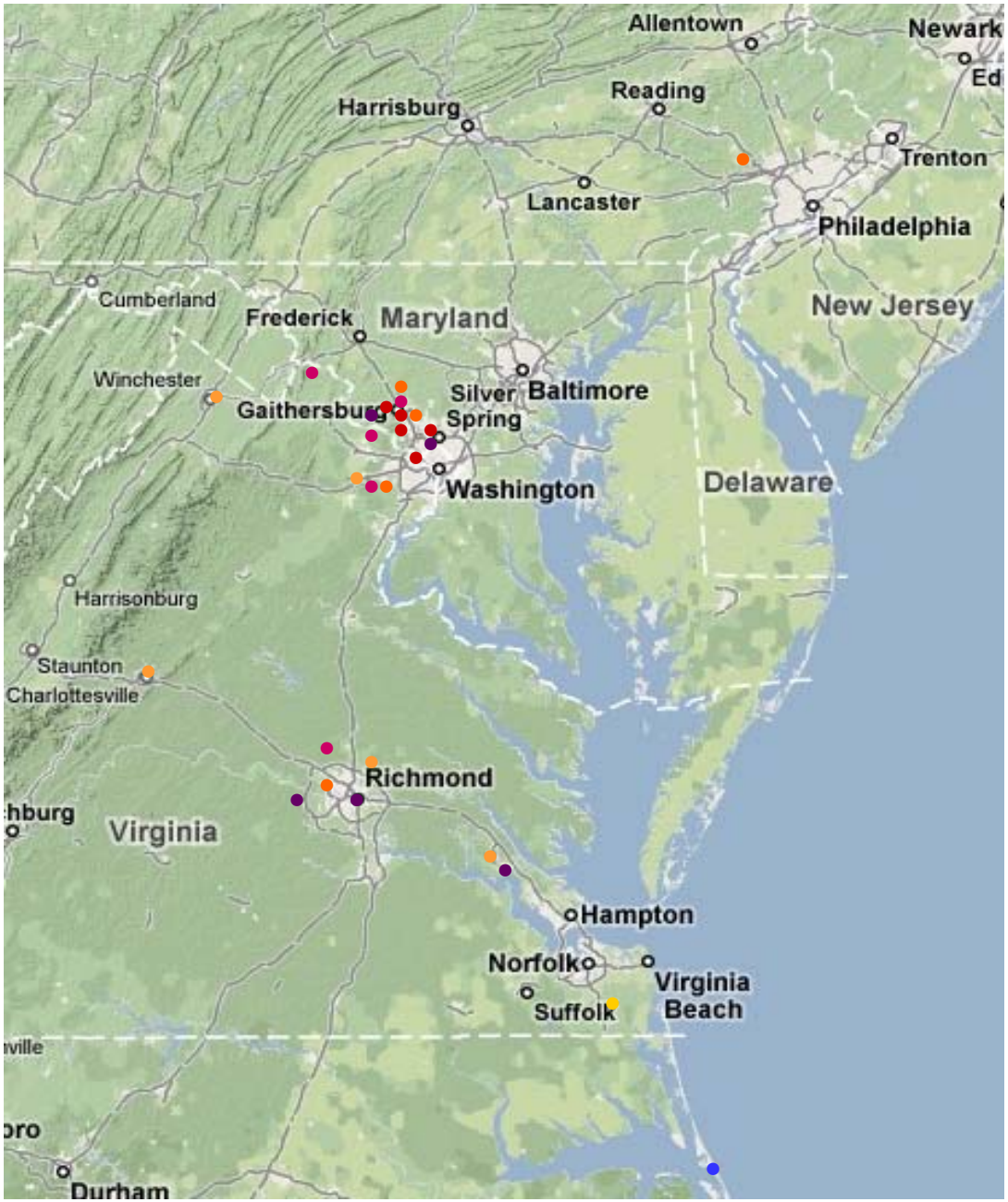
Displayed below are top-line summary findings from the analysis, including the top 10 and 20 percent of the most frequent ZIP codes for the years 2004 -2009.

The chart below – **ZIP Codes in the Top 10 Percent** – depicts in rank order the locations of the ZIP codes in the top 10 percent based on frequency of origin for the years 2004 to 2009.

We chose not to display results over the top 20 percent because an informal review of the data indicated that results at the 10 and 20 percent levels were representative of the global database. Analysis also showed that the change in percentage continued to decrease once the 20 percent mark was passed (there was, in fact, a marked plateau between 10 and 20 percent as the rate of change leveled off – see page 10).

[1] Four firms provided aggregated ZIP code data for 2004-2009; one firm provided year-by-year data for 2004-2009; and two firms provided year-by-year data for 2006-2009 (Note: the firm was founded in 2006). This inconsistency in the data received means that the analyses of the total data for 2004-2009 and the analyses exploring year-over-year fluctuations later in this report are inevitably based on different sets of data.

ZIP Codes in the Top 10 Percent

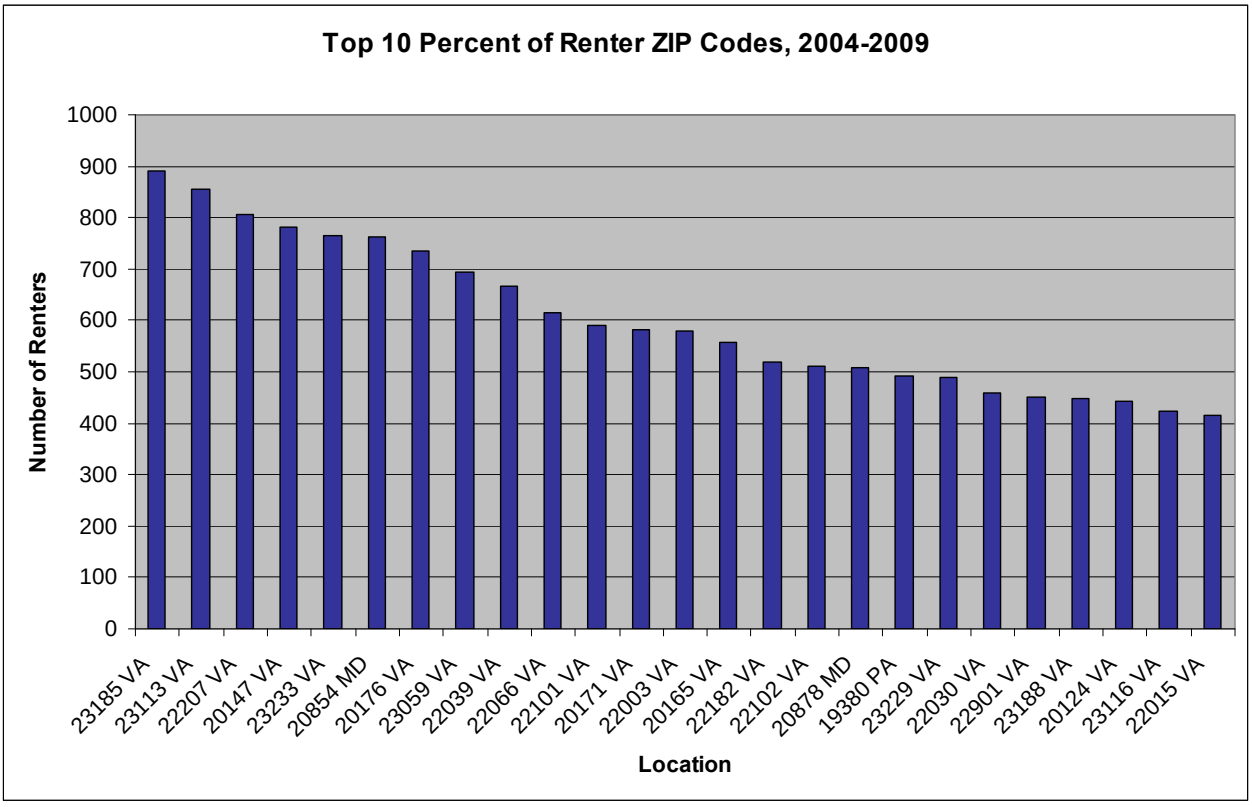


Rank	ZIP Code	City, State
1	23185	Williamsburg, VA
2	23113	Midlothian, VA
3	22207	Arlington, VA
4	20147	Ashburn, VA
5	23233	Richmond, VA
6	20854	Potomac, MD
7	20176	Leesburg, VA
8	23059	Wyndham, VA
9	22039	Fairfax, VA
10	22066	Great Falls, VA
11	22101	McLean, VA
12	20171	Herndon, VA
13	22003	Annandale, VA
14	20165	Sterling, VA
15	22182	Vienna, VA
16	22102	Tysons Corner, VA
17	20878	Gaithersburg, MD
18	19380	West Chester, PA
19	23229	Richmond, VA
20	22030	Fairfax, VA
21	22901	Charlottesville, VA
22	23188	Williamsburg, VA
23	20124	Clifton, VA
24	23116	Mechanicsville, VA
25	22015	Burke, VA
26	23322	Chesapeake, VA
-	27949	Kitty Hawk, NC*

* Kitty Hawk is excluded from the top 10 percent because further investigation with area realtors indicated that its appearance in this group was, in fact, an anomaly (see explanation next page)

*While data analysis placed the 27949 ZIP code, which includes Kitty Hawk, N.C., as the 10th most frequent, this result was excluded from the research report.[2]

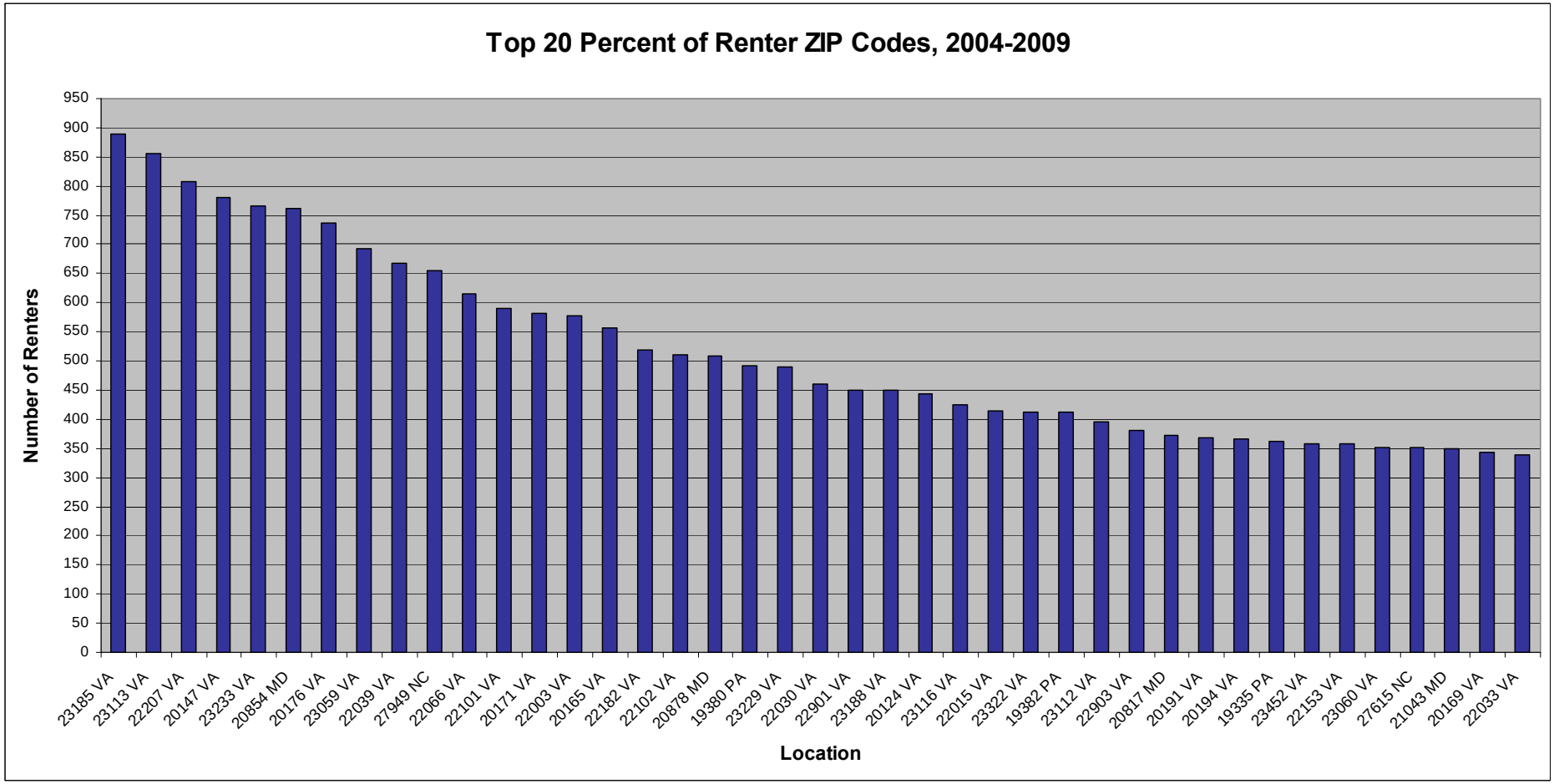
The chart below (**Top 10 Percent of Renter ZIP Codes, 2004-2009)** illustrates the number of renters from the ZIP codes in the top 10 percent (as depicted in the map above). The top 10 percent were determined by the number of times those particular ZIP codes appeared in the aggregate realtor data for the time period. Those with the greatest frequency (viz., the ZIP codes from which the highest number of visitors originated) are considered in the "top."



[2] To help explain this anomaly, we contacted three of the area's leading realtors. All three suggested the finding was misleading and should be disregarded. Explanations included:

- "[That ZIP code result is] Mostly owners and us testing property reservations…"
- "All seven or eight8 reservations from Kitty Hawk were made by the same person (two different physical addresses, I believe) who was renting multiple homes for family members to visit. They may have been planning a family reunion or something of this nature. And, since the town of Kitty Hawk is not very big, it has but one ZIP code. In much larger cities, the city name may be the same while the city is assigned multiple ZIP codes depending on where you live within the city."
- "This has to be owner time. It should be considered as occupied in your analysis, but put that aside to determine where the people are coming from."

The chart below (**Top 20 Percent of Renter ZIP Codes, 2004-2009)** illustrates the number of renters from the ZIP codes in the top 20 percent. The top 20 percent were determined by the number of times those particular ZIP codes appeared in the aggregate realtor data for the time period. Those with the greatest frequency (viz., the ZIP codes from which the highest number of visitors originated) are considered in the "top." Specific rankings and locations are listed in the table following the chart.



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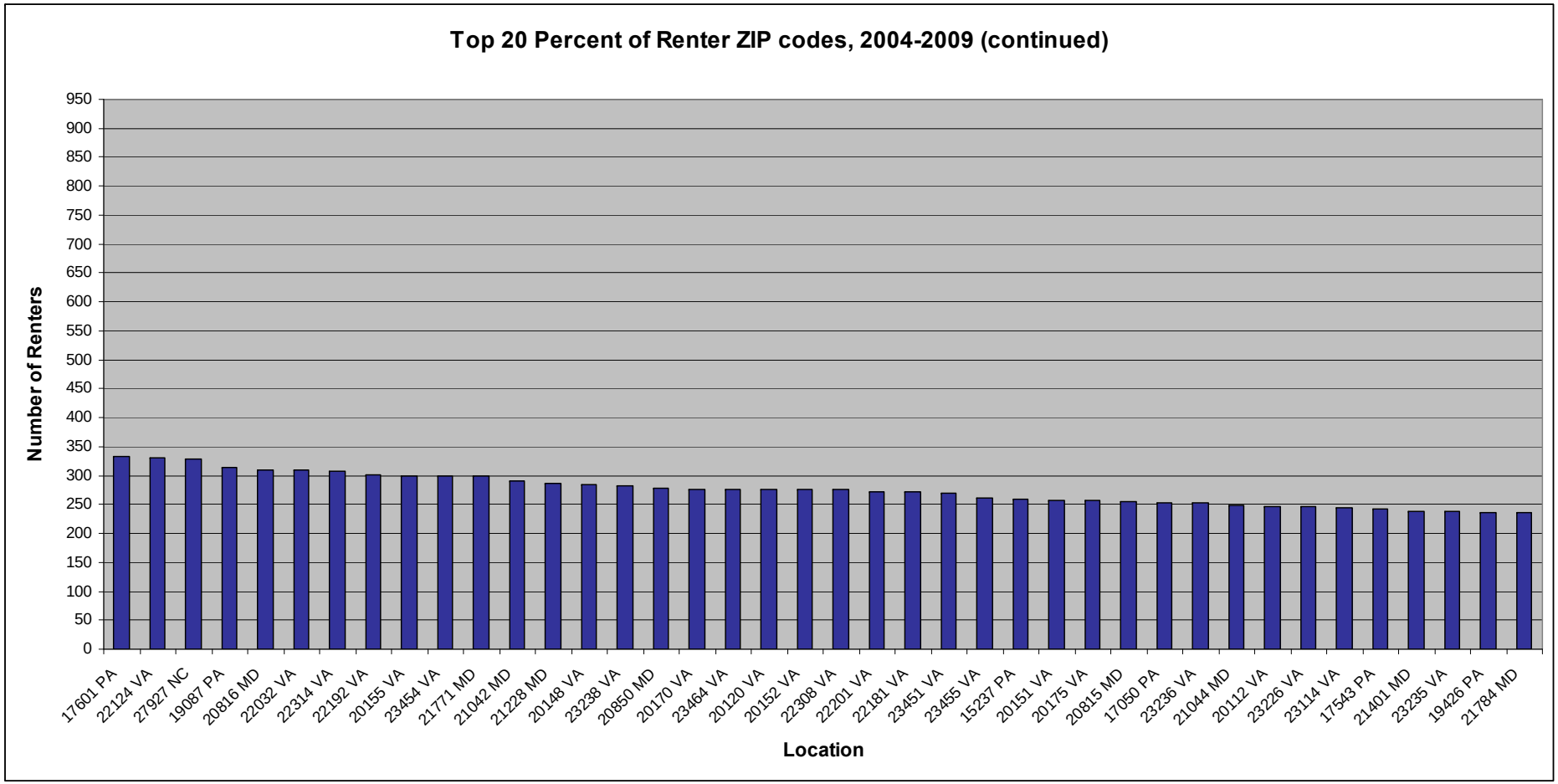
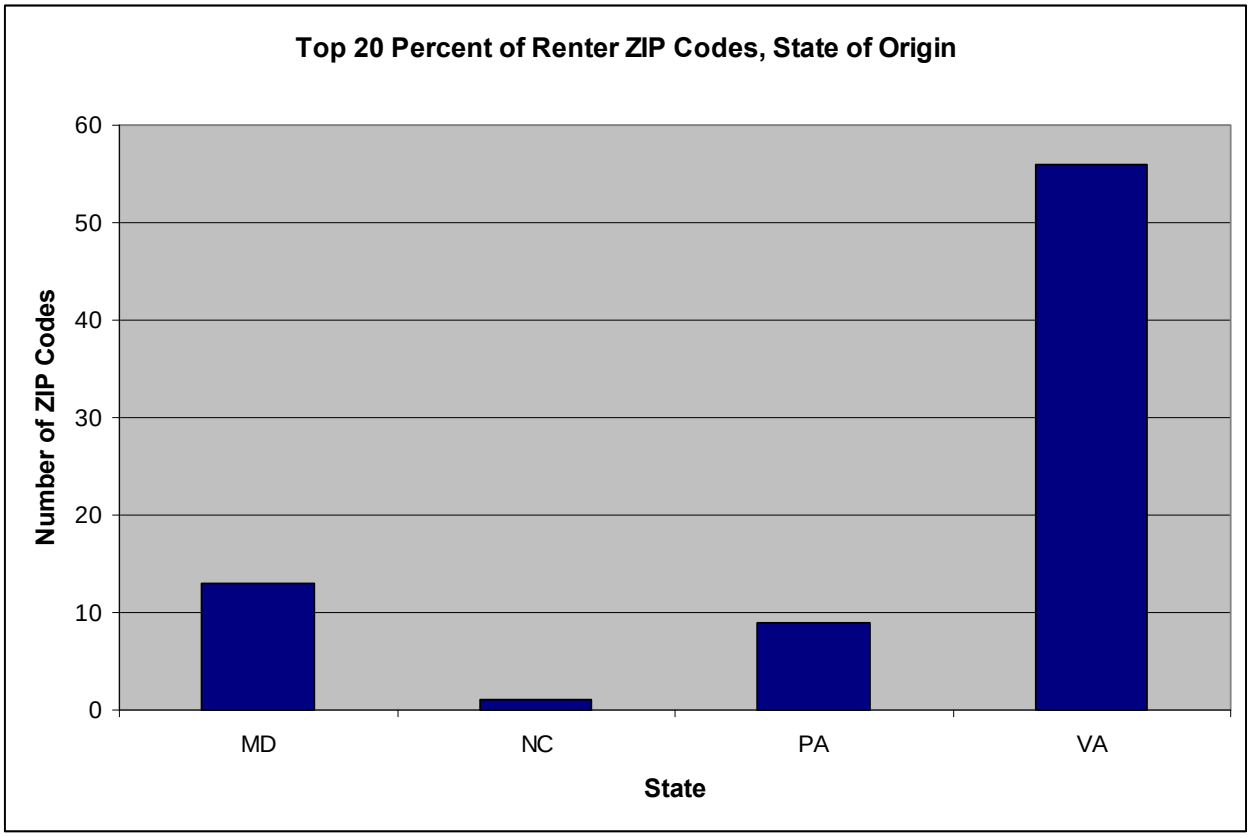

Top 20 Percent of Renter ZIP codes, 2004-2009 (continued)
Number of Renters
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
17601 PA
22124 VA
27927 NC
19087 PA
20816 MD
22032 VA
22314 VA
22192 VA
20155 VA
23454 VA
21771 MD
21042 MD
21228 MD
20148 VA
23238 VA
20850 MD
20170 VA
23464 VA
20120 VA
20152 VA
22308 VA
22201 VA
22181 VA
23451 VA
23455 VA
15237 PA
20151 VA
20175 VA
20815 MD
17050 PA
23236 VA
21044 MD
20112 VA
23226 VA
23114 VA
17543 PA
21401 MD
23235 VA
19426 PA
21784 MD
Location

Top 20 Percent of Renter ZIP Codes, 2004-2009				
Rank	**Zip Code**	**Frequency**	**# of Renters**	**Percentage**
1	23185 VA	890	**890**	**0.55%**
2	23113 VA	856	**1,746**	**1.09%**
3	22207 VA	807	**2,553**	**1.59%**
4	20147 VA	781	**3,334**	**2.07%**
5	23233 VA	765	**4,099**	**2.55%**
6	20854 MD	762	**4,861**	**3.02%**
7	20176 VA	736	**5,597**	**3.48%**
8	23059 VA	693	**6,290**	**3.91%**
9	22039 VA	668	**6,958**	**4.33%**
-	27949 NC	656	**7,614**	**4.74%**
10	22066 VA	615	**8,229**	**5.12%**
11	22101 VA	591	**8,820**	**5.49%**
12	20171 VA	582	**9,402**	**5.85%**
13	22003 VA	578	**9,980**	**6.21%**
14	20165 VA	557	**10,537**	**6.55%**
15	22182 VA	518	**11,055**	**6.88%**
16	22102 VA	511	**11,566**	**7.19%**
17	20878 MD	508	**12,074**	**7.51%**
18	19380 PA	492	**12,566**	**7.82%**
19	23229 VA	490	**13,056**	**8.12%**
20	22030 VA	460	**13,516**	**8.41%**
21	22901 VA	450	**13,966**	**8.69%**
22	23188 VA	449	**14,415**	**8.97%**
23	20124 VA	443	**14,858**	**9.24%**
24	23116 VA	424	**15,282**	**9.51%**
25	22015 VA	414	**15,696**	**9.76%**
26	23322 VA	413	**16,109**	**10.02%**
27	19382 PA	412	**16,521**	**10.28%**
28	23112 VA	395	**16,916**	**10.52%**
29	22903 VA	380	**17,296**	**10.76%**
30	20817 MD	372	**17,668**	**10.99%**
31	20191 VA	369	**18,037**	**11.22%**
32	20194 VA	367	**18,404**	**11.45%**
33	19335 PA	362	**18,766**	**11.67%**
34	23452 VA	358	**19,124**	**11.90%**
35	22153 VA	357	**19,481**	**12.12%**
36	23060 VA	352	**19,833**	**12.34%**
37	27615 NC	351	**20,184**	**12.55%**
38	21043 MD	349	**20,533**	**12.77%**
39	20169 VA	343	**20,876**	**12.99%**
40	22033 VA	338	**21,214**	**13.20%**
41	17601 PA	332	**21,546**	**13.40%**
42	22124 VA	331	**21,877**	**13.61%**
-	27927 NC	328	**22,205**	**13.81%**
43	19087 PA	313	**22,518**	**14.01%**

Top 20 Percent of Renter ZIP Codes, 2004-2009 (continued)				
Rank	**ZIP Code**	**Frequency**	**# of Renters**	**Percentage**
44	20816 MD	309	**22,827**	**14.20%**
45	22032 VA	309	**23,136**	**14.39%**
46	22314 VA	308	**23,444**	**14.58%**
47	22192 VA	301	**23,745**	**14.77%**
48	20155 VA	300	**24,045**	**14.96%**
49	23454 VA	300	**24,345**	**15.14%**
50	21771 MD	299	**24,644**	**15.33%**
51	21042 MD	291	**24,935**	**15.51%**
52	21228 MD	287	**25,222**	**15.69%**
53	20148 VA	285	**25,507**	**15.87%**
54	23238 VA	283	**25,790**	**16.04%**
55	20850 MD	278	**26,068**	**16.21%**
56	20170 VA	276	**26,344**	**16.39%**
57	23464 VA	276	**26,620**	**16.56%**
58	20120 VA	275	**26,895**	**16.73%**
59	20152 VA	275	**27,170**	**16.90%**
60	22308 VA	275	**27,445**	**17.07%**
61	22201 VA	272	**27,717**	**17.24%**
62	22181 VA	271	**27,988**	**17.41%**
63	23451 VA	269	**28,257**	**17.58%**
64	23455 VA	261	**28,518**	**17.74%**
65	15237 PA	260	**28,778**	**17.90%**
66	20151 VA	258	**29,036**	**18.06%**
67	20175 VA	258	**29,294**	**18.22%**
68	20815 MD	255	**29,549**	**18.38%**
69	17050 PA	252	**29,801**	**18.54%**
70	23236 VA	252	**30,053**	**18.69%**
71	21044 MD	248	**30,301**	**18.85%**
72	20112 VA	247	**30,548**	**19.00%**
73	23226 VA	247	**30,795**	**19.16%**
74	23114 VA	244	**31,039**	**19.31%**
75	17543 PA	243	**31,282**	**19.46%**
76	21401 MD	239	**31,521**	**19.61%**
77	23235 VA	238	**31,759**	**19.75%**
78	19426 PA	236	**31,995**	**19.90%**
79	21784 MD	236	**32,231**	**20.05%**

Consistent with the top 10 and 20 percent analyses, a review of the ZIP codes in the top 20 percent as illustrated below in the chart – **Top 20 Percent of Renter ZIP Codes, State of Origin** --confirms that Virginia accounted for the vast majority with 71 percent of the entries; Pennsylvania and Maryland followed at 11 and 16 percent and North Carolina accounted for one percent.



A separate report developed by the land use and demographic consultancy retained by Arup will analyze in more detail the complete universe of ZIP codes entries in the realtor database, including an assessment of the particular ZIP codes from which the largest proportion of renters originated.

VII. Occupancy Rates

Key findings:

- *Between 2005 and 2008, average occupancy rates for the height-of-peak season (early- to mid-July to the end of August) have consistently reached 100 percent.*
- *While off by approximately 7 percent from last year, projected occupancy rates for the peak and height-of-peak seasons in 2009 are relatively consistent with prior years suggesting that tourist traffic will continue to be heavy this summer. However, the 7% decline in occupancy was based on reservations in hand before peak season; more recent anecdotal evidence suggests that tourists may only have been delaying their vacation decision and that occupancy rates may be equal to and higher than last year.*
- *Occupancy rates during the spring shoulder season have consistently ranged between 50 and 60 percent for the past five years.*
- *Occupancy during the fall shoulder season has historically been stronger than the spring season with average rates ranging between 65 and 70 percent.*
- *While off-peak occupancy rates are negligible, holiday occupancy rates have remained steady with most years averaging approximately 50 percent suggesting that the area sees steady traffic during the five designated holidays.*

Four firms provided average seasonal occupancy data either in part or in total for the years 2005-2009.[3] Each firm provided the data in accordance with its own definition of seasonal categories, which, as per the descriptions in Phase I report, vary.

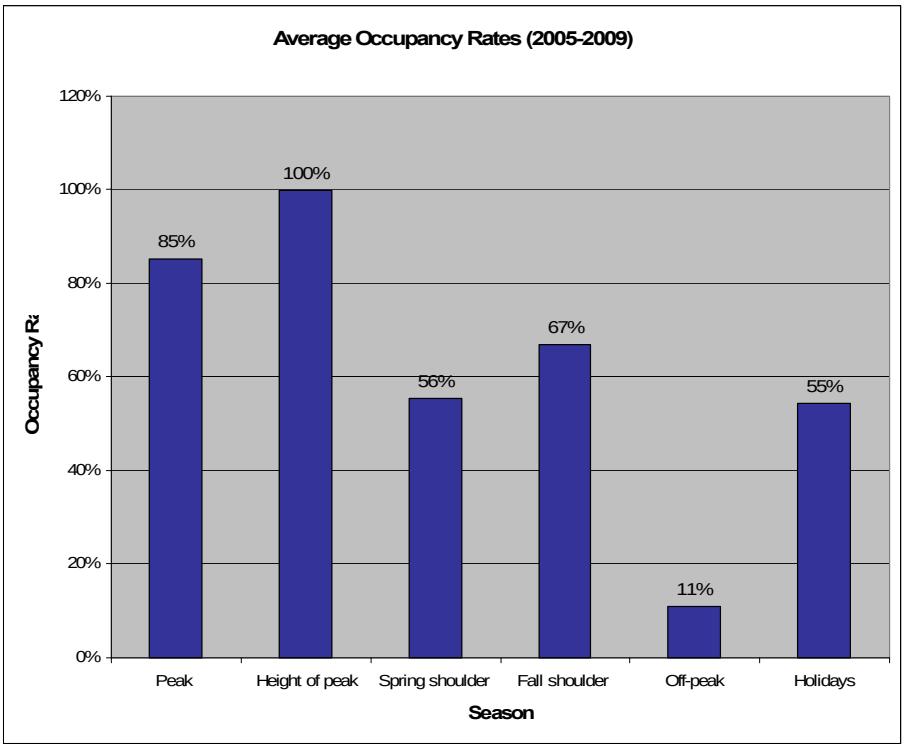
One firm provided vacancy data for 2008 and 2009 on a weekly basis between May 1 and September 27/28, but did not include data for holidays or off-season. In addition, the firm did not designate peak or shoulder seasons. That data has been incorporated as part of the aggregated total.

[3] As of July 22, 2009, no firms were able to provide occupancy data for 2004, and one firm was able to provide data only from 2006 to 2009.

While there were no consistent definitions among the firms, the data are segmented in the following categories:

- Peak: 6/1 – 8/31[4]
- Height of peak: 7/26 – 8/16[5]
- Spring shoulder: 5/1 – 5/31[6]
- Fall shoulder: 9/1 – 9/30
- Off-season: 10/1 – 4/30
- Holidays: Columbus Day, Thanksgiving, Christmas, New Year's, Easter

The charts below – **Average Occupancy Rates 2005-2009** and **Annual Averages – Occupancy Rates** by season -- displays the average seasonal occupancy rates reported by the realtors in this sample for the years 2005 to 2009. Consistent with the anecdotal reports captured in Phase 1 interviews with realtors, the average occupancy rate for peak season (not including the height of peak) is 85 percent and the average rate for the height of peak is 100 percent. As expected, average occupancy rates decrease during the other seasons by between 25 and 50 percent (other than off-peak).



[4] While most firms reported that peak season began in mid-June, one firm reported that its season began on June 1. In addition, some firms reported that peak season ended in mid-August while others identified August 31 as the end date. Therefore, average occupancy rates for peak season represented here stretch from June 1 to August 31.

[5] While in Phase 1 of this research most respondents noted that the height-of-peak season began after the July 4th holiday and ended on August 31, participants in this phase that specified a height-of-peak season listed the dates as July 26 to August 16.

[6] There was wide variation in realtors 'definitions of this season and no consensus emerged. The range and the one for the fall shoulder represent rough approximations only for the purpose of this analysis.

Annual Averages - Occupancy Rates							
	Definition of season	2004	2005	2006	2007	2008	2009
Avg. occupancy rate during peak season	6/1–7/25, 8/17-8/31	N/A	84%	79%	87%	91%	81%
Avg. occupancy rate during height of peak season	7/26–8/16	N/A	100%	100%	100%	100%	93%
Avg. occupancy rate during spring shoulder season	5/1-5/30	N/A	63%	48%	55%	56%	52%
Avg. occupancy rate during fall shoulder season	9/1--9/30	N/A	66%	67%	69%	66%	53%
Avg. occupancy rate during off-season	10/1 – 4/30	N/A	7%	11%	12%	14%	11%
Avg. occupancy rate during holidays	Various	N/A	65%	48%	52%	53%	45%

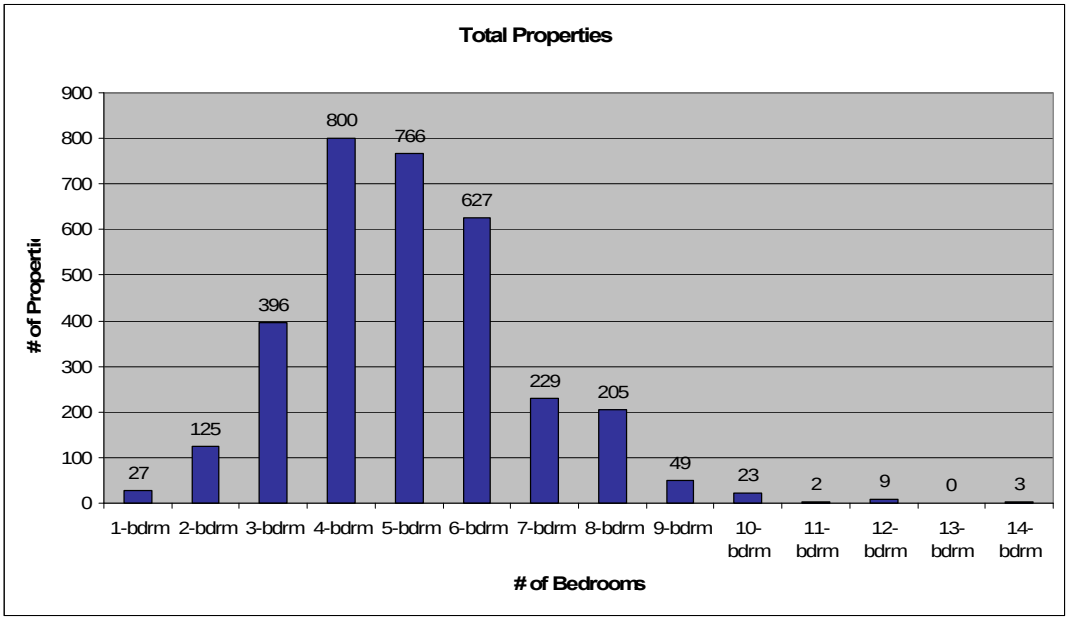
VIII. Rental Unit Profiles

Key findings

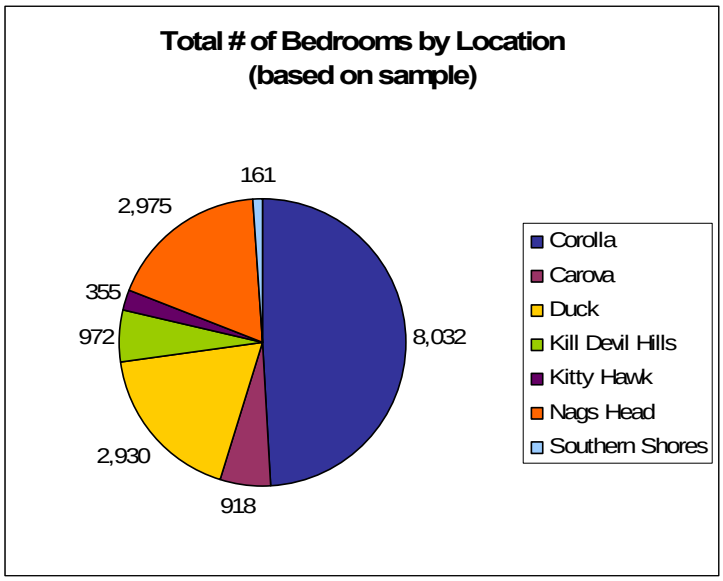
- *67 percent (2,193) of all units on the Outer Banks managed by the respondents have between four and six bedrooms; 77 percent (1,680) of those units are located north of the Wright Memorial Bridge.*
- *Nearly half of the unit bedrooms in the sample are located in Corolla with another 24 percent located in Duck and Carova.*
- *65 percent of all units on the Outer Banks managed by the respondents are Saturday check-in/check-out; 60 percent of those units are located north of the Wright Memorial Bridge.*

Six firms provided data detailing the location and size (i.e., number of bedrooms) of their rental units. In total, 3,261 units are represented in the data regarding location and size of which 70 percent (2,269) are located north of the Wright Memorial Bridge; 2,461 units are represented in the data on check-in/check-out days of which 60 percent (1,469) are located north of the Wright Memorial Bridge.

The **Total Properties** chart below illustrates that the majority of properties represented in the sample have between four and six bedrooms.

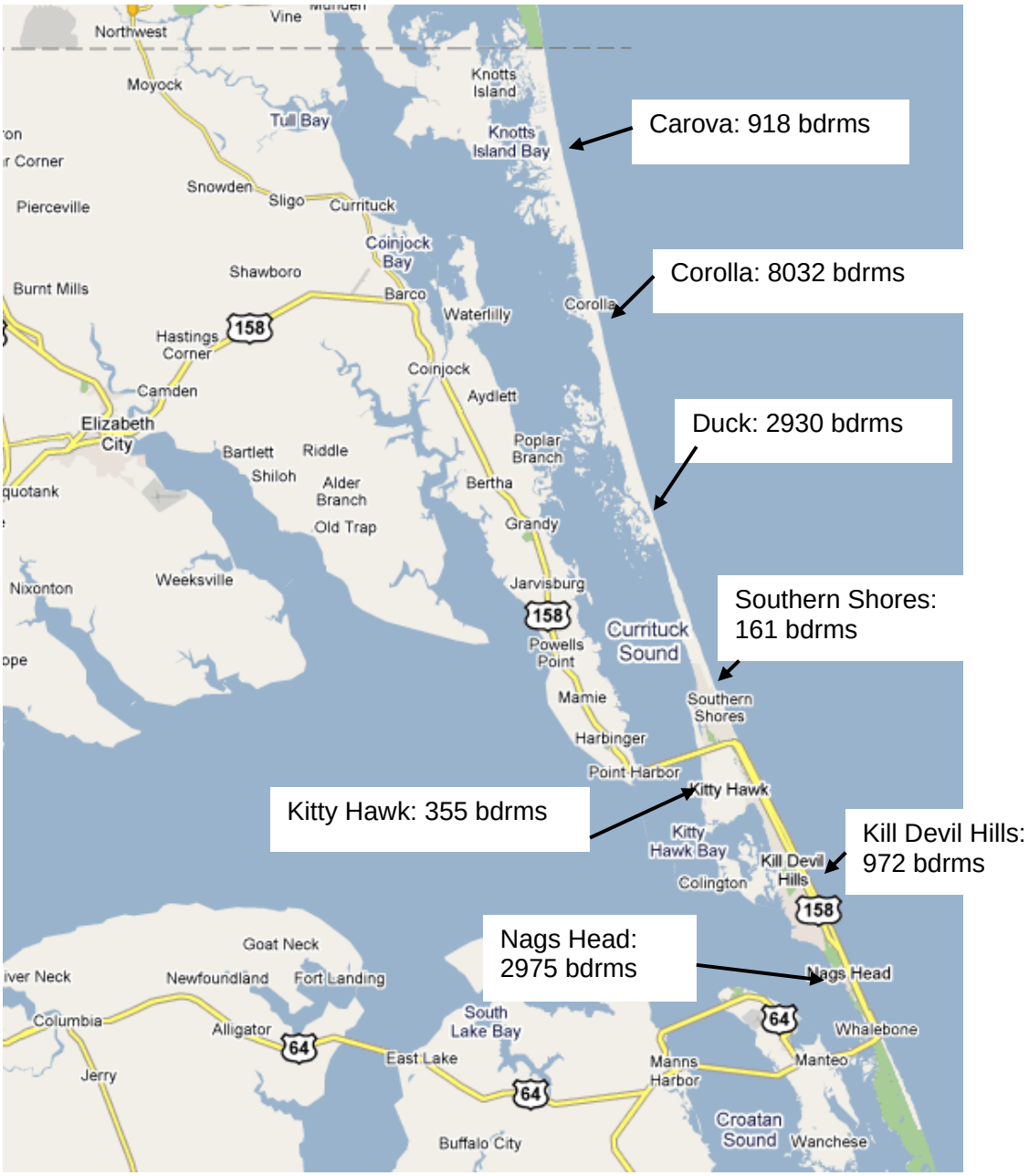


As illustrated in the chart below – **Total # of Bedrooms by Location** -- a review of the sample revealed that nearly half of the bedrooms are located in Corolla with another 24 percent located in Duck and Carova.



The map below -- **Location of Bedrooms Managed by Respondents** -- indicates the number of bedroom units managed by the respondents in the target communities. The chart following provides a breakdown of units managed by the respondents grouped according to location and size (number of bedrooms).

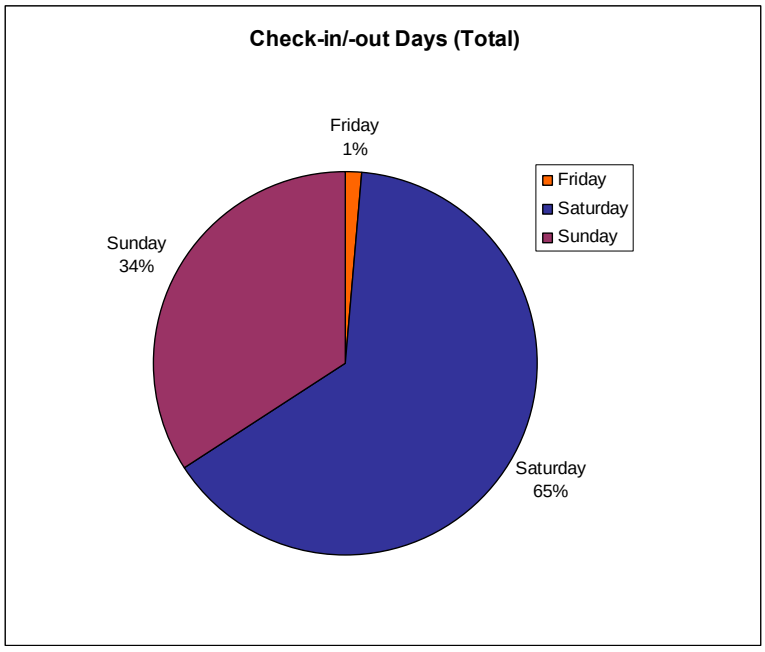
Location of Bedrooms Managed by Respondents



Location of Bedrooms Managed by Respondents (Chart)

# of Bdrms	Corolla	Carova	Duck	Kill Devil Hills	Kitty Hawk	Nags Head	Southern Shores	Totals	Total # of Bdrms	Total # of Bdrms Above WMB
1	0	0	18	9	0	0	0	27	27	18
2	19	2	25	50	7	22	0	125	250	92
3	59	13	44	105	29	144	2	396	1188	354
4	304	25	197	64	31	171	8	800	3200	2136
5	410	33	157	18	9	130	9	766	3830	3045
6	386	40	105	9	6	75	6	627	3762	3222
7	141	10	40	2	7	27	2	229	1603	1351
8	100	18	25	8	0	53	1	205	1640	1152
9	38	8	3	0	0	0	0	49	441	441
10	7	2	2	2	0	8	2	23	230	130
11	0	0	0	0	0	2	0	2	22	0
12	3	3	0	3	0	0	0	9	108	72
13	0	0	0	0	0	0	0	0	0	0
14	0	2	0	1	0	0	0	3	42	28
Total	**1,467**	**156**	**616**	**271**	**89**	**632**	**30**	**3,261**	**16,343**	**12,041**

Consistent with the findings in Phase 1 interviews, the **Check-in/Check-out Days** graph below shows that virtually all rental units in the sample have either Saturday or Sunday check-in and check-out dates, with a majority (65 percent) on Saturday.



IX. Analysis

The realtors who provided data for this study manage 12,041 unique bedrooms in rental properties north of the Wright Memorial Bridge in Carova, Corolla, Duck and Southern Shores. Using the average occupancy rates for the six designated seasons and the estimated 0.75:1.0 ratio of vehicles to bedrooms developed in Phase 1,[7] a rough estimate of the number of vehicles visiting the rental units managed by these realtors can be calculated.[8] It should be noted also that these figures represent estimates based on only 50 percent of the managed rental inventory in the Currituck Outer Banks. The figures do not include rent-by-owner properties or vehicles associated with local residents and Outer Banks employees.

Peak season (6/1 – 8/30, excluding height-of-peak weeks)

- 9 wks x 12,041 bdrm x .85 occp rate x 1.0 (vehicles/bdrm) = 92,114 vehicles
- 9 wks x 12,041 bdrm x .85 occp rate x .75 (vehicles/bdrm) = 69,085 vehicles

Height of Peak (7/26 – 8/16)

- 3 wks x 12,041 bdrm x 1.0 occp rate x 1.0 (vehicles/bdrm) = 36,123 vehicles
- 3 wks x 12,041 bdrm x 1.0 occp rate x .75 (vehicles/bdrm) = 27,092 vehicles

Spring Shoulder (5/1 – 5/30)

- 4 wks x 12,041 bdrm x .56 occp rate x 1.0 (vehicles/bdrm) = 26,972 vehicles
- 4 wks x 12,041 bdrm x .56 occp rate x .75 (vehicles/bdrm) = 20,229 vehicles

Fall Shoulder (9/1 – 9/30)

- 4 wks x 12,041 bdrm x .67 occp rate x 1.0 (vehicles/bdrm) = 32,270 vehicles
- 4 wks x 12,041 bdrm x .67 occp rate x .75 (vehicles/bdrm) = 24,202 vehicles

[7] As there was no consensus among the respondents on an appropriate ratio of vehicles to bedrooms, two calculations have been performed – one using a 1:1 ratio and one using a 0.75:1.0 ratio – to illustrate a likely range of vehicle totals. Many realtors said that subtracting one from the number of bedrooms might yield a reasonable estimate (e.g., five cars for a six-bedroom house) while others believed a 1:1 ratio would be appropriate. Hence, a reasonable estimate of the ratio of vehicles per unit likely ranges from .75 to 1.0.

[8] It must be emphasized that both ratios represent a very rough estimate based on a number of variables, factors and data characteristics that are neither consistent nor reliable. For example, the average occupancy rates comprise properties north and south of the Wright Memorial Bridge (the data was received in aggregate from the realtors), however they are being applied only to properties north of the bridge. In addition, the ratio of vehicles to cars represents a rough average of the top-of-mind estimates provided by area realtors during the Phase 1 interviews. These figures are included here solely to suggest potential vehicle traffic to the properties managed by these realtors and is neither intended not suitable for input in traffic and revenue models.

Holidays (five distinct visits assumed)

- 5 wks x 12,041 bdrm x .55 occp rate x 1.0 (vehicles/bdrm) = 33,113 vehicles
- 5 wks x 12,041 bdrm x .55 occp rate x .75 (vehicles/bdrm) = 24,835 vehicles

Therefore, the total estimated number of vehicles annually driven by tourists to the rental units in the sample ranges from 165,500 to 221,000.

If one assumes the other firms' occupancy rates and inventory characteristics are comparable to the firms represented in this analysis (which represents roughly half of the estimated 4,500 properties north of the Wright Memorial Bridge), the total number of bedrooms in the target area can be doubled to 24,082. Using the same factors in the above equations, then, it can be estimated that between 330,886 and 441,184 vehicles travel to the Currituck Outer Banks annually. These figures represent the estimated number of tourist vehicles only; they do not include any local residents, maintenance crews or other traffic.

Appendix A
Historical Rental Data Request

2005-2009 Historical Rental Data Request Form

1. For 2004 to 2009, please provide aggregate data regarding your clients' city/state of origin and ZIP codes.

   Note: We will be using zip codes to correlate with census data. If you do not have information back to 2004, please provide the information for the years that you do have. Please note: we do not want names, addresses or other identifying information; we want only to identify from where they come.

City, state of rental agreement holder	ZIP code	2004 total # of clients	2005 total # of clients	2006 total # of clients	2007 total # of clients	2008 total # of clients	2009 total # of clients (to date)
Arlington, VA	*22206*	*85*	*100*	*125*	*150*	*175*	*200*

2. From 2004 to 2009, for the properties you manage on the Outer Banks, please provide aggregate data on the number of properties classified by:
    - Size (e.g., 65 four-bedroom homes, 17 six-bedroom homes, etc.)
    - Location (e.g., Corolla, Duck)
    - Check-in/check-out day of the week (Fri/Sat/Sun)

    Note: Please enter "0""if you have no properties of a size in a location. We will be using this information to estimate the number of vehicles that guests bring to the Outer Banks. If you do not have information back to 2004, please provide the information for the years that you do have.

Location	1 bdrm	2 bdrm	3bdrm	…	18 bdrm	>18 bdrm	Friday check-in	Saturday check-in	Sunday check-in
Corolla	**#**	**#`**	**#**	**#**	**#**	**#**	**#**	**#**	**#**
Corova + 4WD area									
Duck									
Southern Shores									
Kitty Hawk									
Kill Devil Hills									
Nags Head									
Other									

3. From 2004 to 2009 (rented to date), please provide the following data for your rentals as a whole. As each firm's definition of a season varies, please define each season in the space provided.

   Note: If you do not have information back to 2004, please provide the information for the years that you do have.

From 2004 to 2009 (rented to date), please provide the following data for your rentals as a whole:							
	Your firm's definition of each season	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Average occupancy rate during your peak season							
Average occupancy rate during the height of your peak season (if you record that data separately)							
Average occupancy rate during your spring shoulder season							
Average occupancy rate during your fall shoulder season							
Average occupancy rate during your off-season							
Average occupancy rate during holidays (i.e., Columbus Day, Thanksgiving, Christmas, New Year's, Easter)							

4. Please provide the contact information for either the managers of your internal housekeeping and maintenance departments or external contract cleaning and maintenance services. We will likely contact these individuals to learn more about the commuting patterns of these groups.

Appendix E

Technical Memo #5 - Peak Season Traffic Survey Report

Currituck Development Group

Mid-Currituck Bridge

Technical Memo #5 - 2010 Peak Season Survey Report

Rep/209783/TM5

FINAL | September 2010

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 209783

ARUP

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Executive Summary

This technical note summarizes the 2010 peak season traffic surveys conducted in Currituck and Dare counties. Three sets of counts were conducted:

- Classified automatic traffic counts (ATC);
- Turning Movement Manual Classification Count (MCC); and
- Journey time surveys.

Traffic data was collected by Peggy Malone Associates (PMA), based in Jacksonville, Florida. PMA are a specialist company who has been performing traffic data collection for over 10 years having been involved in over 1,100 traffic data collection projects in the past five years. The peak season surveys commenced on July 8th 2010 and ran for two weeks until 23rd July 2010. Several rain storm events occurred during the data collection period, but these did not affect the quality of the data. It was necessary to extend the data collection by several days due to damage to equipment at two locations, but this has not affected the quality and reliability of the data. Following an extensive quality assurance process, the data has been deemed robust and appropriate for use in the traffic model.

The ATC counts highlight that the peak hour varies by site and day of the week. In general the PM peak period is the busiest weekday period, whilst the AM and Midday(MD) periods show the highest levels of traffic during Saturday and Sunday respectively. Saturday traffic volumes are the highest of any day, directly associated with the check-in and check-out times for holiday accommodation on the Outer Banks. Sunday volumes are lower than on Saturday, with the busiest period around mid-morning.

The 2010 ATC data was compared with the North Carolina Department of Transport (NCDOT) permanent count location to ensure the data was consistent with an independent data source. In all cases, the 2010 Arup / PMA counts were broadly consistent with data collected at the NCDOT site. Comparisons of the 2010 and 2009 NCDOT data highlights that there is some evidence of daily traffic growth on weekdays and Saturday, whilst a slightly lower total for Sunday was observed in comparison with 2009.

One journey time survey route was undertaken between Barco (intersection of US-158/NC-168) and Corolla (Carova Beach Access). This is the primary route for which the Mid-Currituck Bridge will provide an alternative. The journey time surveys highlighted significant delays associated with vacationers travelling to and from the Outer Banks, with considerable delays observed outbound from the Outer Banks during the Saturday AM peak, and inbound during the Saturday MD and PM peak. There was significantly less variation observed during the week and on Sundays.

Five classified turning movement counts were undertaken. These were conducted at the junctions of US-158 (North Croatan Highway), NC-12 southbound (Virginia Dare Trail) and NC-12 northbound (Ocean Boulevard), and the Walmart/Marketplace @ Southern Shores access points to provide information regarding the volumes of passenger vehicles, trucks, and pedestrians making each turning movement. These surveys were conducted using video recording equipment In addition, two further classified counts were conducted on US-158

and NC-12 at locations close to the ATC surveys to verify these outputs as robust. The proportion of trucks is very low (between 0.4 and 3 percent) at both intersections.

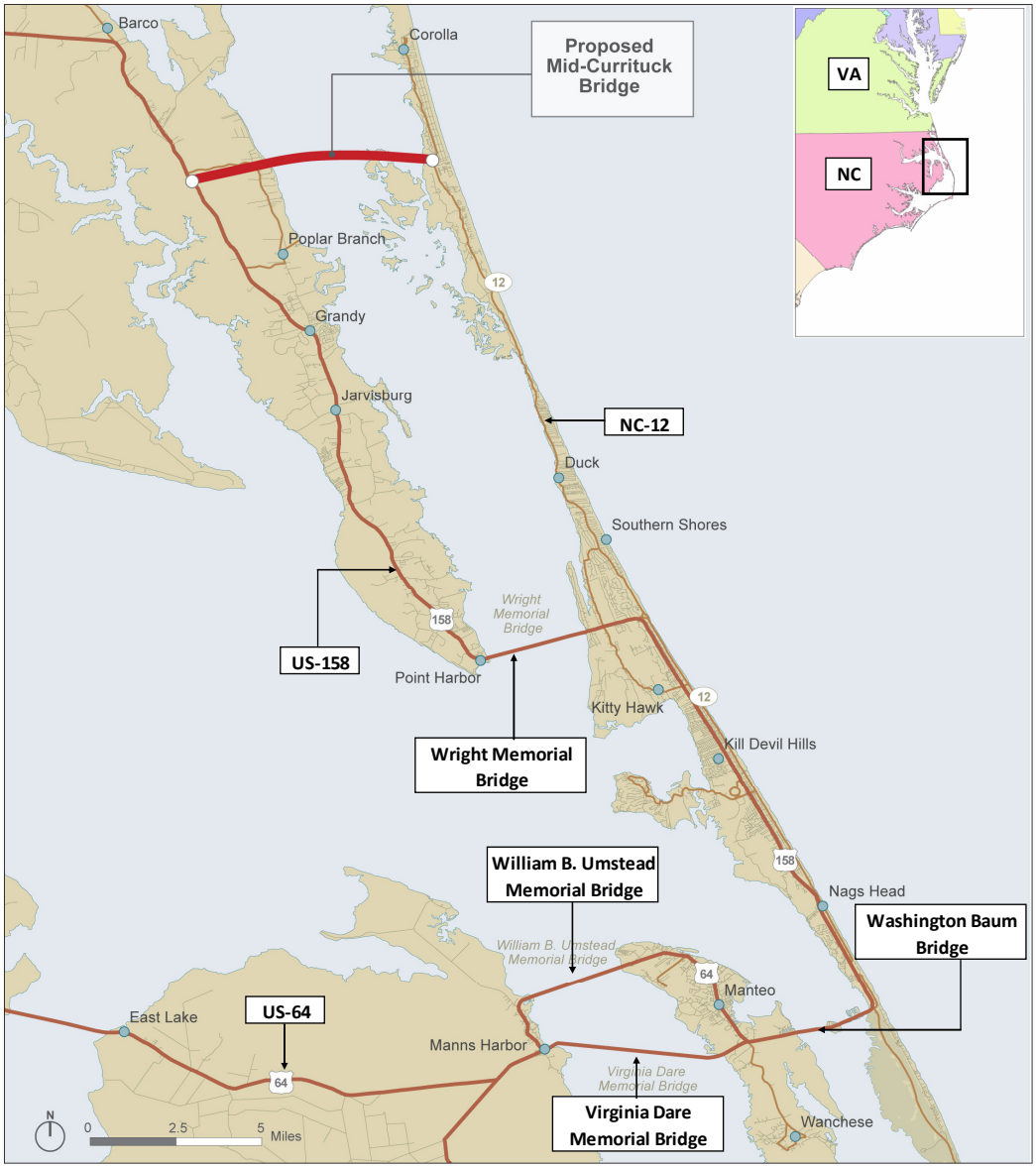
All data was checked to ensure that it will provide a robust base for the development of the traffic model. Further details on how this data will be utilized within the traffic model will be included in Technical Memo #8 - Presentation of the Model and Calibration Results.

1 Introduction

1.1 Project background

The North Carolina Turnpike Authority (NCTA) is authorized to study, plan, develop and undertake preliminary design work on the Mid-Currituck Bridge, a proposed toll facility in the Outer Banks. The Mid-Currituck Bridge is located in northeastern NC and would connect the Currituck County mainland, to Currituck County on the Outer Banks (Figure 1).

Figure 1: Study Area



The Outer Banks is a 200-mile (320-km) long string of narrow barrier islands off the coast of North Carolina. The islands cover approximately half the northern North Carolina coastline, separating the Albemarle Sound and Pamlico Sound from the Atlantic Ocean. The majority of the Outer Banks island communities, from Corolla to Nags Head, are prime summer vacation destinations. At the

moment there are two crossings south of the Virginia border; the Wright Memorial Bridge (around 32 miles south of the Virginia border) and the Washington Baum Bridge further south. Both crossings are untolled facilities.

1.2 The project and the wider area of influence

The proposed Mid-Currituck Bridge involves the construction of approximately seven miles of new road from US-158 on mainland Currituck County, to NC-12 on the Outer Banks (Figure 1). The exact design is currently under development.

This area currently has very limited road access. US-158 and NC-12 are the only means of north-south travel to the Outer Banks. According to preliminary analysis, the new bridge will save approximately 35 miles and significant time for some journeys. It will also improve the evacuation time of the outer banks in the event of emergencies.

In the summer, the Outer Banks become heavily congested and the proposed bridge will significantly ease this congestion whilst facilitating continued growth within the area.

The Outer Banks attracts millions of vacationers throughout the year and significant growth has been observed in recent years. Traffic within the area is highly seasonal, with peak weekend flows between June and August about 125 percent higher on the existing Wright Memorial Bridge and the Outer Banks than traffic observed during the rest of the season. Similarly, weekend traffic is about seventy percent higher than weekday traffic.

The existing road infrastructure operates near or at capacity on NC-12 between US-158/NC-12 and Corolla during summer weekends. The new bridge will substantially improve traffic flow conditions on NC-12 and US-158 and, at the same time, reduce travel time between the mainland and the Outer Banks and improve the overall system efficiency with additional linkage. As a result, it will provide opportunities for sustainable additional development of the northern part of the Outer Banks and the mainland.

In this respect, the Project presents a unique marketing opportunity to leverage the existing Outer Banks travel/tourism industry with tailored marketing strategies to highlight substantial travel time savings, cost savings, and increased accessibility to this beautiful and unique destination.

1.3 Objectives

This technical note summarizes the 2010 peak season traffic surveys conducted in Currituck and Dare counties in North Carolina. This traffic survey data was collected as input to the Mid-Currituck Bridge Traffic Model (MCTM) including:

- Classified automatic traffic counts (ATC);
- Turning Movement Manual Classification Count (MCC);
- Journey time surveys;
- Comparisons of the 2010 and 2009 peak season datasets; and
- Comparisons of the 2010 data with the Wright Memorial Bridge permanent count station.

Following a review of existing counts and consideration of the remaining project milestones, it was agreed to undertake the 2010 peak season survey starting in the week commencing July 8th 2010. Arup commissioned a sub contractor to undertake the traffic survey program. Whilst a sub contractor was commissioned, Arup undertook the scoping of the surveys as well as a supervisory role during the surveys. The chosen sub contractor for these surveys was Peggy Malone and Associates (PMA). Both PMA and an Arup Survey Supervisor were on site throughout the duration of the survey. Arup and PMA worked closely together to ensure any potential issues were identified at the earliest opportunity and any consequential impacts on the data collection process avoided.

2 Survey methodology

2.1 Overview

This section outlines the methodology adopted in undertaking the traffic data collection program. The traffic data was collected by Peggy Malone Associates (PMA), based in Jacksonville, Florida. Arup worked closely with PMA in developing the survey schedule and undertaking the actual surveys. This level of interaction ensured that the survey scope was achieved and any issues that arose were identified early and impacts on the data collection program avoided.

2.2 Planning and site visit

PMA and Arup conducted a review of the proposed count locations and intermediate journey time survey timing points to maximize the collection of accurate data. Specific sites were proposed for all locations to minimize as potential sources of error where possible, such as:

- Placing counters near intersections;
- Placing counters where vehicles drive slowly; and
- Placing counters where traffic backs up or queues across the count equipment.

Given the criticality of site selection to the success of a count, the PMA Field Operations Manager and Project Manager conducted a site visit to the Outer Banks from 1st June to 4th June, 2010. Following this visit, revisions to the count locations and proposed methodologies were made to maximise both the efficiency of the data collection and the robustness of the data for use within the MCTM.

2.3 Data collection

Equipment installation was conducted during non-peak activity times on 5th and 6th July to ensure all equipment was secure and counters were set safely. Before each count was officially started, a two day pilot survey was conducted which included the calibration of counters to ensure that accurate vehicle activity was recorded. The pilot survey commenced on 6th July, while the actual data collection period commenced on 8th July, 2010. The complete survey schedule is detailed in Table 1 below.

If any data collected was found to be erroneous, the counters were reset along with all of the counters at that site location and additional data was collected to infill any gaps.

2.4 Data processing

All count files were processed by PMA prior to being submitted to Arup. PMA assessed the quality of the results by examining:

- Confirmation of complete data in all fields and intervals;
- Comparison of counts for each 15 minute interval; and

- Analysis of peak period flow in conjunction with the related counts in the area.

Following the PMA quality assurance review, Arup conducted further logic checks on the data and engaged PMA in an iterative question and answer process.

Table 1: Survey Schedule

	Sun	Mon	Tue	Wed	Thu	Fri	Sat
	04-Jul	**05-Jul**	**06-Jul**	**07-Jul**	**08-Jul**	**09-Jul**	**10-Jul**
ATC Hose Counts			Pilot Survey	Pilot Survey	Hose Day 1	Hose Day 2	Hose Day 3
Turning Movements					6		6
Travel Time Studies					2		2
	Sun	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
	11-Jul	**12-Jul**	**13-Jul**	**14-Jul**	**15-Jul**	**16-Jul**	**17-Jul**
ATC Hose Counts	Hose Day 4	Hose Day 5	Hose Day 6	Hose Day 7	Hose Day 8	Hose Day 9	Hose Day 10
Turning Movements	6		6	6			
Travel Time Studies	2		1	1			
	Sun	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat / Sun**
	18-Jul	**19-Jul**	**20-Jul**	**21-Jul**	**22-Jul**	**23-Jul**	**24-Jul / 25-Jul**
ATC Hose Counts	Hose Day 11	Hose Day 12	Hose Day 13	Hose Day 14	*Sites 11 / 12 only*	*Sites 11 / 12 only*	*Sites 11 / 12 only*
Turning Movements							
Travel Time Studies							

3 Automatic Traffic Count data

3.1 Methodology

The Automatic Traffic Counts (ATC) were continuous, 24-hour volume counts for a full 2 weeks commencing the July 8th, 2010. The counts were collected in 15-minute intervals and were classified according to the standard Federal Highway Administration (FHWA) classification chart.

ATC data was collected using IRD (International Road Dynamics) Machine Traffic Counters. All counters were tested and certified to meet the Department of Transportation requirements.

The locations were numbered 1 to 4, 9 to 14 and A, B, C. D and F and are shown in Figure 2. After placement, all units were visually checked at least three times a day by the Arup Survey Supervisor and the PMA team. Each ATC counter was opened and monitored for a ten to fifteen minute period every other day to ensure the counters were registering vehicles correctly. If any problems were noted, they were corrected on site and the time noted so that when the data were downloaded, any remaining data gaps could be determined.

There were several rain storm events during the collection of the peak season data but, unlike the 2009 peak season surveys, these did not cause disruption to the data collection program. Approximately 12 hours of data was lost at sites 11 and 12 during the first week of the survey when tubes were damaged by a passing vehicle. As such, this data was lost and needed to be recollected. Therefore, it was necessary to extend the data collection to ensure a full data set was collected at this site. All ATC counts were completed by 25th July, 2010. Hence, the ATC data is deemed robust and appropriate for use within the traffic model.

3.2 ATC Summary

The ATC traffic count data is summarized by site in Table 2, Table 3 and Table 4, with the peak hour indicated in bold. A summary of the daily total traffic is shown in Figure 2.

Table 2 shows the average weekday totals over the survey period by hour. The peak hour varies by site, although in general the PM peak period is the busiest.

Table 3 shows the average Saturday totals over the survey period by hour. Saturday traffic volumes are generally the highest of any day with the late morning period the busiest time of day. The high Saturday traffic volumes are directly associated with the check-in and check-out times for holiday accommodation on the Outer Banks.

Table 4 shows the average Sunday totals over the survey period by hour. Volumes are lower than on Saturday, with the busiest period around midday and the early afternoon.

Traffic flow profiles by site are also shown in Section 3.3, together with a summary of the key points observed from the count data and comparisons with the data collected during the 2009 data collection program. Sites show consistency between the individual weekdays over the survey period and between each pair of

Saturday / Sunday collected during the survey period. This represents a significant improvement over the 2009 counts, when daily fluctuations were observed in some locations. We are aware that traffic patterns shift from week to week during the summer, and that some of the 2009 data fluctuation will be due to the differences between the particular weeks counted in line with the thousands of rental properties and hotel rooms where customer levels vary throughout the summer. However, the consistency in the 2010 data provides confidence that the count equipment was functioning correctly and the count data is suitable for use in the 2010 revalidation.

Figure 2: Peak Season Daily Traffic (24 Hour) by Site

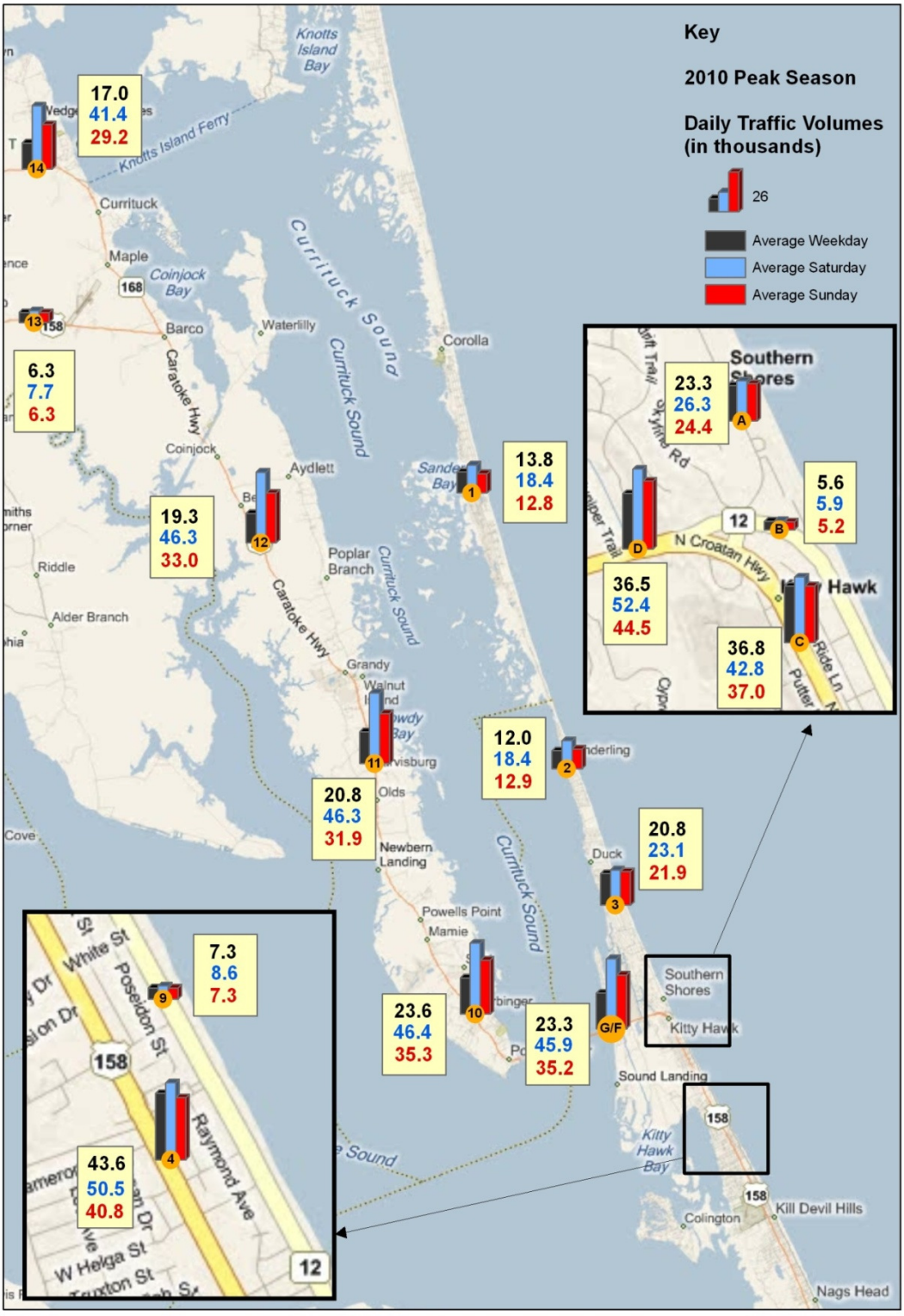


Table 2: Average Weekday Total Daily Traffic Flows by Site

	Average Weekday Total Traffic Flows, Hour Beginning																							
Site	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
1	46	26	22	12	18	38	128	354	599	791	1039	1081	1008	991	981	1024	1050	**1098**	942	828	779	557	259	111
2	49	28	21	17	28	70	172	383	597	713	864	**939**	888	915	893	907	922	930	709	579	524	420	254	129
3	117	62	43	34	59	140	358	742	1147	1317	1448	1499	1456	1471	1483	1510	1543	**1556**	1285	1044	927	811	473	299
4	292	162	130	105	162	354	886	1670	2348	2537	2871	3104	3103	3087	3053	3091	3161	**3257**	2673	2223	1931	1624	1067	707
9	32	20	12	6	5	17	67	169	289	352	443	526	572	592	590	593	622	**641**	524	446	369	240	142	75
10	165	110	70	87	139	302	719	1209	1490	1435	1559	1660	1636	1637	1638	1683	**1737**	1689	1297	996	800	657	502	347
11	164	104	70	78	133	290	641	1031	1188	1220	1375	1448	1396	1403	1426	1489	**1511**	1507	1217	961	778	625	471	323
12	158	96	65	82	133	284	610	906	1011	1127	1306	1354	1315	1287	1344	1356	**1389**	1354	1149	912	721	597	437	301
13	37	20	14	29	48	118	278	410	409	366	381	379	401	406	410	454	484	**488**	363	257	192	155	111	81
14	143	82	54	64	127	288	548	744	813	946	1134	1200	1180	1157	1166	1170	1170	**1240**	1021	854	673	544	401	272
A	132	71	52	42	71	154	419	866	1286	1456	1611	1641	1629	1633	1639	1669	1706	**1740**	1465	1210	1072	917	517	320
B	19	12	9	5	4	17	52	130	235	302	352	410	448	**474**	454	445	450	457	391	341	277	179	104	46
C	230	133	102	93	152	340	808	1480	2031	2245	2533	**2704**	2696	2690	2612	2639	2652	2653	2131	1725	1520	1284	816	555
D	208	131	97	99	148	346	852	1538	2072	2345	2589	2787	**2788**	2722	2656	2681	2689	2552	1966	1626	1374	1082	713	467
F	164	110	75	91	152	321	749	1234	1481	1445	1545	1671	1645	1648	1630	1683	**1735**	1680	1257	977	790	637	484	329
G	160	108	69	84	137	300	722	1198	1466	1409	1528	1643	1624	1637	1618	1676	**1744**	1707	1271	982	794	640	485	331

Maximum hourly flow observed across the day

Table 3: Saturday Total Daily Traffic Flows by Site

	Average Saturday Total Traffic Flows, Hour Beginning																							
Site	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
1	74	34	43	75	194	394	679	865	1112	1140	1288	1212	1115	1158	1167	**1348**	1342	1124	1113	997	928	655	259	97
2	69	45	42	96	256	577	980	1360	**1379**	1332	1247	1051	1017	1005	1034	1241	1229	1047	936	863	802	508	190	128
3	195	116	84	125	325	723	1295	1773	**1937**	1722	1712	1331	1219	1052	1142	1166	1303	1232	1140	1096	928	741	459	308
4	541	342	240	228	335	749	1460	2409	3106	3539	**3670**	3467	3198	3263	3278	3368	3307	2822	2996	2526	2268	1572	1078	739
9	59	36	21	13	8	29	105	188	350	543	675	730	703	666	680	**743**	712	481	551	481	414	231	140	88
10	380	235	160	258	539	1231	2211	3284	3644	3626	**3986**	3755	2891	2767	2598	2614	2463	2325	2475	2221	1117	753	511	396
11	367	226	166	280	565	1254	2259	3235	3546	3739	**4057**	3815	3285	3098	2859	2446	2574	2316	2122	1218	1079	792	573	422
12	353	214	153	256	513	1112	2192	3061	3351	3941	**4349**	4026	3343	3221	3122	2978	2551	1951	1522	1317	1041	752	542	395
13	65	34	29	33	52	108	365	**614**	508	508	517	481	473	435	458	477	582	600	447	333	220	161	131	97
14	367	204	119	176	374	844	1698	2426	3213	3847	**4062**	3859	3447	2968	2724	2529	2023	1611	1410	1190	869	625	471	307
A	221	132	100	132	343	753	1336	1891	**2061**	1872	1879	1571	1411	1329	1378	1376	1533	1495	1393	1309	1147	819	509	331
B	31	24	14	10	15	28	85	149	238	481	**563**	498	462	381	401	394	392	324	377	354	300	185	105	63
C	437	278	182	201	332	754	1472	2387	**2994**	2878	2922	2854	2744	2758	2735	2694	2707	2418	2491	2117	1820	1236	831	568
D	442	285	203	297	594	1330	2313	3329	3850	**3888**	3788	3597	3220	3131	3125	3017	2978	2786	2833	2505	2210	1316	833	569
F	368	242	166	280	584	1289	2259	3268	**3647**	3606	3573	3515	2866	2767	2644	2437	2595	2444	2503	2254	1647	778	514	413
G	366	245	161	270	564	1280	2272	3341	**3711**	3652	3563	3488	2770	2622	2541	2311	2511	2371	2419	2139	1597	778	524	413

Maximum hourly flow observed across the day

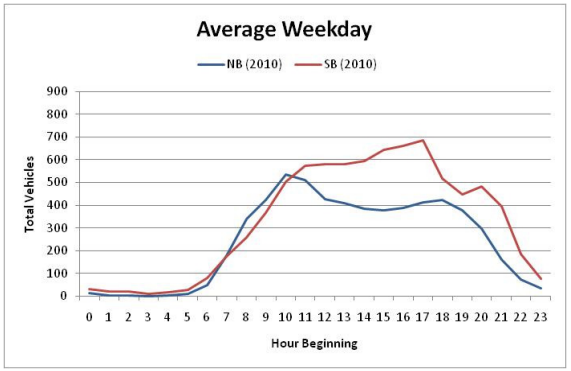
Table 4: Sunday Total Daily Traffic Flows by Site

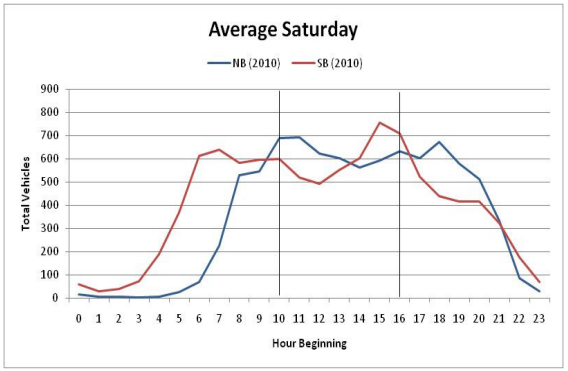
	Average Sunday Total Traffic Flows, Hour Beginning																							
Site	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
1	59	31	29	28	52	104	270	459	827	920	914	890	868	925	950	**969**	878	880	767	662	625	407	190	66
2	49	32	25	45	84	180	396	647	999	1005	927	873	889	956	991	**1015**	900	754	613	476	468	333	183	83
3	130	85	71	70	139	312	687	1180	**1731**	1645	1566	1481	1375	1481	1534	1492	1429	1249	1170	931	828	670	402	210
4	407	259	185	145	174	346	783	1356	2056	2711	**3165**	2990	3105	2895	2934	3102	2814	2507	2327	1977	1753	1366	890	520
9	43	30	20	18	5	18	77	148	293	412	499	561	**634**	631	579	602	580	513	479	428	357	216	125	62
10	243	143	138	159	223	509	1082	1679	2199	2630	**2998**	2966	2882	2750	2762	2712	2311	1887	1520	1157	911	728	428	256
11	240	158	123	131	267	541	1041	1702	2148	2120	**2841**	2598	2468	2432	2455	2286	2017	1667	1530	1092	809	649	380	236
12	236	143	113	124	250	479	946	1627	1984	2480	**3028**	2947	2620	2621	2549	2245	2000	1702	1598	1130	882	651	365	238
13	57	37	19	28	42	66	201	401	343	328	423	409	376	417	422	492	**533**	482	359	288	240	174	103	74
14	191	119	82	100	176	319	676	1152	1597	2262	2962	**3027**	2520	2519	2417	1937	1609	1377	1262	1009	786	554	342	214
A	148	101	85	84	149	325	742	1294	1814	**1816**	1767	1621	1544	1576	1704	1727	1634	1381	1344	1104	987	767	439	240
B	34	21	15	8	9	16	56	121	202	296	345	372	404	406	**423**	398	368	388	375	305	293	178	91	50
C	298	196	154	122	167	354	757	1299	1993	2585	**2896**	2869	2861	2749	2664	2801	2560	2249	2012	1698	1456	1089	710	430
D	297	193	164	155	276	561	1208	1946	2648	3311	**3493**	3403	3346	3278	3176	3260	2983	2646	2341	1922	1630	1191	699	418
F	238	149	128	139	265	529	1101	1677	2206	2639	**2945**	2770	2779	2722	2699	2651	2298	1898	1563	1156	910	691	438	266
G	236	147	127	136	265	522	1092	1682	2229	2680	**2995**	2796	2808	2774	2704	2661	2364	1915	1615	1164	931	700	434	264

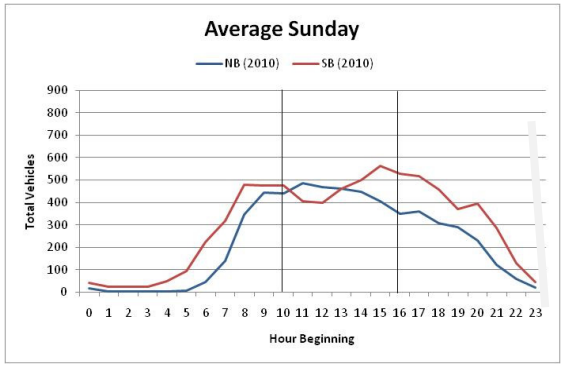
Maximum hourly flow observed across the day

3.3 ATC traffic flow profiles by site

3.3.1 Site 01 NC 12, Corolla Area between Onions Way and Driftwood Way (average over two weeks)



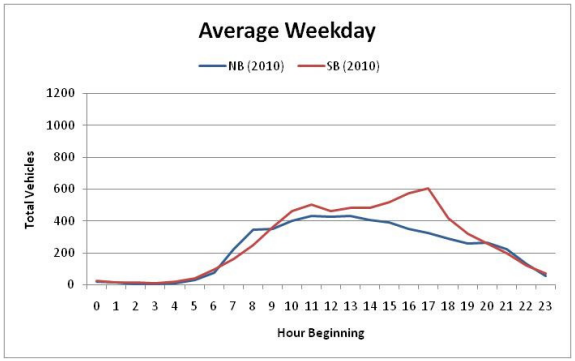


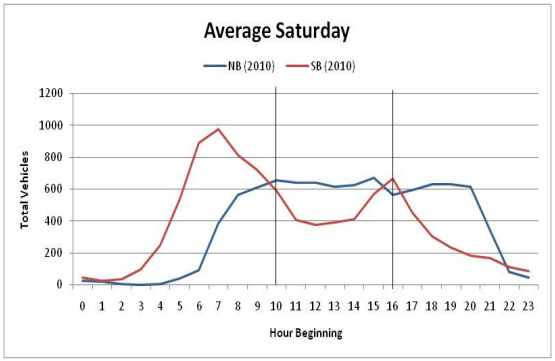


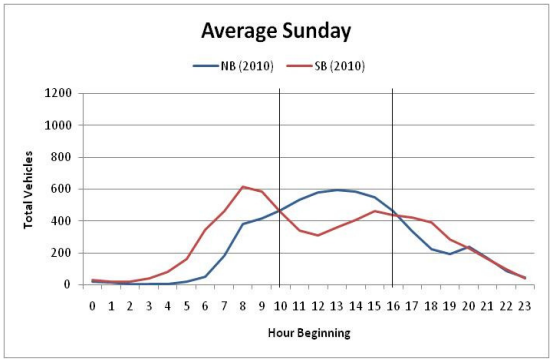
Key points:

- Saturday traffic 34% higher than average weekday
- Sunday traffic 7% lower than average weekday
- Saturday traffic is 44% higher than average Sunday
- Early AM and PM peak southbound on Saturdays

3.3.2 Site 02 NC 12, Sanderling Area between Blue Heron Way and Oyster Catcher Lane (average over two weeks)



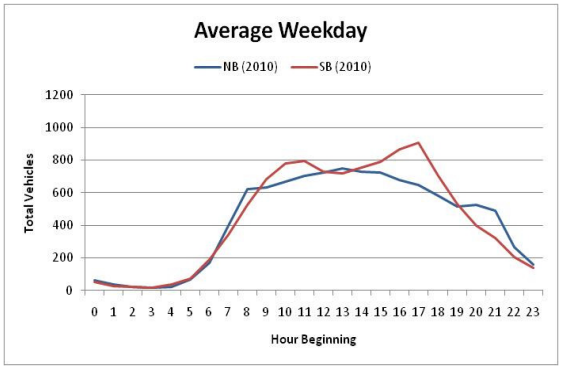


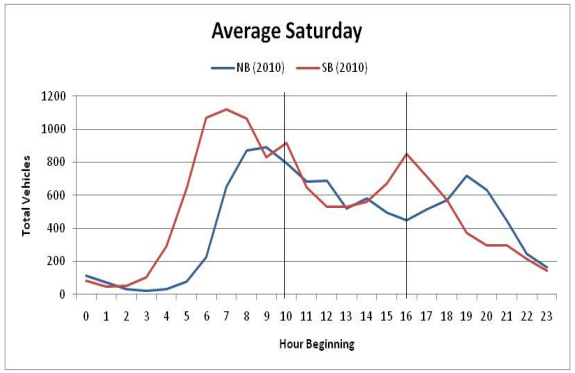


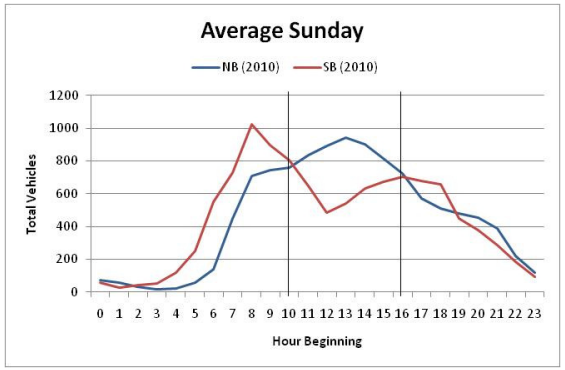
Key points:

- Similar volumes to Site 01, with a busier average Saturday AM Peak.
- Saturday traffic 54% higher than average weekday
- Sunday traffic 8% higher than average weekday
- Saturday traffic is 43% higher than average Sunday
- Defined early southbound peak on Saturday

3.3.3 Site 03, NC 12 Between Dogwood Trail and Porpoise Run (average over two weeks)



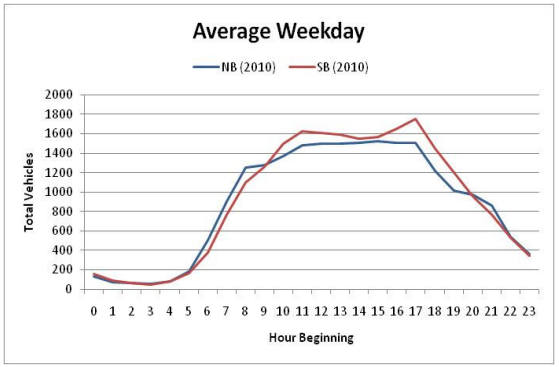


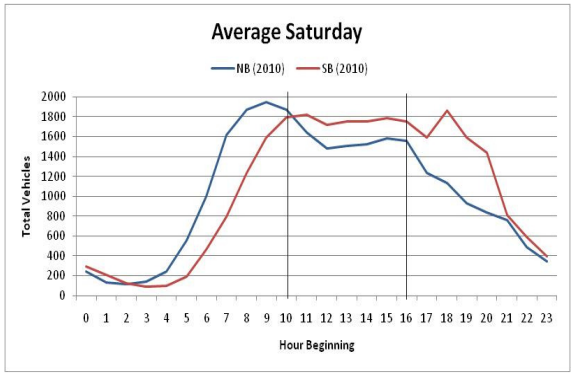


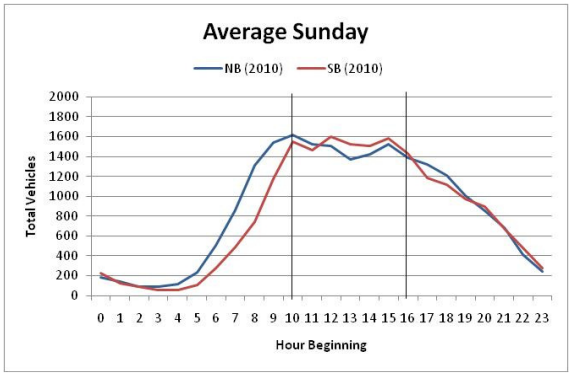
Key points:

- Higher volumes than Sites 01 and 02
- Saturday traffic 11% higher than average weekday
- Sunday traffic 5% higher than average weekday
- Saturday traffic is 6% higher than average Sunday
- Early southbound peak on Saturday

3.3.4 Site 04 US 158 Between E. Sibbern Ave and W. Hayman Blvd (average over two weeks)



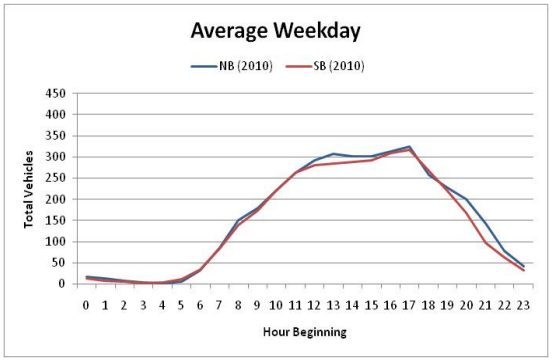


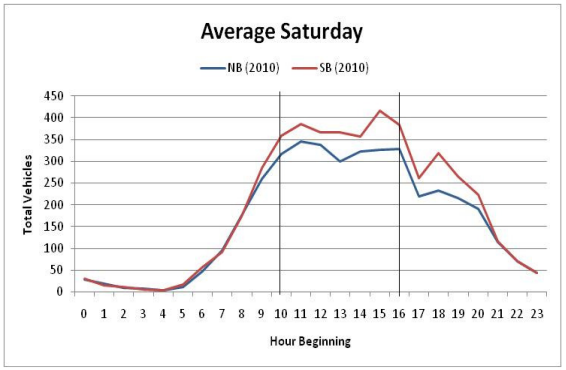


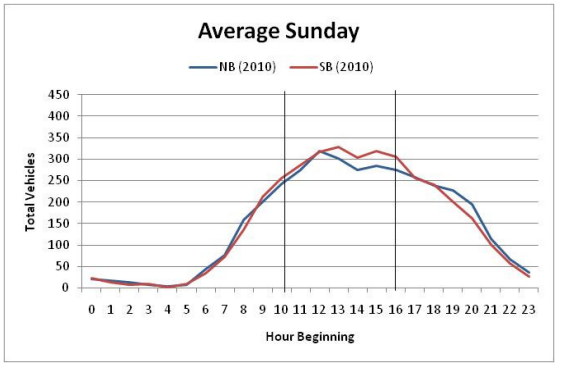
Key points:

- High traffic volumes
- Saturday traffic 16% higher than average weekday
- Sunday traffic 6% lower than average weekday
- Saturday traffic is 24% higher than average Sunday
- Defined PM southbound peak on Saturday

3.3.5 Site 09 NC 12, Between E. Sibbern Ave and W. Hayman Blvd (average over two weeks)



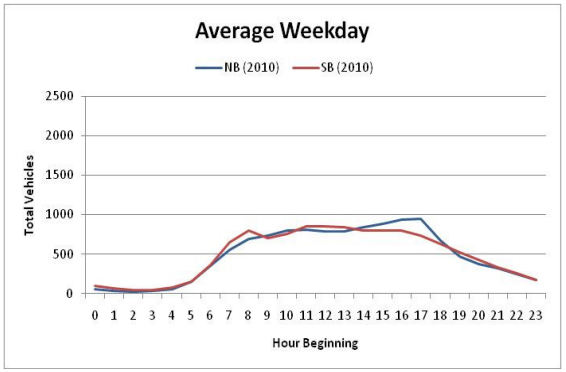


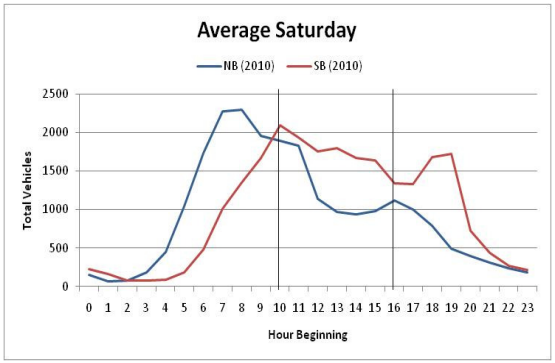


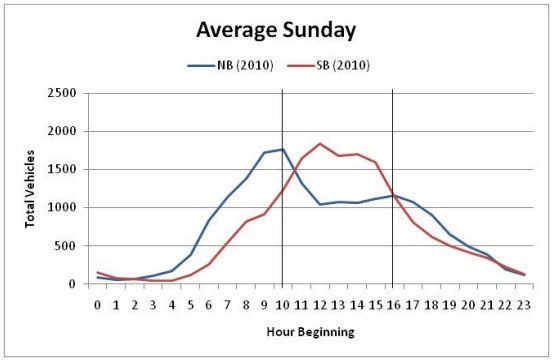
Key points:

- Low traffic volume
- Saturday traffic 18% higher than average weekday and average Sunday
- Sunday traffic volumes similar to average weekday
- Defined midday and PM southbound peaks on Saturday

3.3.6 Site 10 US 158, Between New Beach Road and Pinegrove Lane (average over two weeks)



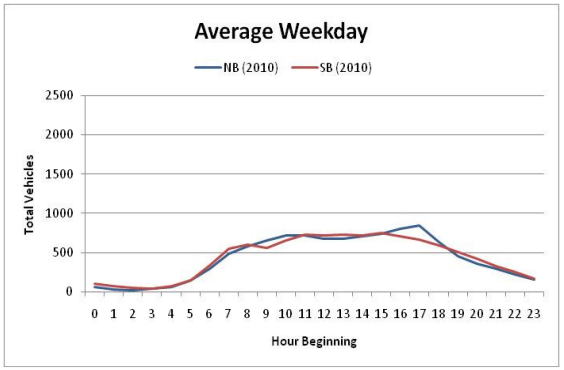


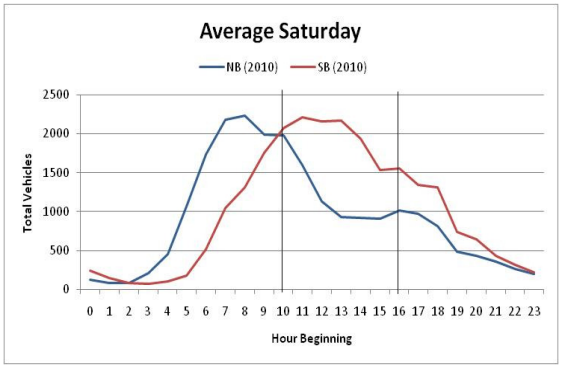


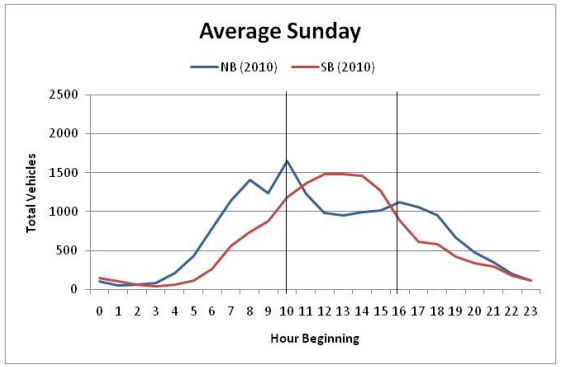
Key points:

- High traffic volumes on the weekend
- Saturday traffic 97% higher than average weekday
- Sunday traffic 50% higher than average weekday
- Saturday traffic is 32% higher than average Sunday
- Defined PM southbound peak on Saturday

3.3.7 Site 11 US 158, Between Forbes Road and Meadow Lake Circle (average over two weeks)



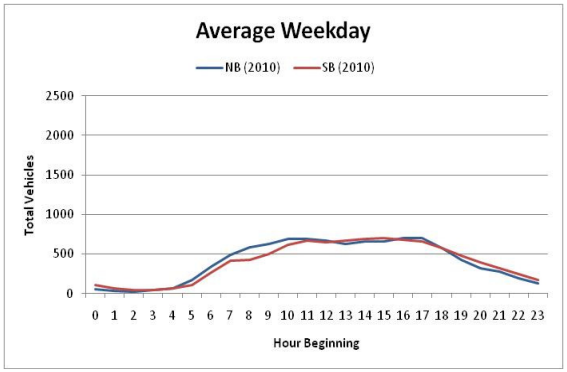


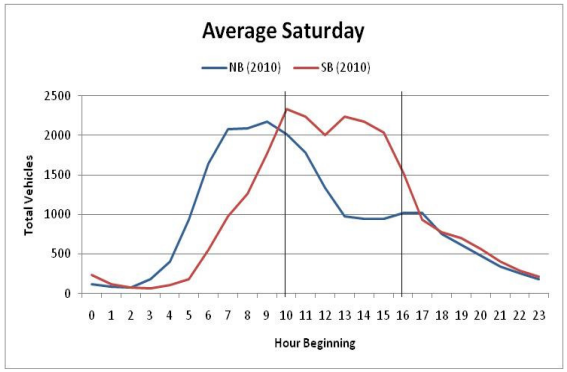


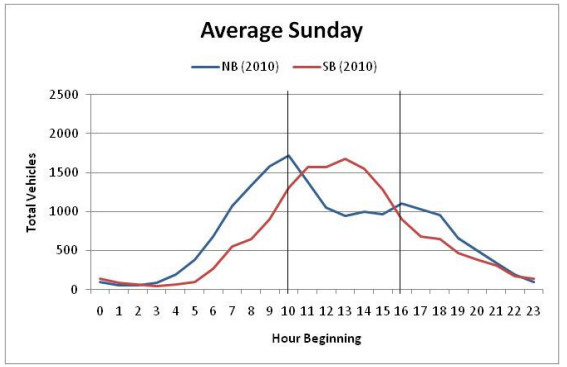
Key points:

- Similar traffic levels to Site 10
- Saturday traffic is 2.2 times the average weekday traffic
- Sunday traffic 53% higher than average weekday
- Saturday traffic is 45% higher than average Sunday
- A pronounced midday peak period on Saturday, southbound
- A defined early midday peak on Sunday, northbound

3.3.8 Site 12 US 158, Between Market Road and Aydlett Road (average over two weeks)



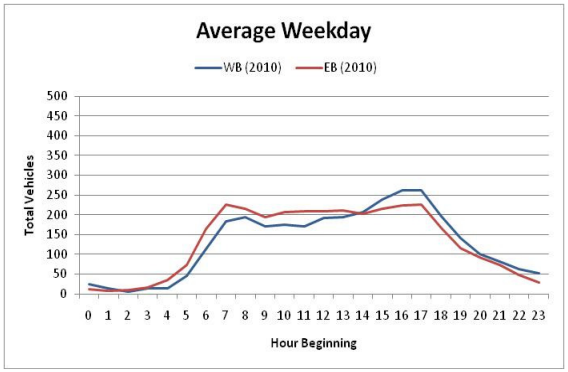


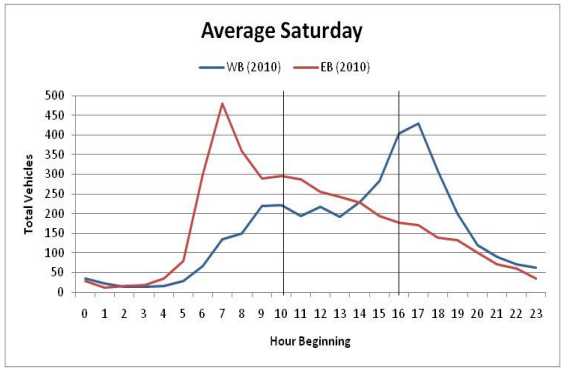


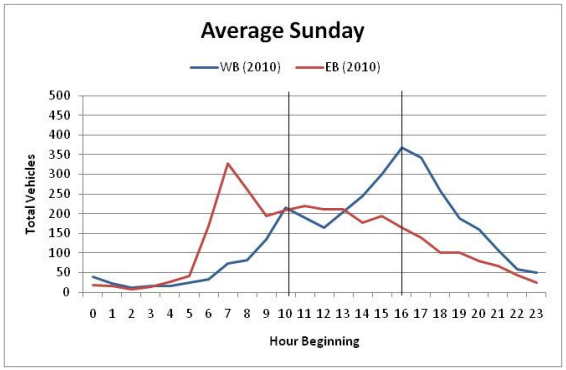
Key points:

- Similar traffic levels to Site 10 and Site 11
- Saturday traffic is 2.4 times higher than average weekday traffic
- Sunday traffic 71% higher than average weekday
- Saturday traffic 40% higher than Sunday traffic

3.3.9 Site 13 US 158, Between Little Joe Lane and Barco Road (average over two weeks)



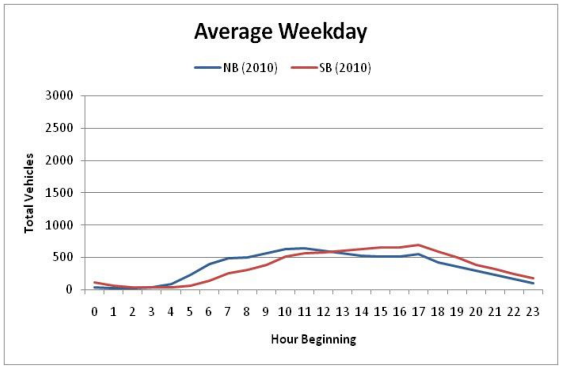


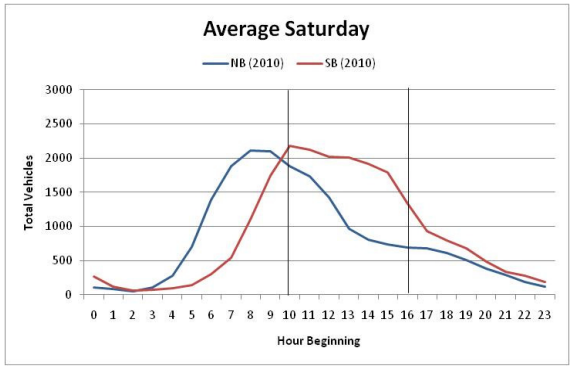


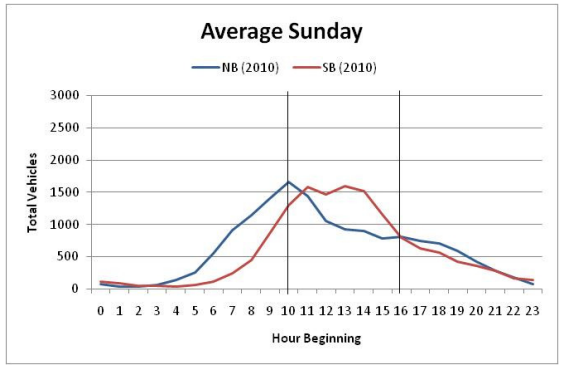
Key points:

- Low volumes compared with Site 14
- Saturday traffic 23% higher than average weekday and 22% than average Sunday
- Sunday traffic volume similar to average weekday
- High eastbound flow in the AM Peak on Saturday and high PM flow in reverse direction. Defined AM eastbound peak and PM westbound peak on Saturday and Sunday

3.3.10 Site 14 NC 168, Between Poyners Road and Dozier Road (average over two weeks)



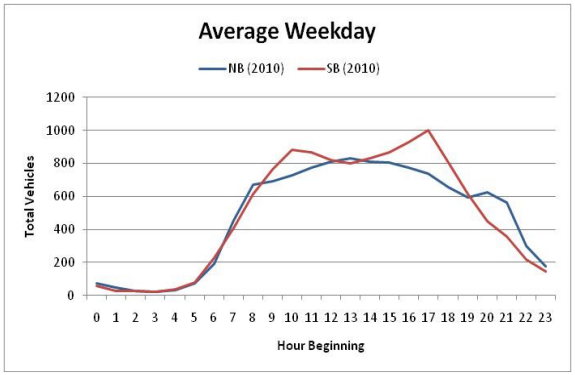


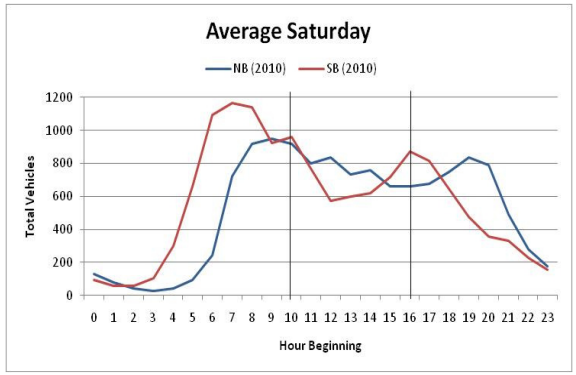


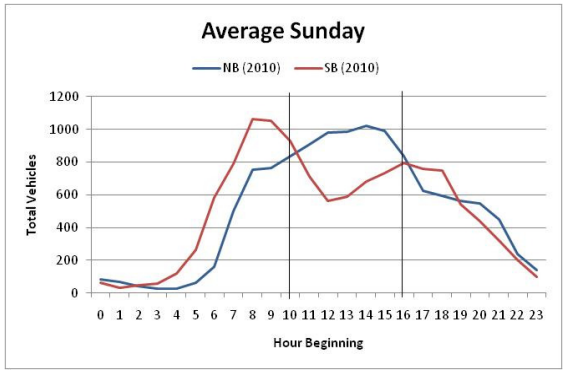
Key points:

- Similar traffic profile to Site 10, Site 11 and Site 12
- Saturday traffic is 2.4 times the average weekday traffic
- Sunday traffic 72% higher than average weekday
- Saturday traffic 42% higher than average Sunday

3.3.11 Site A NC 12, North of US-158 / NC 12 Intersection (average over two weeks)



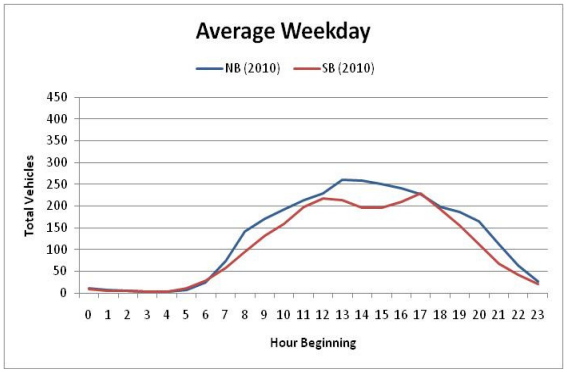


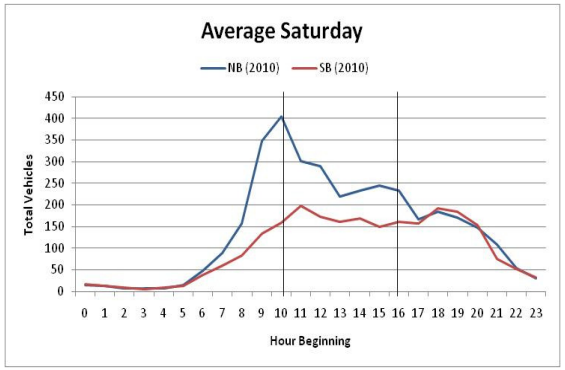


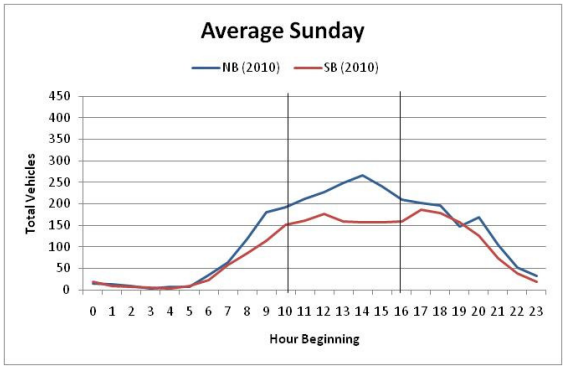
Key points:

- Saturday traffic 13% higher than average weekday
- Sunday traffic 5% higher than average weekday
- Saturday traffic 8% higher than average Sunday
- Early AM Saturday and Sunday peaks in southbound direction

3.3.12 Site B NC 12, South of US-158 / NC 12 Intersection (average over two weeks)



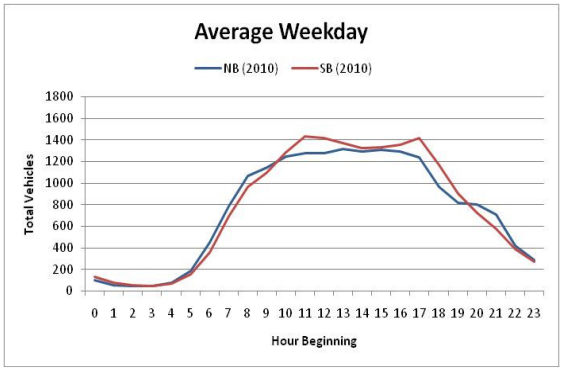


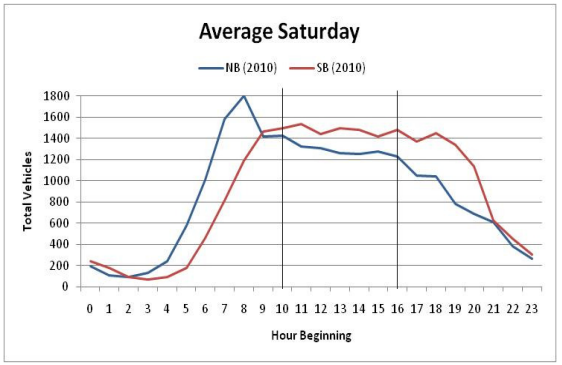


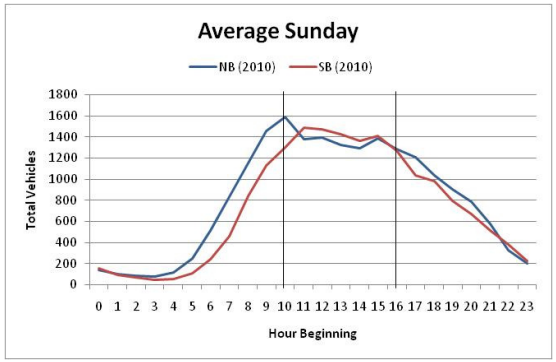
Key points:

- Saturday traffic 5% higher than average weekday
- Sunday traffic 8% lower than average weekday
- Saturday traffic 14% higher than average Sunday
- Significant AM northbound peak on Saturdays

3.3.13 Site C US 158, South of US-158 / NC 12 Intersection (average over two weeks)



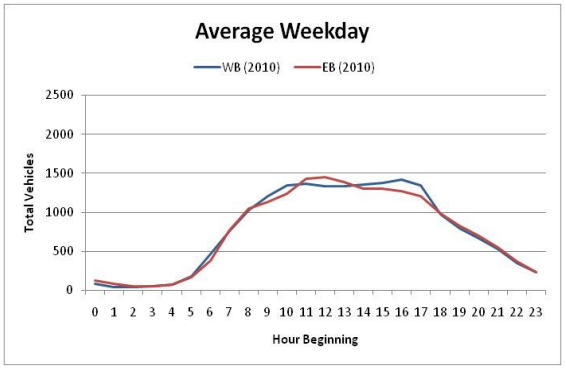


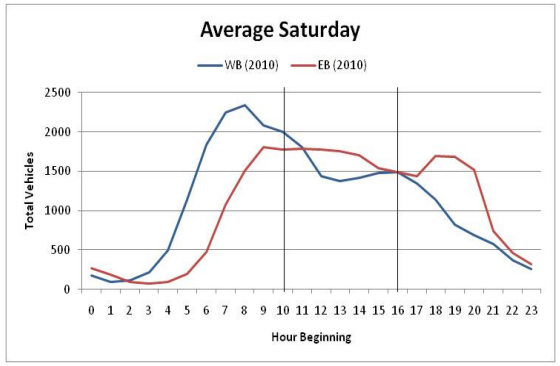


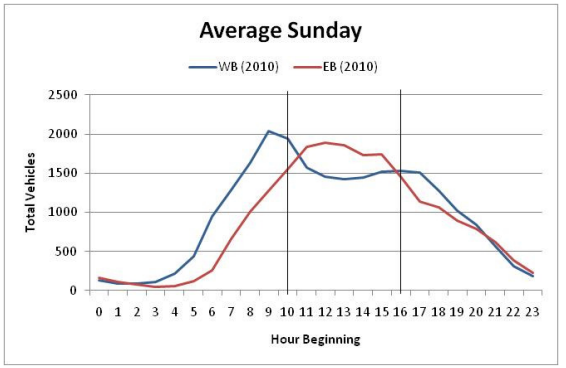
Key points:

- Saturday traffic 16% higher than average weekday
- Sunday traffic is similar to average weekday
- Saturday traffic 16% higher than average Sunday
- Defined AM peak in the northbound direction on weekend

3.3.14 Site D US 158, West of US-158 / NC 12 Intersection (average over two weeks)



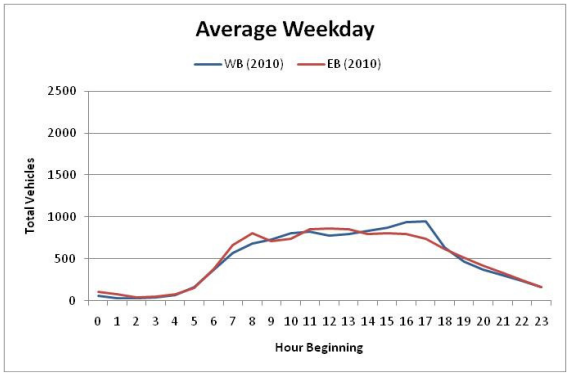


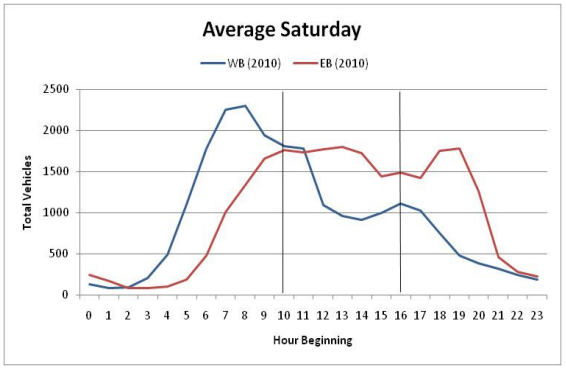


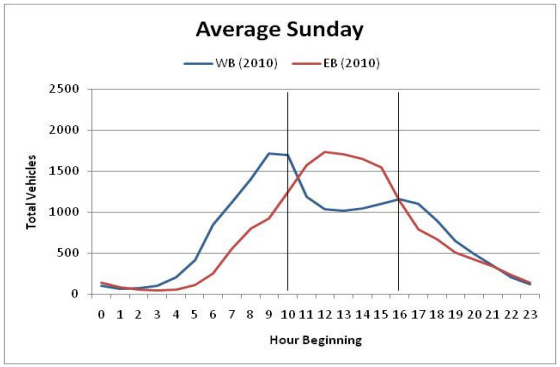
Key points:

- Saturday traffic 44% higher than average weekday
- Sunday traffic 22% higher than average weekday
- Saturday traffic 18% higher than average Sunday
- Significant AM peak in westbound direction on weekend

3.3.15 Site F US 158, Wright Memorial Bridge (average over two weeks)



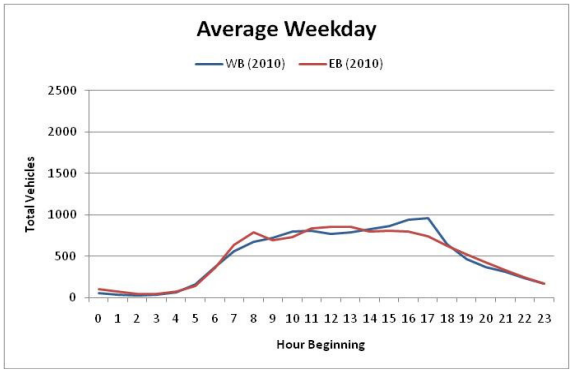


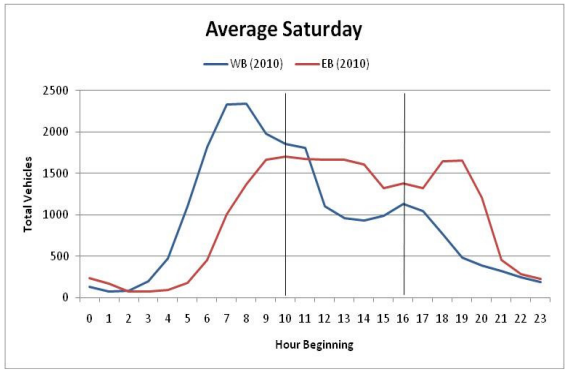


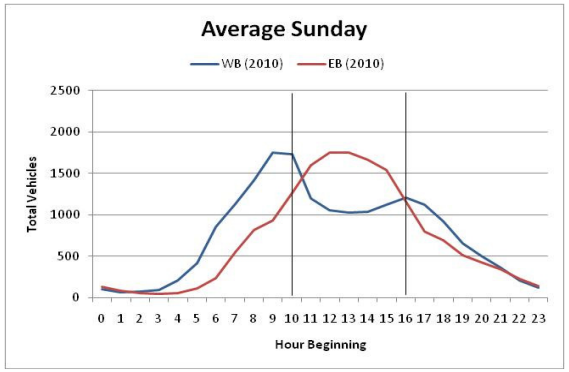
Key points:

- Saturday traffic is twice the average weekday traffic
- Sunday traffic 48% higher than average weekday
- Saturday traffic 34% higher than average Sunday
- Defined AM westbound peak and PM eastbound peak on Saturday

3.3.16 Site G US 158, Wright Memorial Bridge (average over two weeks)







Key points:

- Saturday traffic is twice the average weekday traffic
- Sunday traffic 51% higher than average weekday
- Saturday traffic 30% higher than average Sunday
- Defined AM westbound peak and PM eastbound peak on Saturday

4 2010 Peak Turning Movement Counts

4.1 Overview

Turning movement count data was collected using Automated Video Collection units. These are automated self contained units that record all intersection for the time frames programmed for the count (7AM to 7PM). Video units are advantageous as they are not affected by rain or standing water. The units were mounted on a pole or tripod on top of a 25 foot telescoping mast at each count location. Video Data files were recorded onto an SD (memory card) card that was subsequently uploaded to a computer and processed to identify all vehicle activity at the intersection.

4.2 Turning Movement Data

Video surveys were conducted at three locations:

- US 158 / Juniper Trail – access to Walmart and Marketplace @ Southern Shores;
- US 158 / Cypress Knee Trail – secondary access to Walmart and Marketplace @ Southern Shores; and
- NC 12 / US 158.

In addition, two supplemental counts were conducted to verify the outputs from the ATC counters at the following locations:

- US 158 – At site 12 between Market Road and Aydlett Road; and
- NC 12 – Near site 3 at intersection of E. Dogwood Trail and Porpoise Run.

The counts were classified between passenger vehicles, trucks, and pedestrians and were undertaken on a Thursday, Saturday, Sunday, Tuesday and Wednesday from 0700 to 1900 each day. The specific dates of the surveys at each site are shown in Table 1.

4.2.1 US 158 / NC 12 Intersection

Analysis of the turning movement counts is focused on the US 158 / NC 12 intersection, as this provided a good estimate of the origins of traffic heading north on NC 12 in the peak season. Figure 3, Figure 4 and Figure 5 show graphically the turning movement counts for the average Weekday, Saturday and Sunday, respectively. A summary of key movements at this intersection is shown in Table 5.

Figure 3: Summary of Average Weekday Turning Movement Counts at US 158/NC 12

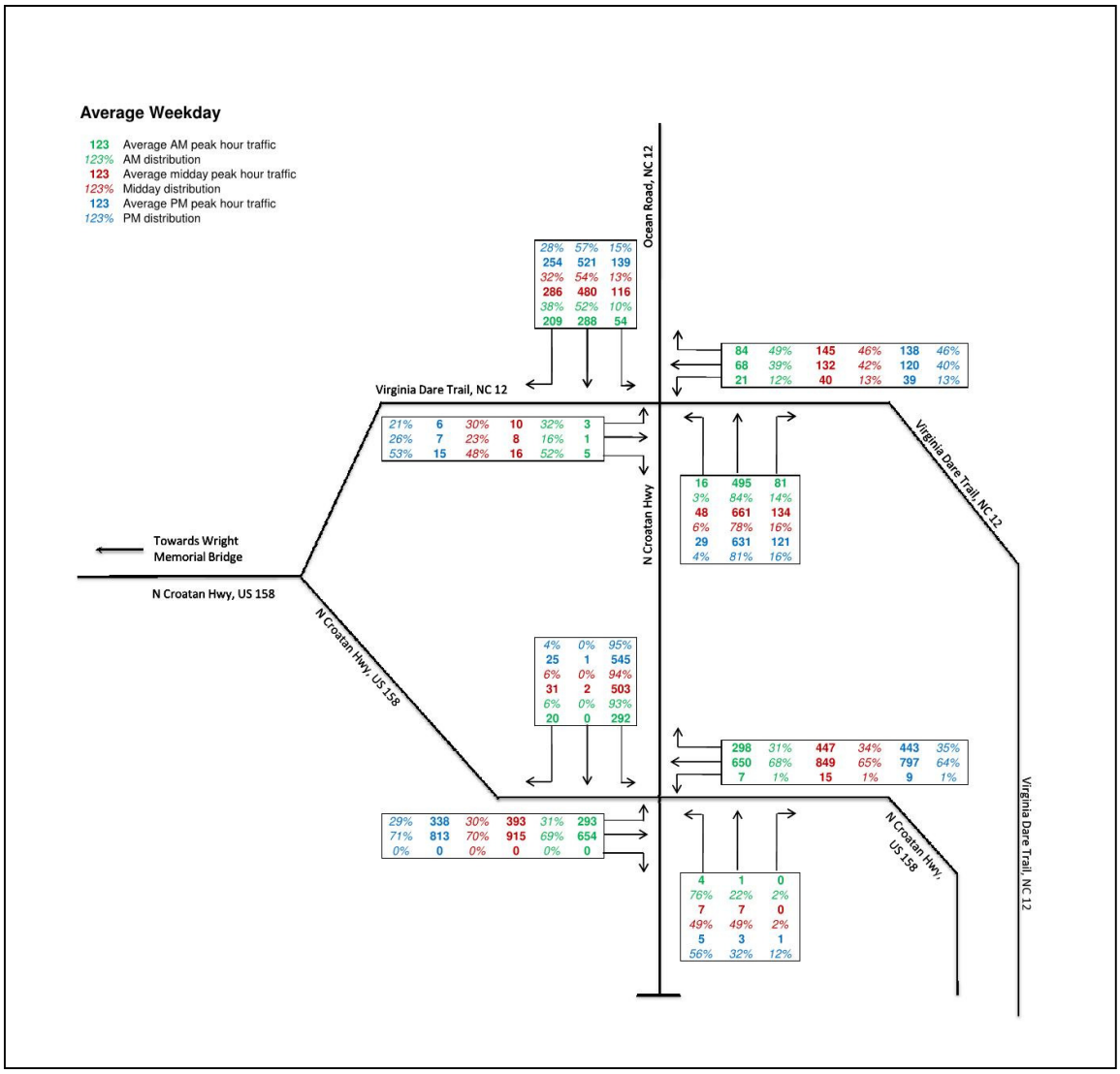


Figure 4: Summary of Average Saturday Turning Movement Counts at US 158/NC 12

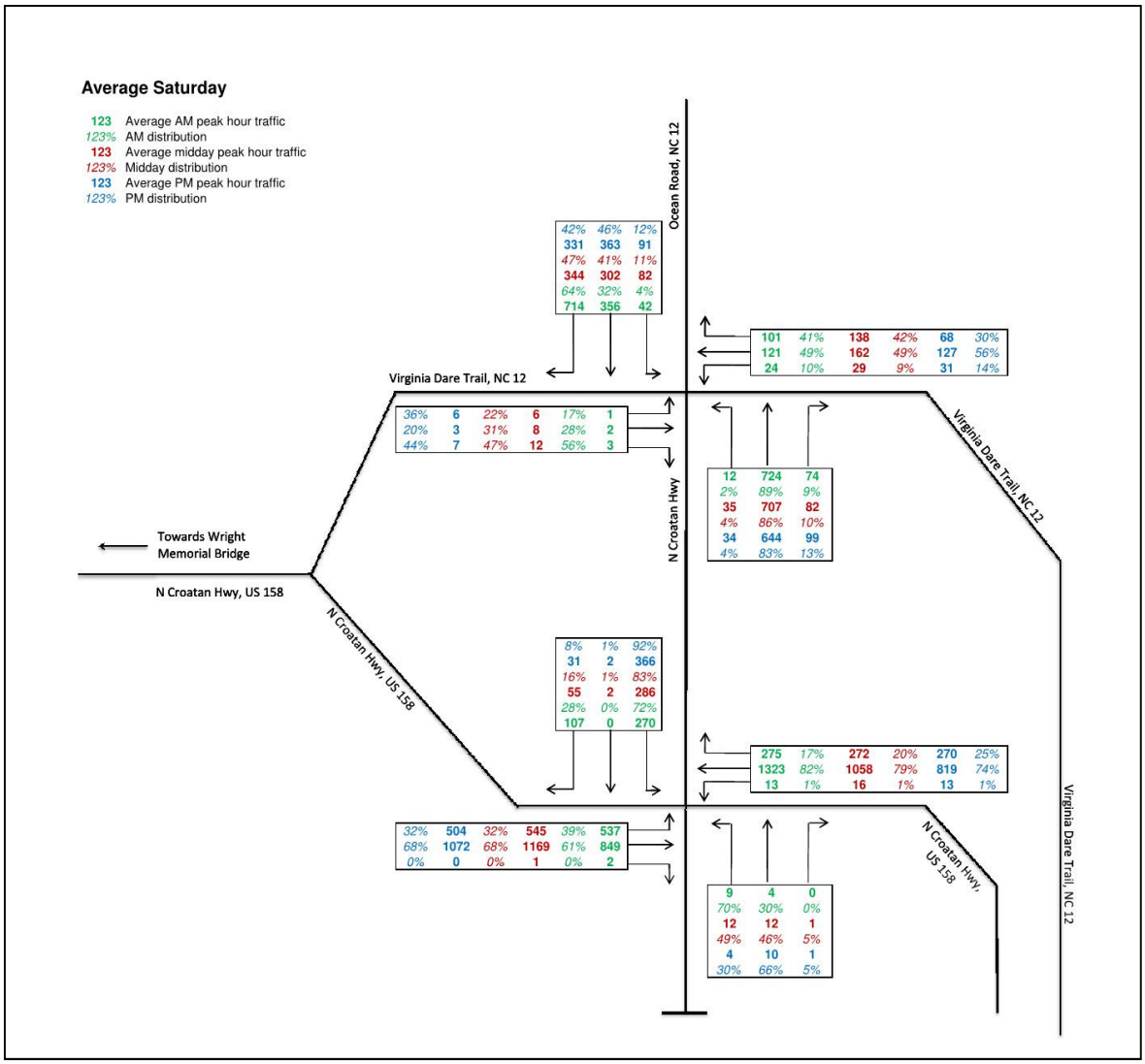


Figure 5: Summary of Average Sunday Turning Movement Counts at US 158/NC 12

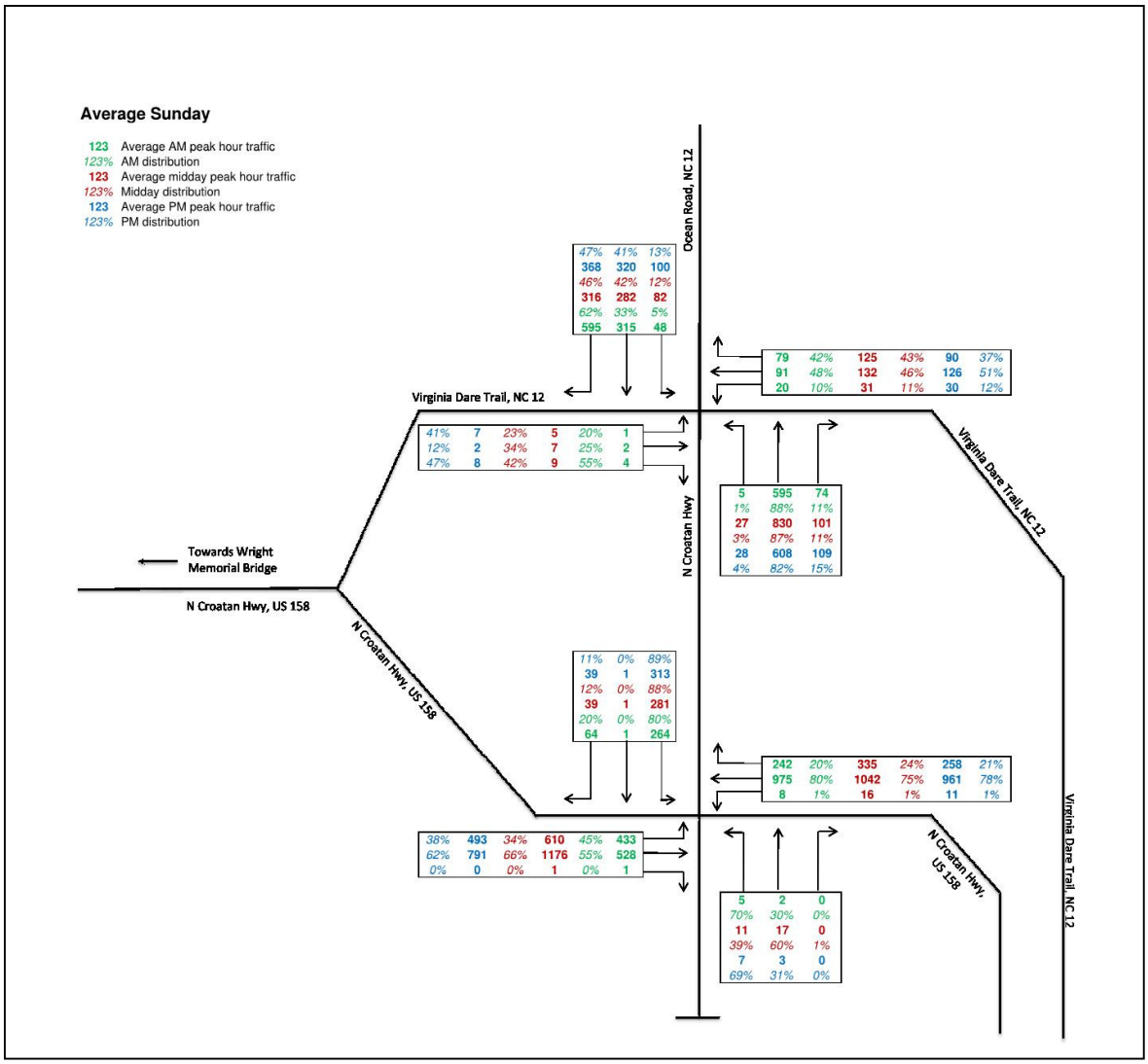


Table 5: Turning Movement Summary, US 158 / NC 12 Intersection

AM Peak Average Hour	To NC 12 Northbound					
From	Average Weekday		Saturday		Sunday	
US-158 / WMB (EB)	293	49.6%	537	66.1%	433	64.2%
US-158 / N. Croatan Hwy (NB)	298	50.4%	275	33.9%	242	35.8%
Total	**591**	**100%**	**812**	**100%**	**675**	**100%**
Midday Average Hour	To NC 12 Northbound					
From	Average Weekday		Saturday		Sunday	
US-158 / WMB (EB)	393	46.8%	545	66.7%	610	64.6%
US-158 / N. Croatan Hwy (NB)	447	53.2%	272	33.3%	335	35.4%
Total	**840**	**100%**	**817**	**100%**	**945**	**100%**
PM Peak Average Hour	To NC 12 Northbound					
From	Average Weekday		Saturday		Sunday	
US-158 / WMB (EB)	338	43.3%	504	65.1%	493	65.7%
US-158 / N. Croatan Hwy (NB)	443	56.7%	270	34.9%	258	38.2%
Total	**781**	**100%**	**774**	**100%**	**751**	**104%**

It can be seen that:

- Northbound flows onto NC 12 during the AM and PM peak periods are highest on Saturdays. In the Midday Peak they are highest on Sundays.
- Flows approaching from the WMB (N Croatan Highway 158) are highest at the weekends in all time periods.
- During Saturdays and Sundays, approximately 65% of traffic heading north on NC 12 originates from destinations from the WMB. During the average weekday this changes to around 50%, reflecting the increased level of demand originating from the WMB at weekends.
- During the average weekday, the split of trips from the WMB and to the south (Kitty Hawk) differs, between 50% and 56%. On a weekend this reduces to 30%-40%, showing more traffic is turning north on a weekend.
- The proportion of trucks crossing the WMB and heading north on NC 12 varies by the day of the week. 3.0% were trucks on an average weekday compared to 0.7% and 0.4% on Saturday and Sunday respectively.

4.2.2 US-158 / Walmart / Market Place Intersections

Two traffic counts were conducted at the access points to the Walmart and Marketplace @ Southern Shores retail areas between the US 158 / NC 12

intersection and the WMB. These surveys were conducted to ascertain the proportion of traffic along US 158 between the Wright Memorial Bridge and the NC 12 intersection which were associated with these retail sites.

The proportion of 'through' traffic is shown below in Table 6 and Table 7 for the two intersections.

Table 6: Percentage Through Car Traffic, US-158/Juniper Trail Intersection

Time Period		EB Traffic Passing Through	% EB Traffic Passing Through	WB Traffic Passing Through	% WB Traffic Passing Through
Weekday	AM	674	90.0%	663	70.9%
	MD	833	89.9%	804	62.8%
	PM	722	90.2%	758	64.5%
Saturday	AM	1,232	92.1%	2,022	89.1%
	MD	1,402	95.1%	1,221	77.2%
	PM	1,311	96.6%	935	71.1%
Sunday	AM	730	89.5%	1,386	83.9%
	MD	1,442	94.5%	1,142	75.1%
	PM	910	92.6%	1,107	72.5%

Table 7: Percentage Through Car Traffic, US 158/Cypress Knee Trail Intersection

Time Period		EB Traffic Passing Through	% EB Traffic Passing Through	WB Traffic Passing Through	% WB Traffic Passing Through
Weekday	AM	685	86.6%	633	89.1%
	MD	789	83.8%	782	87.2%
	PM	684	84.7%	771	88.6%
Saturday	AM	1,239	88.2%	2,041	95.5%
	MD	1,429	88.5%	1,251	94.5%
	PM	1,266	90.9%	985	92.1%
Sunday	AM	749	86.9%	1,352	92.5%
	MD	1,457	88.8%	1,138	91.5%
	PM	873	90.1%	1,101	91.7%

It can be seen that:

- The majority of traffic is through traffic at each of these junctions;
- At the US-158 / Juniper Trail Intersection, there is a 20%-40% decrease in through traffic in the westbound direction, due to traffic turning off US-158 and going to Market Place at Southern Shores and Walmart.

4.3 Comparison of Turning Movement Counts and Automatic Classification Counts

At two sites, turning movement counts and automatic classification counts were conducted, to verify the consistency of the two data collection methods. Table 8 and Table 9 show the comparisons at the two sites, US-158 on the mainland and NC-12 on the outer banks, respectively.

Table 8: NC-12, Site 6Turning Movement Count (MCC) v Site 12 Automatic Traffic Count (ATC)

Direction	Time Period	12 Hour Total Traffic		Percentage Difference, MCC-ATC
		MCC, Site 6	ATC, Site 12	
Northbound	Average Weekday	6,718	6,850	-1.9%
	Saturday	17,077	17,425	-2.0%
	Sunday	13,671	14,184	-3.6%
Southbound	Average Weekday	6,456	6,456	0.0%
	Saturday	19,679	20,650	-4.7%
	Sunday	13,330	13,269	0.5%

Table 9: US-158, Site 1Turning Movement Count (MCC) v Site 3 Automatic Traffic Count (ATC)

Direction	Time Period	12 Hour Total Traffic		Percentage Difference, MCC-ATC
		MCC, Site 1	ATC, Site 3	
Northbound	Average Weekday	8,017	7,945	0.9%
	Saturday	8,583	8,068	6.4%
	Sunday	9,219	8,970	2.8%
Southbound	Average Weekday	8,781	8,634	1.7%
	Saturday	9,199	9,241	-0.5%
	Sunday	8,585	8,476	1.3%

The comparisons show that in the majority of time periods, the difference between the turning movement counts and the automatic traffic counts are within ±5%, which, in our view, is within the acceptable tolerances for the two survey methods. In the northbound direction on NC-12 on the Saturday, the percentage difference between the two survey methods is 6.4%, which is due to the high level of congestion at this time and direction.

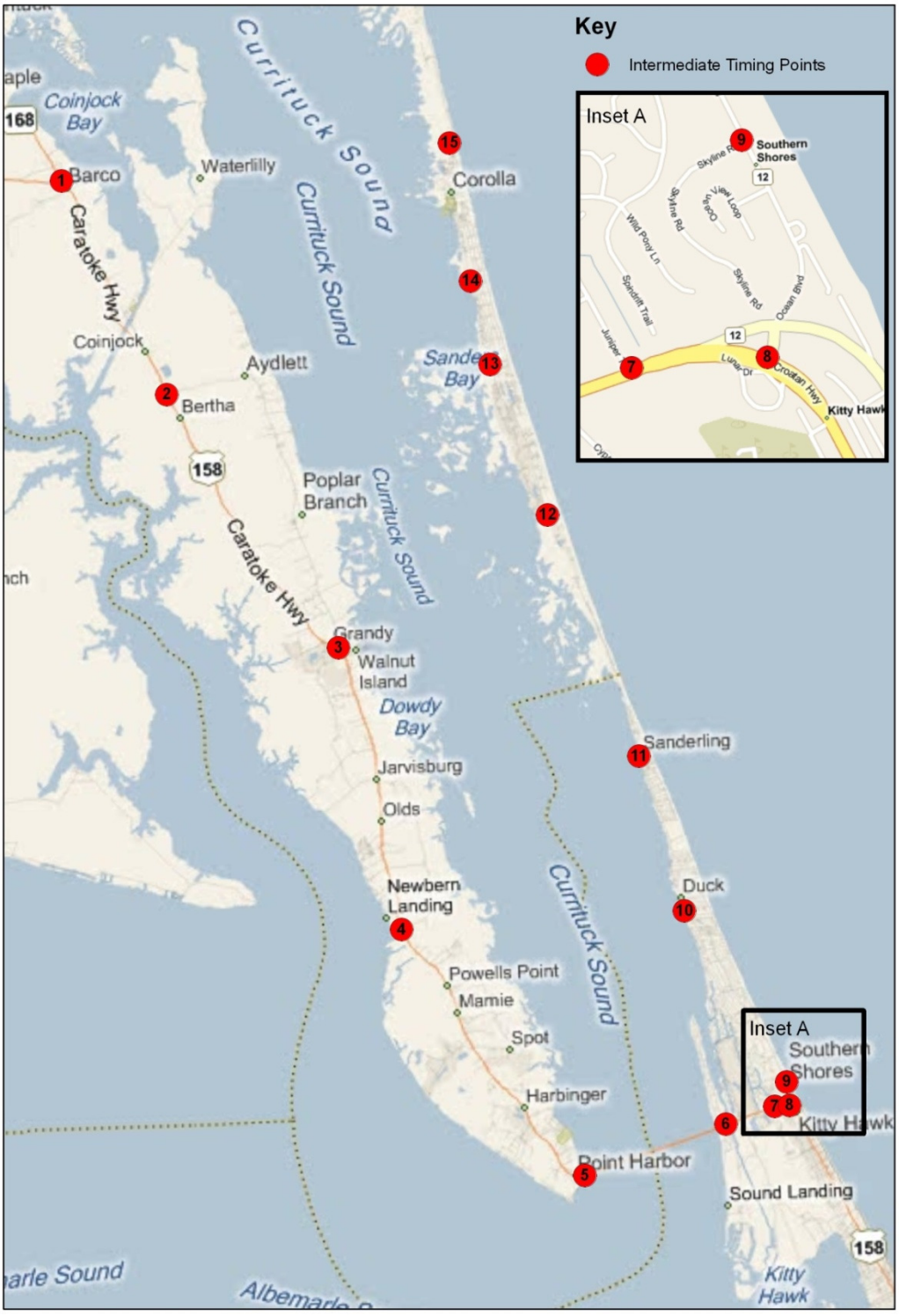
Overall, it can be concluded that the turning movement and automatic traffic counts are comparable.

5 2010 Peak Journey Time Surveys

5.1 Overview

Journey time surveys were undertaken between US-158/NC-12 (Southern Shores) and Corolla, with intermediate timing points as shown in Figure 6.

Figure 6: Intermediate Timing Points used for Journey Time Surveys



Surveys were conducted in each direction and in the following time periods:

a. AM peak - between 07:00 and 10:00;
b. Inter-peak – between 10:00 and 16:00; and
c. PM peak – between 16:00 and 19:00.

The scope provided to PMA included the objective to undertake four journey time survey runs in each direction within each period for weekday and weekends. Additional journey time survey data was collected by Arup during the site visit, using the similar methodologies and equipment.

Journey time surveys were undertaken by PMA on the weekdays of July 8th, July 10th and July 13th – 14th 2010, and on the weekends of July 10th – 11th and July 17th 2010.

5.2 Journey Time Survey Findings

A summary of the journey time results for the weekday, Saturday and Sunday are shown in Table 10, Table 11 and Table 12, respectively.

The key points to note are:

- There was only a small amount of variation in the weekday and Sunday journey times throughout all time periods.
- Significant delays were observed during the PM peak on Saturdays when traveling from Barco to Corolla (towards the Outer Banks).
- Arup journey time data was similar to PMA's data.
- For the Arup runs, the above tables are based on complete runs between Barco and Corolla.

Table 10: Summary of Weekday Journey Time Surveys

Direction	Period	Source	No. of Runs	Minimum (hh:mm:ss)	Maximum (hh:mm:ss)	Average (hh:mm:ss)	Standard Deviation (hh:mm:ss)	Average Speed (mph)
Barco to Corolla	AM Peak	PMA	4	01:07:57	01:12:06	01:10:26	00:01:54	44
		Arup	1	-	-	01:18:02	-	40
		Combine	5	01:07:57	01:18:02	01:11:57	00:03:47	42
	Midday Peak	PMA	4	01:13:24	01:15:12	01:14:40	00:00:51	41
		Arup	4	01:12:18	01:18:02	01:14:18	00:02:37	42
		Combine	8	01:12:18	01:18:02	01:14:29	00:01:48	41
	PM Peak	PMA	4	01:11:03	01:16:42	01:13:25	00:02:30	42
		Arup	1	-	-	01:12:48	-	42
		Combine	5	01:11:03	01:16:42	01:13:18	00:02:11	42
Corolla to Barco	AM Peak	PMA	4	01:07:42	01:11:03	01:09:25	00:01:46	44
		Arup	2	01:11:14	01:14:00	01:12:37	00:01:57	42
		Combine	6	01:07:42	01:14:00	01:10:29	00:02:19	43
	Midday Peak	PMA	4	01:12:42	01:31:15	01:17:59	00:08:54	39
		Arup	6	01:10:34	01:28:40	01:16:56	00:06:57	40
		Combine	10	01:10:34	01:31:15	01:17:21	00:07:19	40
	PM Peak	PMA	4	01:09:42	01:15:03	01:13:36	00:02:36	42
		Arup	3	01:12:27	01:27:26	01:18:28	00:07:55	39
		Combine	7	01:09:42	01:27:26	01:15:41	00:05:34	41

Table 11: Summary of Saturday Journey Time Surveys

Direction	Period	Source	No. of Runs	Minimum (hh:mm:ss)	Maximum (hh:mm:ss)	Average (hh:mm:ss)	Standard Deviation (hh:mm:ss)	Average Speed (mph)
Barco to Corolla	AM Peak	PMA	2	01:10:18	01:13:12	01:11:45	00:02:03	43
		Arup	1	-	-	01:14:57	-	41
		Combine	3	01:10:18	01:14:57	01:12:49	00:02:21	42
	MiddayPeak	PMA	2	01:18:45	02:29:45	01:54:15	00:50:12	27
		Arup	2	01:31:56	02:39:40	02:05:48	00:47:54	25
		Combine	4	01:18:45	02:39:40	02:00:02	00:40:37	26
	PM Peak	PMA	2	02:58:58	03:47:15	03:23:07	00:34:08	15
		Arup	1	-	-	03:49:36	-	13
		Combine	3	02:58:58	03:49:36	03:31:56	00:28:35	14
Corolla to Barco	AM Peak	PMA	2	01:13:48	01:15:30	01:14:39	00:01:12	41
		Arup	2	01:16:03	01:47:59	01:32:01	00:22:35	33
		Combine	4	01:13:48	01:47:59	01:23:20	00:16:28	37
	MiddayPeak	PMA	2	01:13:03	01:45:00	01:29:02	00:22:36	35
		Arup	1	-	-	01:13:56	-	42
		Combine	3	01:13:03	01:45:00	01:24:00	00:18:12	38
	PM Peak	PMA	1	01:32:45	01:32:45	01:32:45	-	33
		Arup		-	-	-	-	-
		Combine	1	01:32:45	01:32:45	01:32:45	-	33

Table 12: Summary of Sunday Journey Time Surveys

Direction	Period	Source	No. of Runs	Minimum (hh:mm:ss)	Maximum (hh:mm:ss)	Average (hh:mm:ss)	Standard Deviation (hh:mm:ss)	Average Speed (mph)
Barco to Corolla	AM Peak	PMA	2	01:09:36	01:13:36	01:11:36	00:02:50	43
		Arup	1	-	-	01:13:20	-	42
		Combine	3	01:09:36	01:13:36	01:12:11	00:02:14	43
	Midday Peak	PMA	2	01:11:57	01:17:50	01:14:53	00:04:10	41
		Arup	4	01:14:03	01:42:36	01:27:03	00:12:35	35
		Combine	6	01:11:57	01:42:36	01:23:00	00:11:44	38
	PM Peak	PMA	2	01:09:23	01:11:42	01:10:32	00:01:38	44
		Arup	1	-	-	01:13:15	-	42
		Combine	3	01:09:23	01:13:15	01:11:27	00:01:57	43
Corolla to Barco	AM Peak	PMA	2	01:08:06	01:13:15	01:10:40	00:03:38	44
		Arup	2	01:14:28	01:19:17	01:16:53	00:03:24	40
		Combine	4	01:08:06	01:19:17	01:13:46	00:04:36	42
	Midday Peak	PMA	2	01:10:06	01:13:24	01:11:45	00:02:20	43
		Arup	1	-	-	01:11:29	-	43
		Combine	3	01:10:06	01:13:24	01:11:40	00:01:39	43
	PM Peak	PMA	2	01:09:39	01:11:36	01:10:37	00:01:23	44
		Arup	1	-	-	01:12:43	-	42
		Combine	3	01:09:39	01:12:43	01:11:19	00:01:33	43

5.2.1 Summary of Weekday Journey Time Runs – Average Travel Times between Barco and Corolla

Figure 7, Figure 8 and Figure 9 show the average travel times between Barco and Corolla, for a average weekday, Saturday and Sunday. The Arup runs are based on all data collected during the survey period, of which some are only available for certain sections of the route between Barco and Corolla. These graphs show the breakdown of the total journey time between Barco and Corolla, indicating congested and delayed sections of the route.

5.2.2 Summary of Weekday Journey Time Runs - Average Travel Times between Barco and Corolla

Figure 7: Summary of Weekday Journey Time Runs - Average Travel Times between Barco and Corolla

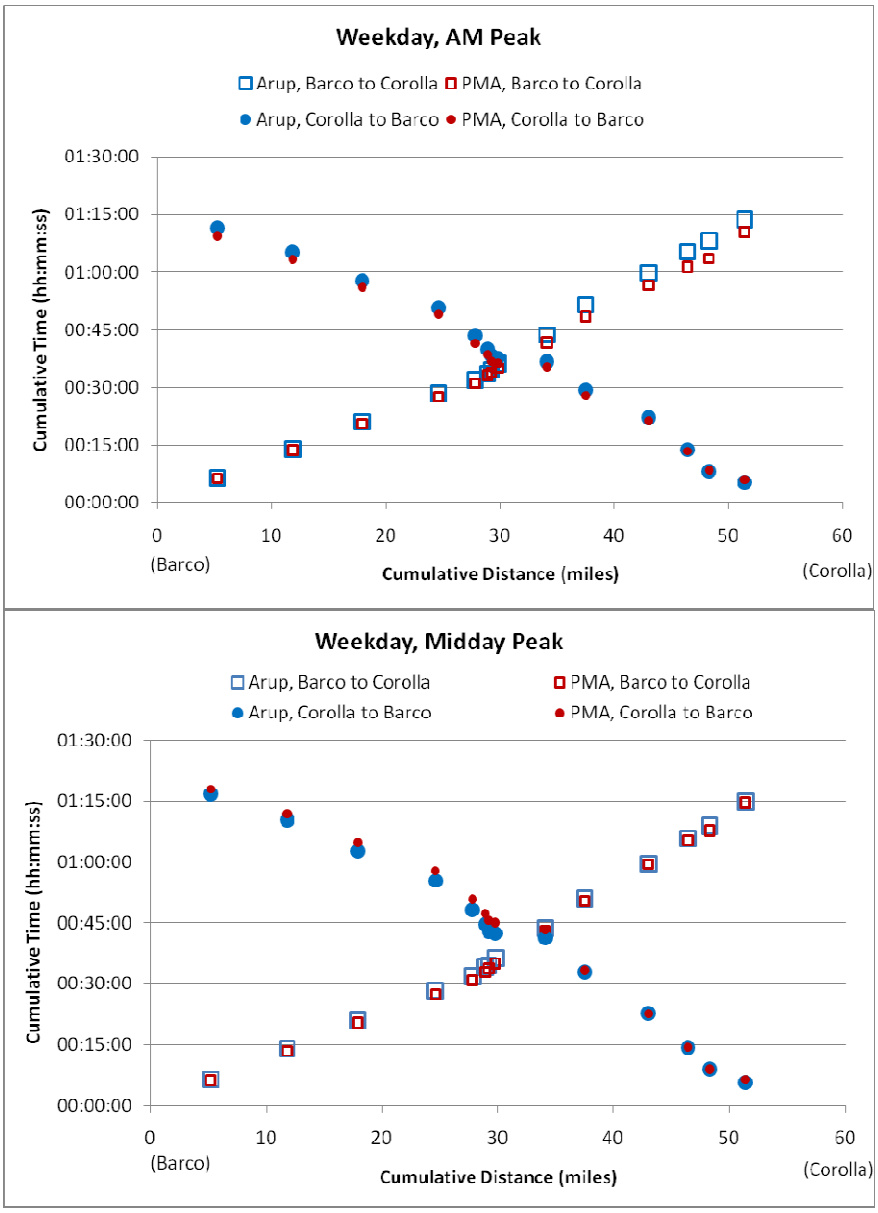
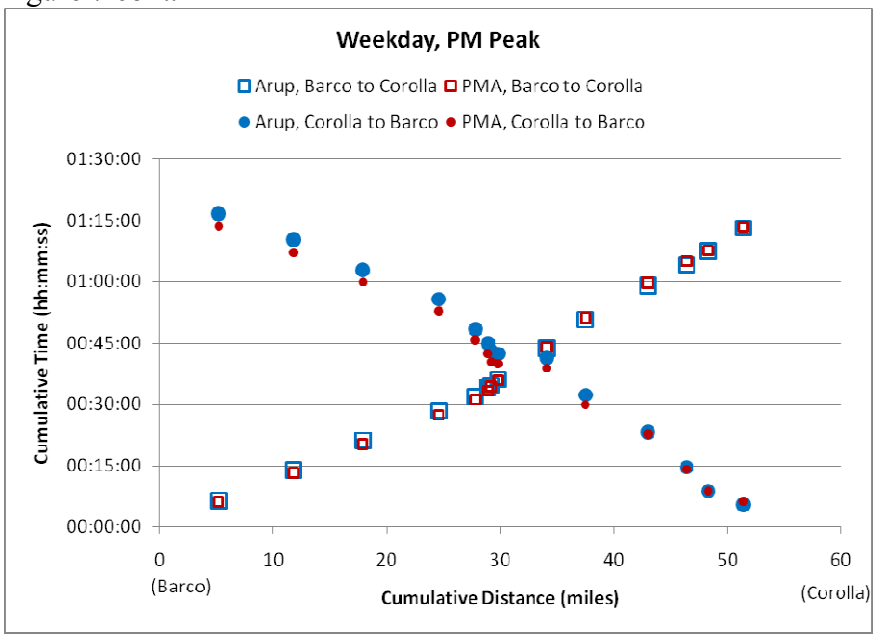


Figure 7 cont.



Key points:

- Little journey time variation was observed during the weekday time periods, with consistency between the Arup and PMA data collection programs.
- Near free-flow conditions were maintained throughout the weekday journey time runs in both directions.

5.2.3 Summary of Saturday Journey Time Runs - Average Travel Times between Barco and Corolla

Figure 8: Summary of Saturday Journey Time Runs - Average Travel Times between Barco and Corolla

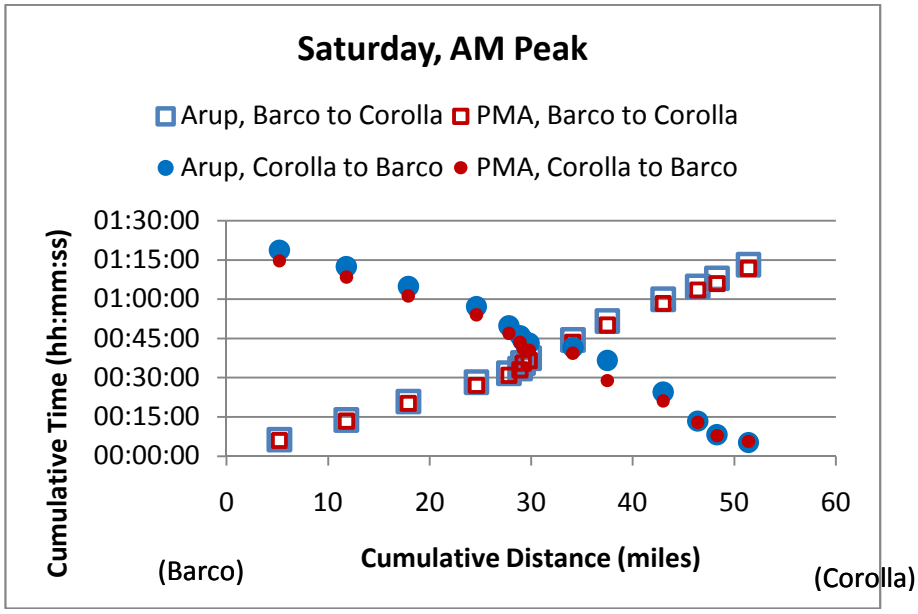
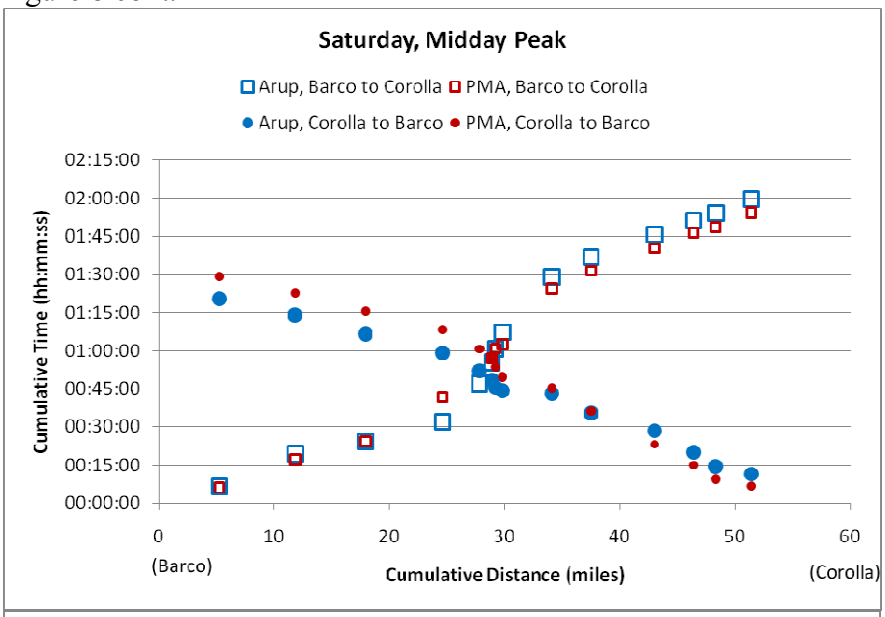
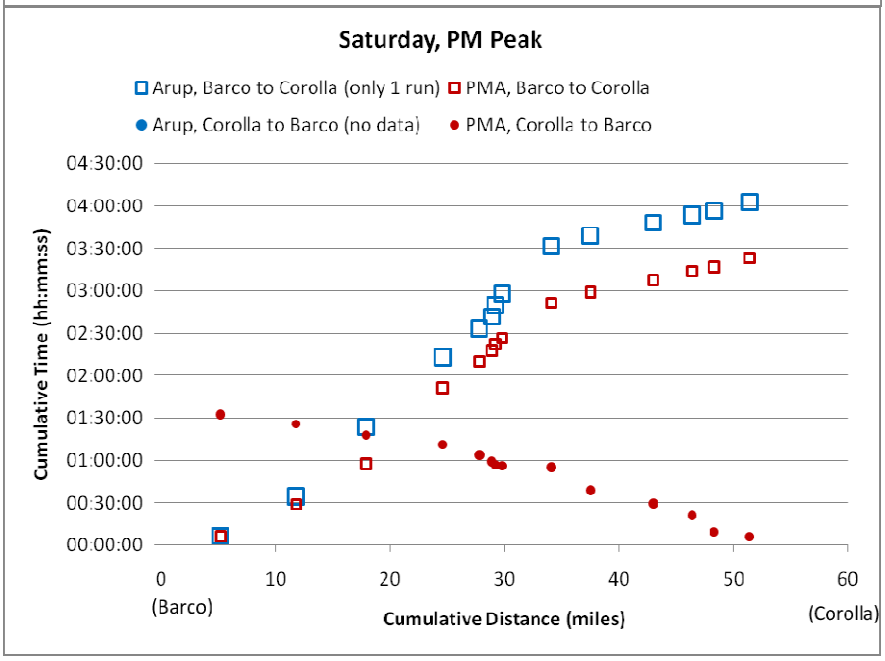


Figure 8 cont.





Key points:

- Little variation was observed in the Saturday AM Peak Hour between the Arup and PMA journey time surveys.
- Significant delay was observed in the Midday average hour at the US-158 / NC-12 intersection (approximately 30 miles from Corolla and Barco).
- Similar observations were observed in the PM Peak hour with queuing on the inbound journey time surveys beginning near Grandy on US-158.
- The PM Peak runs were the lengthiest, with some runs taking approximately 4 hours to travel from Barco to Corolla. The AM and Midday surveys took approximately 1 hour 15 minutes and 2 hours respectively.

- Significant variability was observed between the Arup and PMA data collection. This can be attributed to the journey times commencing at different times within the PM Peak period (16:00 to 19:00).

5.2.4 Summary of Sunday Journey Time Runs - Average Travel Times between Barco and Corolla

Figure 9: Summary of Sunday Journey Time Runs - Average Travel Times between Barco and Corolla

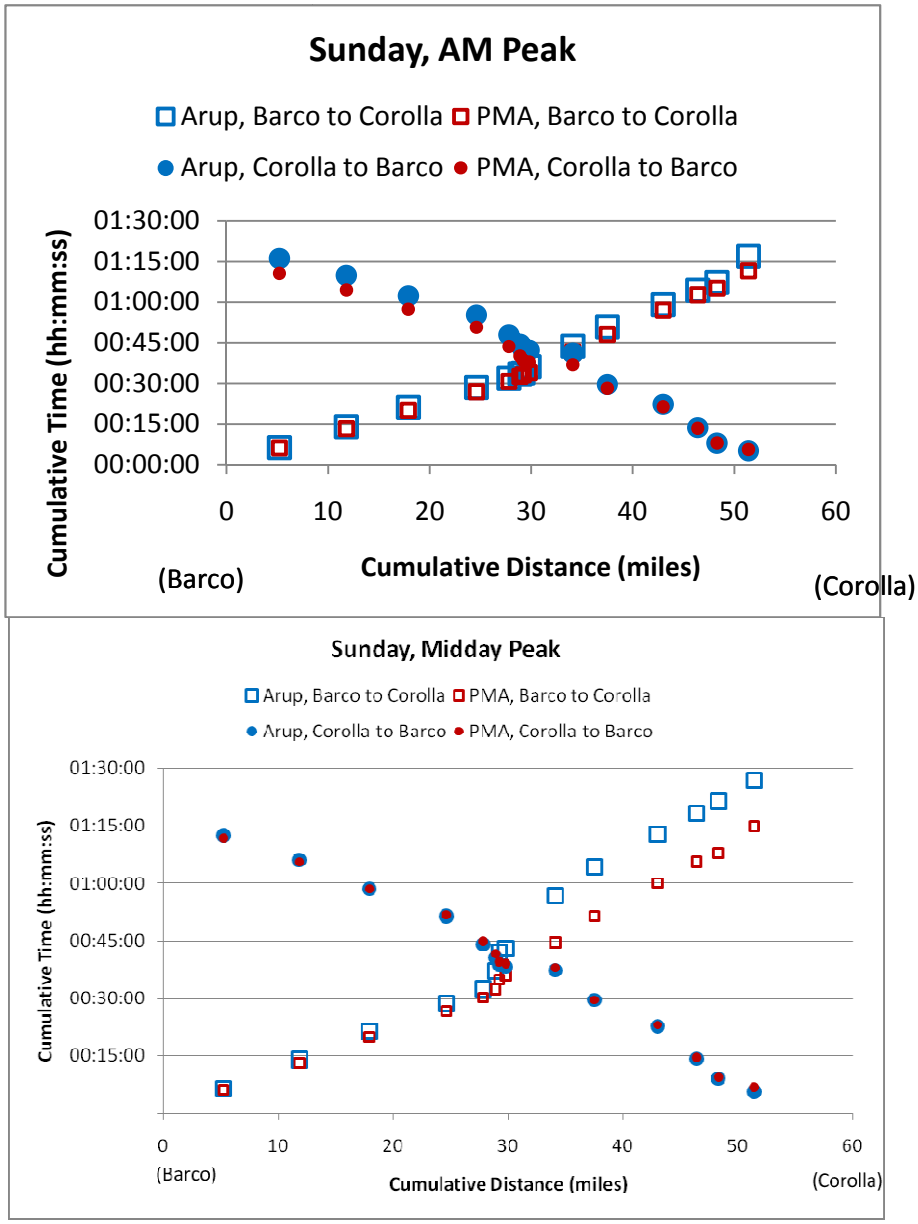
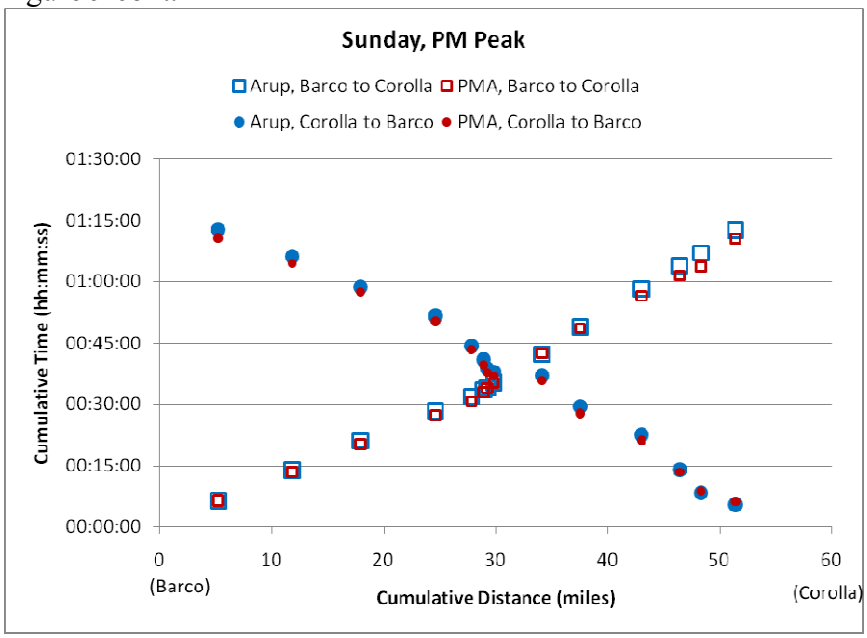


Figure 9 cont.



Key points:

- The Sunday journey time surveys show significantly less delay than those observed on Saturdays.
- Inbound journeys from Barco to Corolla took between 1 hour 15 minutes and 1 hour 30 minutes throughout the day.
- Variability was observed between the Arup and PMA data in the Midday average hour as a result of differential survey start times.

6 Traffic Count Data Comparisons

North Carolina Department of Transportation (NCDOT) Automatic Traffic maintains a series of permanent traffic recording stations throughout the study area. Recorder Station A2703 is located on US 158 east of the bridge, and the data has been used to verify the data collected as part of the 2010 survey program.

Table 13 below compares the NCDOT permanent count Site A2703, on the Wright Memorial Bridge, between 2009 and 2010. Table 14 shows the comparison between Arup Site G July 2010 and NCDOT permanent count Site A2703 July 2010.

Table 13: Comparison of NCDOT Site A2703, July 2009 v July 2010

Day	Total Traffic Flows Across Peak Periods (AM 07:00-10:00, MD 10:00-16:00, PM 16:00-19:00, Daily 24hrs)								% Difference			
	July 2009 - A2703 NCDOT				July 2010 - A2703 NCDOT							
	AM	MD	PM	Daily Total	AM	MD	PM	Daily Total	AM	MD	PM	Daily Total
Average Weekday	4,102	10,000	4,772	23,798	4,135	10,047	4,865	24,092	1%	0%	2%	1%
Saturday	10,254	18,815	7,722	46,002	11,036	17,900	7,991	48,529	8%	-5%	3%	5%
Sunday	6,559	17,528	6,001	35,834	6,726	16,490	5,475	34,739	3%	-6%	-9%	-3%

Table 13 highlights that:

- Growth in traffic levels has been observed between 2009 and 2010 on weekdays and Saturdays, with 1% and 5% additional daily traffic respectively.
- Within the modeled time period, a reduction in traffic of 5% was observed on Saturday during the Midday average hour.
- A slight reduction in traffic was observed on a Sunday in both the Midday and PM periods. A growth rate of 3% was observed in the AM Peak.

Table 14: Comparison of Arup Site G July 2010 v NCDOT Site A2703 July 2010

Day	Total Traffic Flows Across Peak Periods (AM 07:00-10:00, MD 10:00-16:00, PM 16:00-19:00, Daily 24hrs)								% Difference			
	July 2010 – Arup Site G				July 2010 – A2703 NCDOT							
	AM	MD	PM	Daily Total	AM	MD	PM	Daily Total	AM	MD	PM	Daily Total
Average Weekday	4,073	9,726	4,722	23,333	4,135	10,047	4,865	24,092	2%	3%	3%	3%
Saturday	10,704	17,295	7,301	45,909	11,036	17,900	7,991	48,529	3%	3%	9%	6%
Sunday	6,591	16,738	5,894	35,241	6,726	16,490	5,475	34,739	2%	-1%	-7%	-1%

Table 14 highlights that:

- The Arup data from Site G collected during July 2010 and the NCDOT July 2010 show a maximum difference of ±9%, with a number of time periods significantly less.
- Given the differences in the count equipment and significant congestion observed across the Wright Memorial Bridge, and the fact that NCDOT counts are an average of the whole month of July and that Arup July 2010 counts are only for two weeks, we believe that these two sets of data are compatible and that the 2010 survey data is suitable for use within the model development.

Appendix F

Technical Memo #6 - Shoulder-Peak Season Traffic Survey Report

Currituck Development Group

Mid-Currituck Bridge

Technical Memo #6 – Shoulder Peak Traffic Survey Results

FINAL

Currituck Development Group

Mid-Currituck Bridge

Technical Memo #6 – Shoulder Peak Traffic Survey Results

October 2009

This report takes into account the particular instructions and requirements of our client.
It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party

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Executive Summary

This technical note summarizes the 2009 off-peak season traffic surveys conducted in Currituck and Dare counties: Three sets of counts were conducted:

- Classified automatic traffic counts (ATC);
- Turning Movement Manual Classification Count (MCC); and
- Journey time surveys.

Traffic data was collected by Arcadis, based in Raleigh, North Carolina. Arcadis are a specialist company who has been performing traffic data collection for more than 25 years including 16 years on the North Carolina Department of Transportation Traffic Engineering Branch Turning Movement Count on-call contracts. The off-peak season surveys commenced in the week of September 17th 2009. Unlike the peak season counts, the off-peak counts were unaffected by any weather related events - just one count site needed to be reset following a traffic incident.

The ATC counts highlight that the peak hour varies by site. During weekdays, the PM peak period is generally the busiest. Saturday was observed as the busiest day of the week, with traffic volumes peaking during late morning and early afternoon. Sunday volumes are lower than on Saturday, with the busiest period around late morning and midday. All locations with the exception of sites 6 and 9 exhibited considerable growth between the off-peak and peak seasons.

The 2009 ATC data was compared with the existing 2006 WSA survey data where useful comparisons could be drawn. In all cases, the new counts are broadly consistent with those undertaken for the 2006 study, although it should be noted that the 2009 counts were undertaken for 14 days and the 2006 counts for 7 days and, whilst the survey periods and locations did not necessarily correspond exactly between years, they were deemed similar enough for comparison. There is evidence of traffic reductions on weekdays, while Saturdays and Sunday counts show a broadly consistent traffic total overall. The weekday reductions are most pronounced in the northern Outer Banks (sites 1 and 2, Corolla), and on US-158 (site 12).

Three journey time surveys were undertaken. In addition, information from the Arcadis survey logs was used to infer journey times associated with journeys between other key locations on the Outer Banks, such as trips between US-158/NC-168 and Corolla for example, the primary route for which the Mid-Currituck Bridge will provide an alternative. The journey time surveys highlighted less variation than observed during the peak season. It is widely observed that the peak season journey times are greater than those observed in the off-peak season, primarily due to the additional volume of traffic associated with the peak tourism season.

The manual classified count was undertaken at the junction of US-158 (North Croatan Highway), NC-12 southbound (Virginia Dare Trail) and NC-12 northbound (Ocean Boulevard), and classified traffic between passenger vehicles, trucks, and pedestrians. The analysis of the turning movement counts concentrated upon movements onto North Croatan Highway/Virginia Dare Trail westbound, as these should provide a good estimate of the origins of traffic crossing the Wright Memorial Bridge during the off-peak season. The volumes of traffic travelling towards the bridge are much reduced compared with the peak season. The proportion of trucks remains low (between 2 and 5 percent) at both intersections.

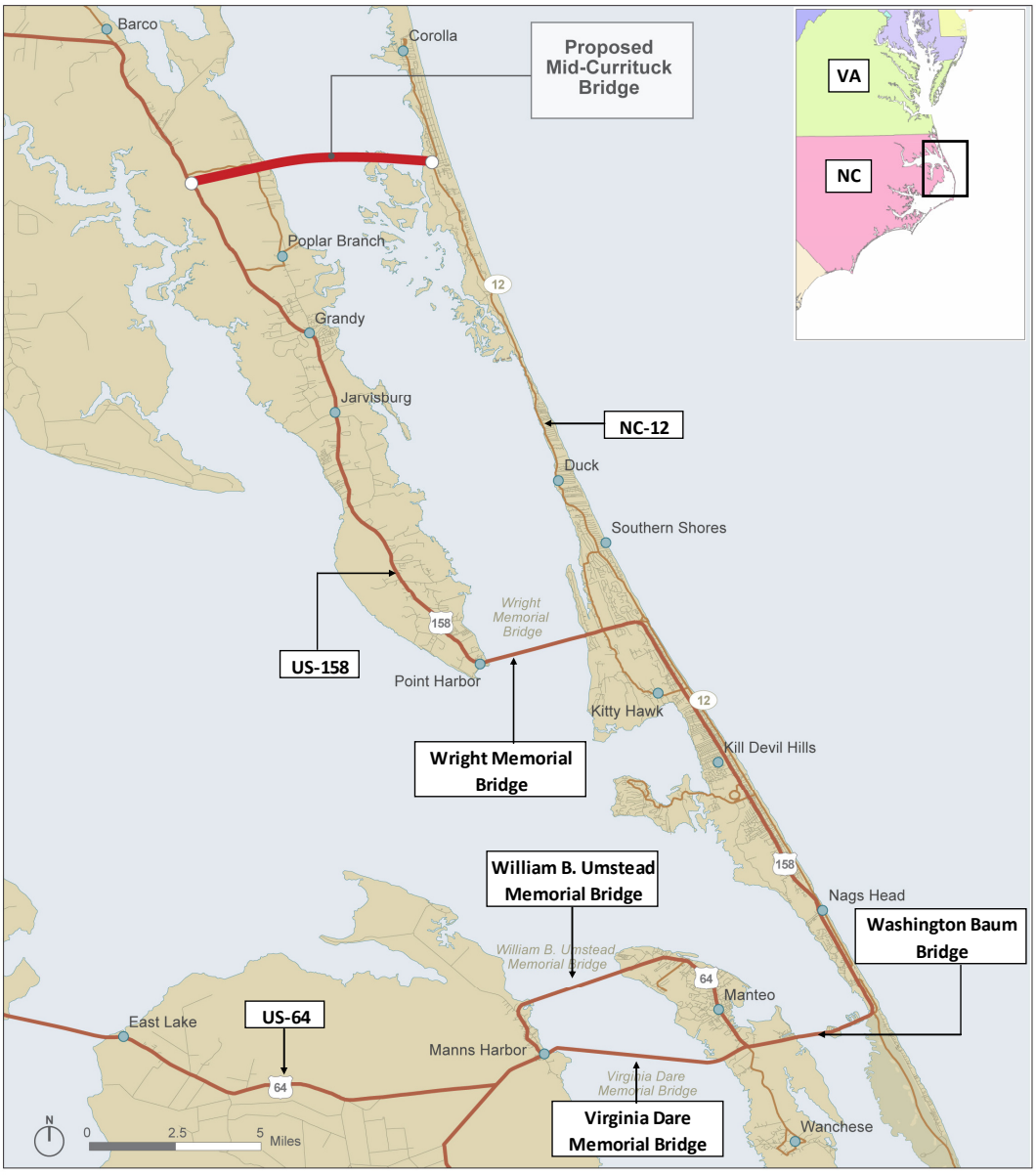
Further details on how this data will be utilized within the traffic model will be included in Technical Memo #8 - Presentation of the Model and Calibration Results.

1 Introduction

1.1 Project Background

The North Carolina Turnpike Authority (NCTA) is authorized to study, plan, develop and undertake preliminary design work on the Mid-Currituck Bridge, a proposed toll facility in the Outer Banks. The Mid-Currituck Bridge is located in northeastern NC and would connect the Currituck County mainland, to Currituck County on the Outer Banks (Figure 1).

Figure 1: Study Area



The Outer Banks is a 200-mile (320-km) long string of narrow barrier islands off the coast of North Carolina. The islands cover approximately half the northern North Carolina coastline, separating the Albemarle Sound and Pamlico Sound from the Atlantic Ocean. The majority of the Outer Banks island communities, from Corolla to Nags Head, are prime summer vacation destinations. At the moment there are two crossings south of the Virginia border; the Wright Memorial Bridge (around 32 miles south of the Virginia border) and the Washington Baum Bridge further south. Both crossings are untolled facilities.

1.2 The Project and the wider area of influence

The proposed Mid-Currituck Bridge involves the construction of approximately seven miles of new road from US-158 on mainland Currituck County, to NC-12 on the Outer Banks (Figure 1). The exact design is currently under development.

This area currently has very limited road access. US-158 and NC-12 are the only means of north-south travel to the Outer Banks. According to preliminary analysis, the new bridge will save approximately 35 miles and significant time for some journeys. It will also improve the evacuation time of the outer banks in the event of emergencies.

In the summer, the Outer Banks become heavily congested and the proposed bridge will significantly ease this congestion whilst facilitating continued growth within the area.

The Outer Banks attracts millions of vacationers throughout the year and significant growth has been observed in recent years. Traffic within the area is highly seasonal, with peak weekend flows between June and August about 125 percent higher on the existing Wright Memorial Bridge and the Outer Banks than traffic observed during the rest of the season. Similarly, weekend traffic is about seventy percent higher than weekday traffic.

The existing road infrastructure operates near or at capacity on NC-12 between US-158/NC-12 and Corolla during summer weekends. The new bridge will substantially improve traffic flow conditions on NC-12 and US-158 and, at the same time, reduce travel time between the mainland and the Outer Banks and improve the overall system efficiency with additional linkage. As a result, it will provide opportunities for sustainable additional development of the northern part of the Outer Banks and the mainland.

In this respect, the Project presents a unique marketing opportunity to leverage the existing Outer Banks travel/tourism industry with tailored marketing strategies to highlight substantial travel time savings, cost savings, and increased accessibility to this beautiful and unique destination.

1.3 Objectives

This technical note summarizes the 2009 off-peak season traffic surveys conducted in Currituck and Dare counties in North Carolina including:

- Classified automatic traffic counts (ATC);
- Turning Movement Manual Classification Count (MCC); and
- Journey time surveys.
- Comparisons with the peak season traffic survey results (reported separately in Technical Memo #5 – Peak Season Traffic Count Results.

Following a review of existing counts and consideration of the project milestones, it was decided to undertake the off-peak season survey starting in the week commencing September 17th 2009.

2 Automatic Traffic Count Data

2.1 Methodology

The Automated Traffic Counts were continuous, 24-hour volume counts for a full 2 weeks (Table 1). The counts were collected in 15-minute intervals and were classified according to the standard Federal Highway Administration (FHWA) classification chart.

Traffic data was collected by Arcadis, based in Raleigh, North Carolina. Arcadis are a specialist company who have been performing traffic data collection for more than 25 years including 16 years on the North Carolina Department of Transport Traffic Engineering Branch Turning Movement Count on-call contracts.

The locations are numbered 1-14 and are shown in Figure 2. After placement, all units were monitored by visiting at least every two days. At each visit, the tubes were checked to see if they were still in place and attached to the counter boxes. Then, the boxes were opened and monitored for 15 to 20 minutes to assure that the counters were registering vehicles correctly. If there were issues, they were corrected on site and the time noted so that when the data were downloaded, any remaining data gaps could be determined.

No significant disruptive events were noted during the collection of the off-peak season data.

Table 1: Off-Peak Season Automatic Traffic Count Schedule

Location	Description	Week	Dates Surveyed							Issues, Delay
			Sun	Mon	Tue	Wed	Thu	Fri	Sat	
1	NC 12, Corolla area between Albacore Street and Sandfiddler Trail	1	10/4	10/5	10/6	10/7	10/8	10/2 & 10/9	10/3	None noted
		2	10/11	10/12	10/13	10/14	10/15	10/9 & 10/16	10/10	
2	NC 12, Sanderling area between Blue Heron Ln and Oyster Catcher Ln	1	10/4	10/5	10/6	10/7	10/8	10/2 & 10/9	10/3	None noted
		2	10/11	10/12	10/13	10/14	10/15	10/9 & 10/16	10/10	
3	NC 12 Between Dogwood Trail and Porpoise Run	1	10/4	10/5	10/6	10/7	10/8	10/2 & 10/9	10/3	None noted
		2	10/11	10/12	10/13	10/14	10/15	10/9 & 10/16	10/10	
4	NC 12 Between E. Sibbern Ave and E. Hayman Blvd	1	9/20	9/21	9/22	9/23	9/17 & 9/24	9/18	9/19	None noted
		2	9/27	9/28	9/29	9/30	9/24 & 10/1	9/25	9/26	
5	NC 12, South of US 264, south of Whalebone	1	10/4	10/5	10/6	10/7	10/8	10/2 & 10/9	10/3	None noted
		2	10/11	10/12	10/13	10/14	10/15	10/9 & 10/16	10/10	
6	US 64/264 William B. Umstead Bridge, North of Mann's Harbor	1	10/4	10/5	10/6	10/7	10/8	10/2 & 10/9	10/3	None noted
		2	10/11	10/12	10/13	10/14	10/15	10/9 & 10/16	10/10	
7	US 64/264 Bypass East of Mann's Harbor	1	10/4	10/5	10/6	10/7	10/8	10/2 & 10/9	10/3	None noted
		2	10/11	10/12	10/13	10/14	10/15	10/9 & 10/16	10/10	
8	US 64/264 Just West of Whalebone on S. Virginia Dare Trail	1	10/4	10/5	10/6	10/7	10/8	10/2, 10/9 & 10/16	10/3	Counter reset following traffic incident
		2	10/11 & 10/18	10/12	10/13	10/14	10/15	10/16	10/17	

Location	Description	Week	Dates Surveyed							Issues, Delay
			Sun	Mon	Tue	Wed	Thu	Fri	Sat	
9	US 158 Between E. Sibbern Ave and E. Hayman Blvd	1	9/20	9/21	9/22	9/23	9/17 & 9/24	9/18	9/19	None noted
		2	9/27	9/28	9/29	9/30	9/24 & 10/1	9/25	9/26	
10	US 158 Between Harbinger and Point Harbor	1	9/20	9/21	9/22	9/23	9/17 & 9/24	9/18	9/19	None noted
		2	9/27	9/28	9/29	9/30	9/24 & 10/1	9/25	9/26	
11	US 158 Jarvisburg, near Fisher Landing Road	1	9/20	9/21	9/22	9/23	9/17 & 9/24	9/18	9/19	None noted
		2	9/27	9/28	9/29	9/30	9/24 & 10/1	9/25	9/26	
12	US 158, Bertha, north of Macedonia Church Road	1	9/20	9/21	9/22	9/23	9/17 & 9/24	9/18	9/19	None noted
		2	9/27	9/28	9/29	9/30	9/24 & 10/1	9/25	9/26	
13	US 158, Just west of Currituck County Airport	1	9/20	9/21	9/22	9/23	9/17 & 9/24	9/18	9/19	None noted
		2	9/27	9/28	9/29	9/30	9/24 & 10/1	9/25	9/26	
14	NC 168, North of Currituck, South of Sligo	1	9/20	9/21	9/22	9/23	9/17 & 9/24	9/18	9/19	None noted
		2	9/27	9/28	9/29	9/30	9/24 & 10/1	9/25	9/26	

2.2 ATC Summary

The ATC traffic Count Data by site is summarized in the following tables with the peak hour for each site indicated in bold. A summary of the daily total traffic is shown in Figure 2.

Table 2 shows the average weekday totals over the survey period by hour. The peak hour varies by site, although in general the PM peak period is the busiest.

Table 3 shows the average Saturday totals over the survey period by hour. Saturday traffic volumes are generally the highest of any day with the late morning and mid-afternoon periods the busiest time of day.

Table 4 shows the average Sunday totals over the survey period by hour. Volumes are lower than on Saturday, with the busiest period around late morning.

Traffic flow profiles by site are shown in the following sections, together with a summary of the key points observed from the count data. Certain sites show significant variation between individual weekdays over the survey period and between each pair of Saturday or Sunday data from different weeks. We are aware that traffic patterns shift from week to week. Therefore, even though this is all off-peak season data, there could be some different numbers from week to week.

It is important to ensure that the counts are internally consistent for use in validation of the traffic model. Further benchmarking will be undertaken where required, including further validation and comparison with permanent count sites data. This process will be described subsequently in Technical Memo #8 - Presentation of the Model and Calibration Results.

Figure 2: Off-Peak Season Daily Traffic (24 Hour) by Site

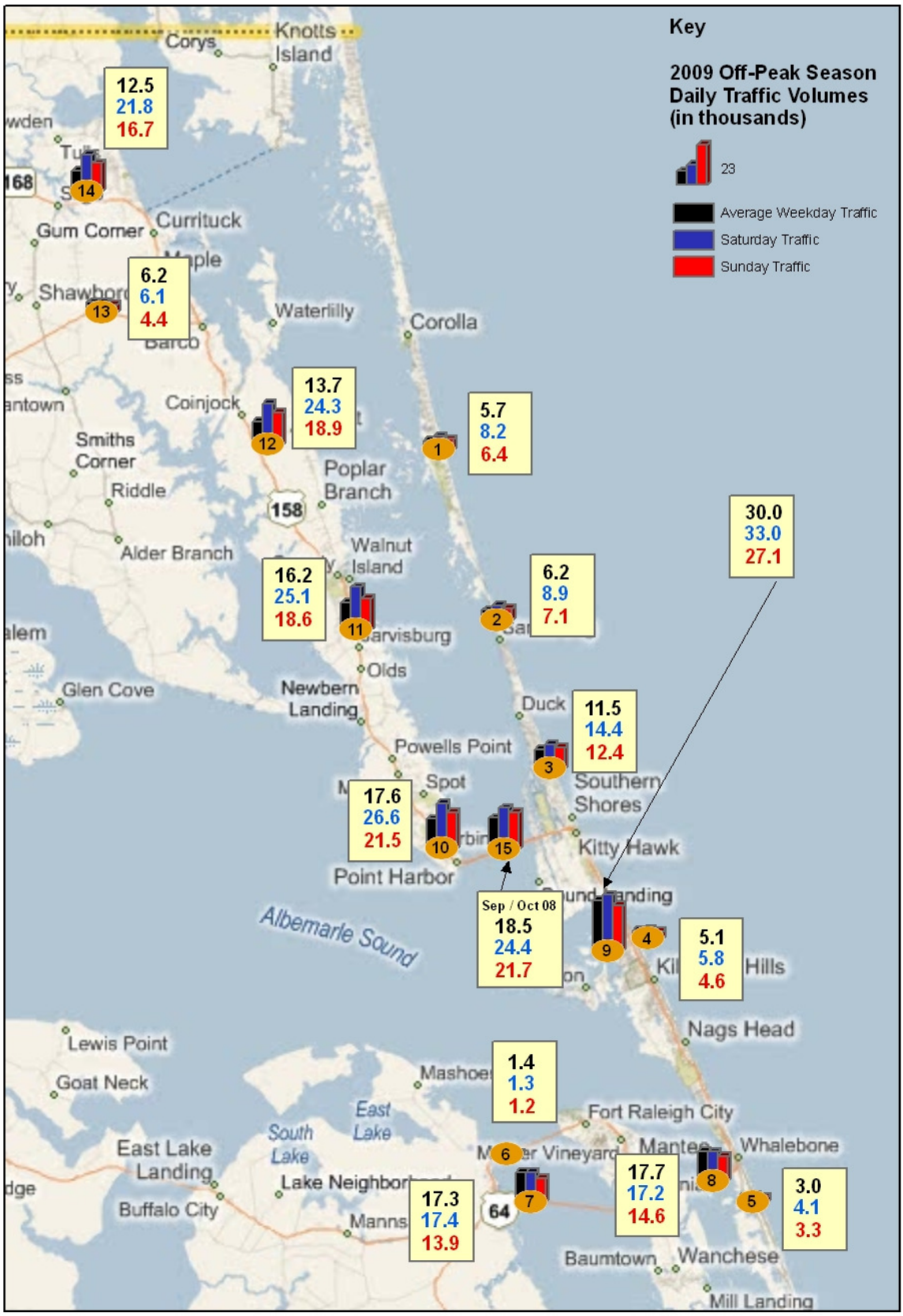


Table 2: Average Weekday Total Daily Traffic Flows by Site

	Hour Commencing																								
Site	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
1	10	10	10	0	10	20	50	140	300	370	460	530	**540**	500	490	480	450	430	320	230	150	110	70	30	5,700
2	20	10	10	10	10	30	90	210	360	430	480	**520**	510	510	**520**	510	490	470	320	240	160	130	90	50	6,160
3	40	20	20	10	20	60	170	470	730	840	860	**910**	880	880	890	**910**	900	900	660	460	330	260	180	90	11,490
4	50	40	30	20	10	10	40	110	210	250	320	350	400	430	430	440	**450**	420	360	260	180	120	100	100	5,120
5	10	0	0	0	0	20	60	90	170	220	**250**	240	**250**	240	230	220	230	220	190	130	90	50	30	20	2,960
6	10	0	0	0	10	20	50	**130**	80	80	80	100	90	90	100	120	120	110	80	50	40	30	20	10	1,410
7	60	30	30	30	70	160	470	920	1,160	1,070	1,140	1,250	1,260	1,250	1,310	**1,420**	1,410	1,360	960	640	470	390	260	140	17,270
8	70	30	30	30	70	150	460	850	1,170	1,070	1,150	1,260	1,300	1,310	1,320	1,420	**1,460**	1,410	1,040	710	510	420	270	140	17,660
9	170	110	80	70	120	290	740	1,550	1,790	1,790	1,930	2,060	2,130	2,090	2,030	**2,220**	**2,220**	2,190	1,750	1,400	1,220	970	670	400	29,980
10	90	50	40	50	80	230	550	980	1,240	1,140	1,140	1,170	1,180	1,210	1,220	1,320	**1,390**	**1,390**	980	710	520	410	290	180	17,560
11	100	50	40	50	80	230	550	940	1,090	970	1,010	1,030	1,080	1,090	1,150	1,220	**1,270**	**1,270**	930	690	530	400	290	180	16,230
12	80	40	30	50	90	220	460	820	860	830	870	890	900	880	950	**1,060**	1,040	1,050	800	590	450	340	250	160	13,690
13	30	10	10	10	30	90	250	480	470	350	330	330	360	360	400	470	500	**550**	380	250	190	130	100	60	6,150
14	60	40	30	40	90	200	420	800	690	710	750	780	830	790	850	**1,010**	910	960	790	600	420	300	240	140	12,450
All	790	460	360	360	680	1,730	4,370	8,500	10,310	10,100	10,780	11,430	11,710	11,640	11,890	12,810	**12,840**	12,720	9,570	6,940	5,240	4,080	2,850	1,680	

Table 3: Saturday Total Daily Traffic Flows by Site

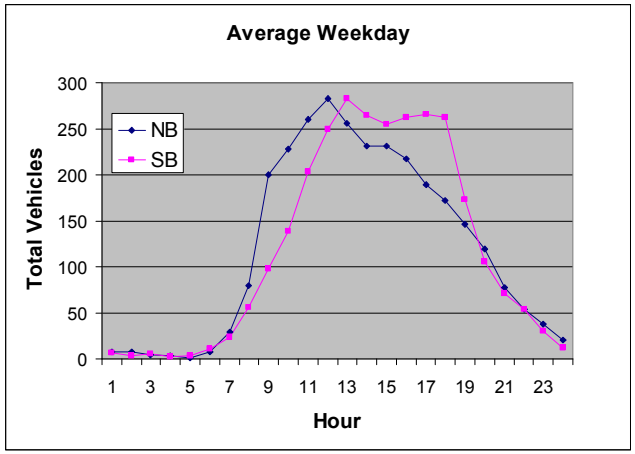
	Hour Commencing																							
Site	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
1	40	30	20	20	20	50	80	220	440	610	670	630	650	630	700	**760**	690	560	420	370	250	170	110	60	8,190
2	50	30	20	20	20	70	150	280	530	740	720	640	620	690	760	**780**	710	580	470	330	240	190	150	80	8,860
3	100	50	40	30	50	100	240	450	910	1,150	1,120	1,050	1,010	1,090	1,130	**1,220**	1,130	980	820	560	420	330	270	150	14,390
4	20	10	10	0	0	10	50	130	240	390	470	470	490	500	510	**520**	510	410	400	250	170	140	80	40	5,810
5	10	10	10	0	10	30	50	140	230	330	320	300	320	320	320	**370**	360	280	250	190	130	90	30	30	4,110
6	10	10	10	10	10	20	30	50	70	70	100	**110**	100	100	90	100	100	90	70	40	40	40	20	20	1,310
7	130	80	70	40	80	140	270	540	890	1,120	1,320	1,480	1,420	1,420	**1,490**	1,420	1,270	1,150	910	680	510	450	340	230	17,430
8	140	80	60	40	80	140	290	540	820	1,070	1,220	**1,450**	1,390	1,400	1,420	1,360	1,230	1,090	990	790	550	510	360	200	17,240
9	310	200	140	160	330	560	1,020	1,530	1,900	2,300	**2,380**	2,370	2,310	2,300	2,280	2,350	2,240	1,910	1,760	1,400	1,190	960	660	450	33,030
10	170	110	80	90	140	320	670	1,280	1,920	2,280	**2,500**	2,390	1,940	1,870	2,040	2,090	1,760	1,370	1,040	830	620	490	370	250	26,630
11	180	110	90	80	130	300	630	1,150	1,690	2,020	2,310	**2,360**	1,920	1,800	2,040	2,060	1,670	1,240	940	800	570	470	340	240	25,130
12	150	90	70	80	130	270	570	1,090	1,540	1,970	2,410	**2,520**	2,010	1,820	2,000	1,850	1,460	1,160	880	790	540	400	310	200	24,310
13	60	30	20	20	30	70	190	410	400	340	390	420	410	440	270	420	**470**	**470**	350	310	220	160	130	90	6,100
14	130	100	60	60	110	210	460	740	1,220	1,700	2,190	**2,430**	2,080	1,790	2,000	1,590	1,180	910	810	700	530	350	280	180	21,790
All	1,500	940	690	660	1,140	2,300	4,710	8,550	12,810	16,070	18,110	**18,610**	16,680	16,180	17,040	16,890	14,780	12,170	10,100	8,030	5,960	4,730	3,460	2,200	

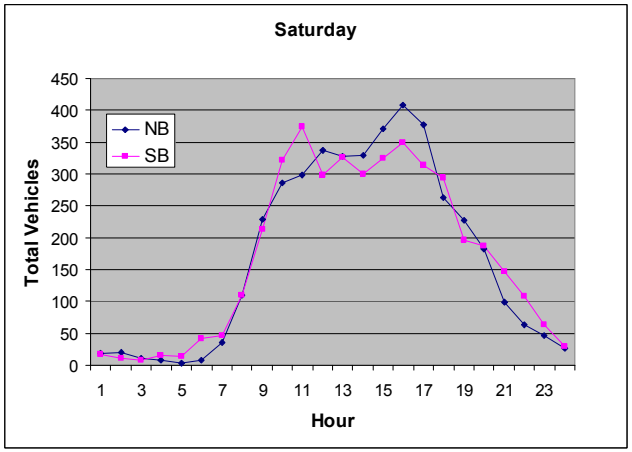
Table 4: Sunday Total Daily Traffic Flows by Site

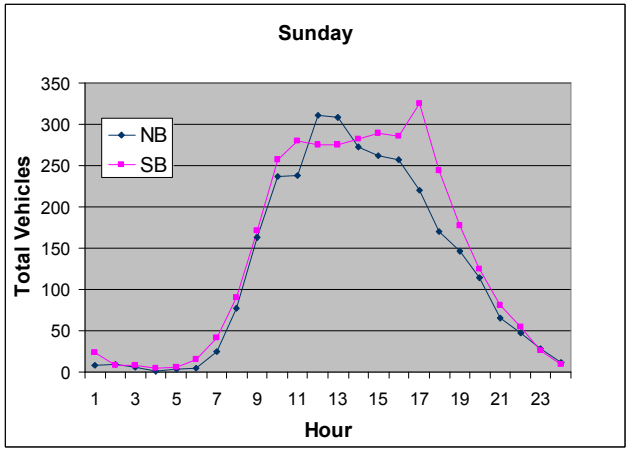
	Hour Commencing																								
Site	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
1	30	20	10	10	10	20	70	170	340	490	520	**590**	580	550	550	540	550	420	320	240	150	100	60	20	6,350
2	50	20	20	10	10	40	120	220	460	540	**650**	600	590	570	610	620	560	450	360	250	150	120	80	40	7,130
3	80	40	30	20	20	60	190	370	810	970	**1,070**	1,060	960	950	1,020	1,030	940	870	700	470	300	200	150	70	12,390
4	20	10	10	0	0	10	40	120	200	330	430	410	430	**450**	380	380	370	310	280	200	100	60	30	10	4,580
5	10	10	0	10	10	20	50	120	200	270	290	290	**300**	280	230	250	250	230	190	140	100	60	20	10	3,310
6	10	10	0	0	0	10	20	30	50	60	90	80	90	100	**110**	100	100	90	80	60	40	20	20	10	1,190
7	140	80	60	40	60	110	190	340	650	820	1,140	1,140	**1,270**	1,210	1,120	1,190	1,100	910	780	580	380	270	220	120	13,930
8	120	70	60	50	60	100	180	330	610	780	1,080	1,110	**1,400**	1,310	1,250	1,270	1,190	1,000	890	680	430	330	230	140	14,630
9	270	190	140	110	130	280	570	950	1,480	1,790	**2,160**	2,090	2,120	2,020	1,950	2,060	1,830	1,650	1,440	1,290	1,020	750	520	280	27,110
10	120	100	70	70	80	220	430	790	1,270	1,640	**1,960**	1,850	1,750	1,700	1,820	1,800	1,590	1,380	960	710	510	330	220	130	21,490
11	120	90	60	70	70	210	400	710	1,090	1,440	**1,790**	1,580	1,410	1,410	1,610	1,530	1,280	1,170	850	660	460	310	200	120	18,640
12	120	80	60	60	80	180	350	680	940	1,350	1,760	**1,790**	1,630	1,590	1,650	1,580	1,320	1,160	850	660	420	300	180	110	18,900
13	60	30	30	20	20	40	100	260	250	270	270	300	350	370	**400**	**400**	360	390	310	240	170	110	70	40	4,860
14	100	80	50	50	80	130	260	460	690	1,100	1,530	**1,670**	1,630	1,540	1,500	1,390	1,130	1,030	780	600	410	280	170	100	16,740
All	1,240	810	600	490	620	1,430	2,970	5,540	9,030	11,860	**14,750**	14,550	14,520	14,050	14,200	14,150	12,590	11,060	8,780	6,770	4,650	3,240	2,150	1,200	

2.3 ATC Traffic Flow Profiles by Site

2.3.1 Site 01 NC 12, Corolla area between Albacore Street and Sandfiddler Trail (average over two weeks)



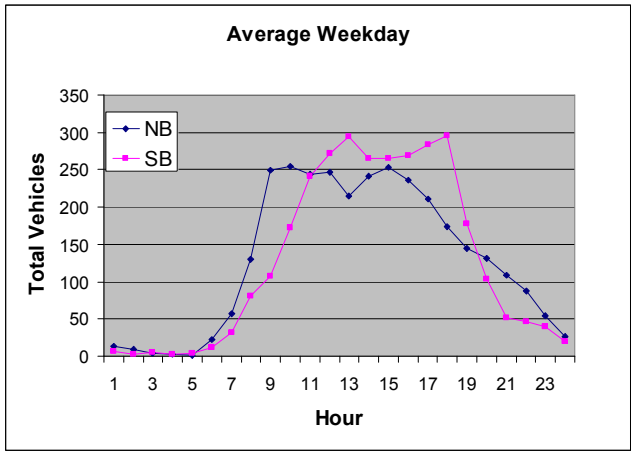


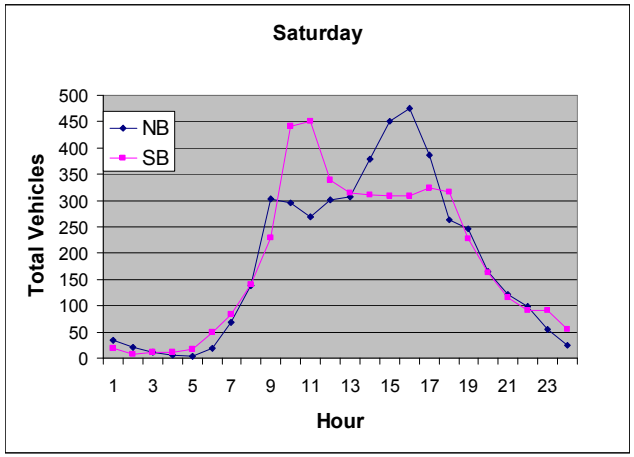


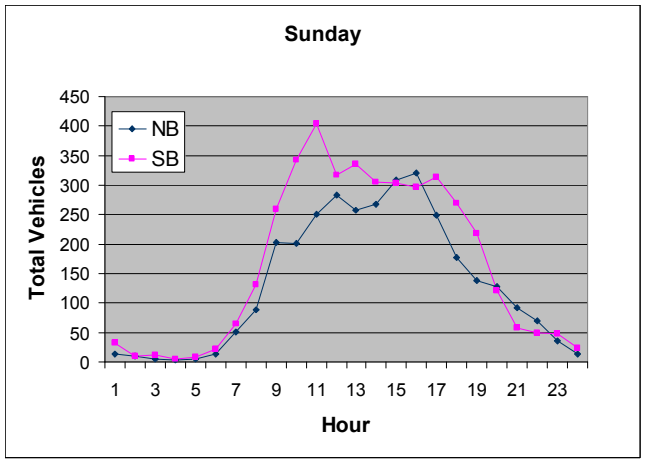
Key points:

- Comparatively low traffic volumes
- Peak Saturday traffic 41% higher than average weekday peak
- Peak Sunday traffic 9% higher than average weekday peak
- Flat profile during the Week and Sundays
- AM peak southbound on Saturdays, and a corresponding PM peak northbound

2.3.2 Site 02 NC 12, Sanderling area between Blue Heron Ln and Oyster Catcher Ln (average over two weeks)



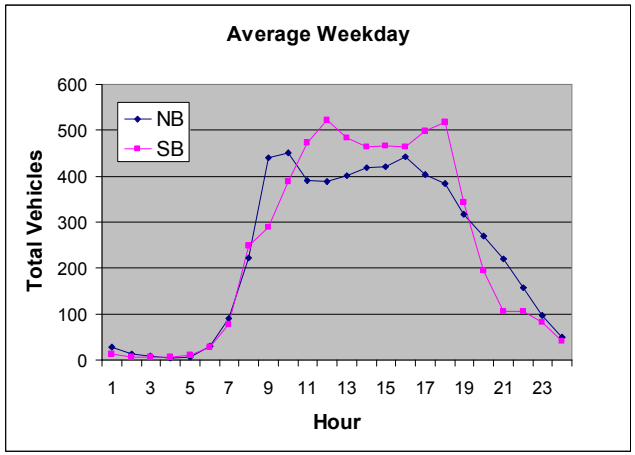


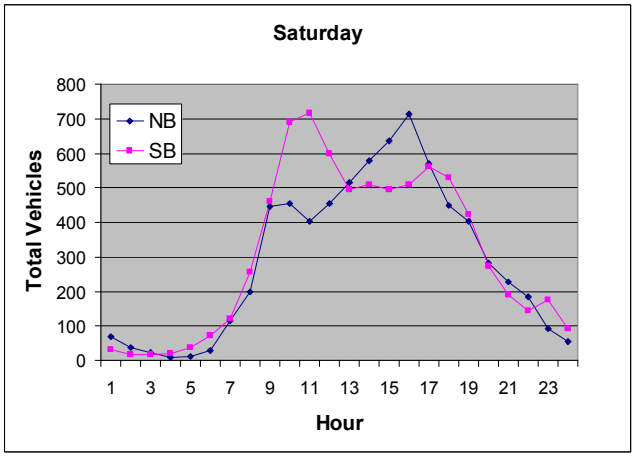


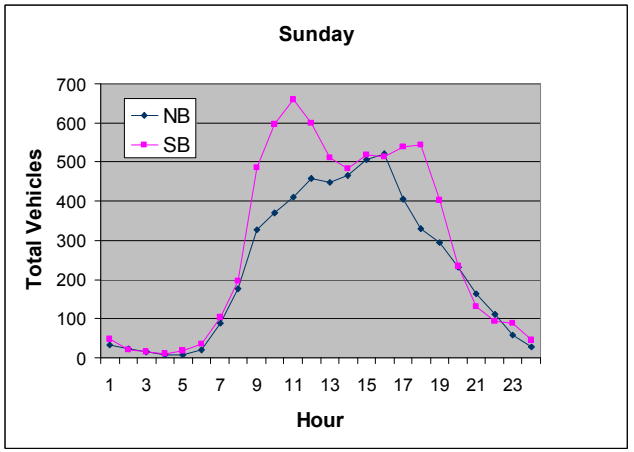
Key points:

- Similar volumes to Site 1 throughout the week
- Peak Saturday traffic 50% higher than average weekday peak
- Peak Sunday traffic 25% higher than average weekday peak
- Late weekday PM peak southbound
- Marked southbound AM peak and northbound PM peak on both Saturday and Sunday

2.3.3 Site 03 NC 12 Between Dogwood Trail and Porpoise Run (average over two weeks)



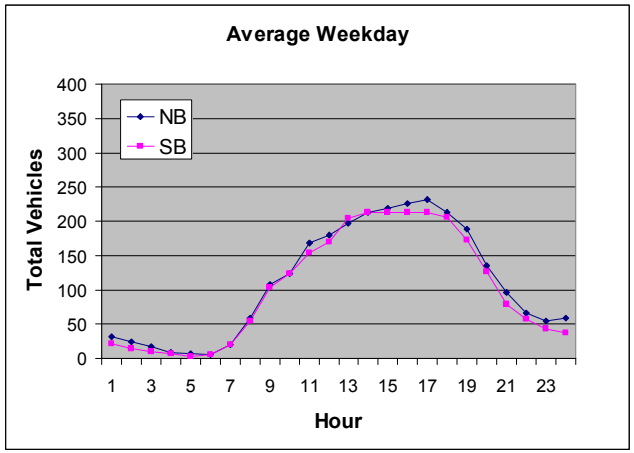


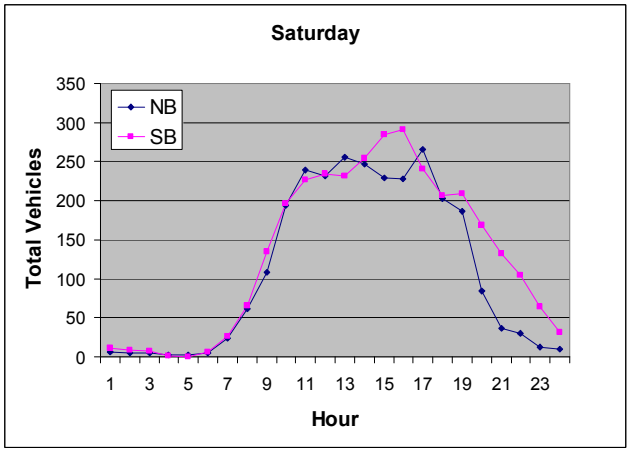


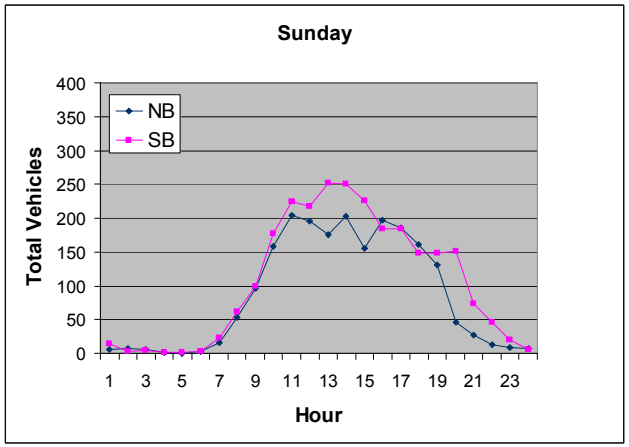
Key points:

- Higher volumes than Sites 01 and 02
- Peak Saturday traffic 34% higher than average weekday peak
- Peak Sunday traffic 18% higher than average weekday peak
- Relatively flat profile on weekdays, with minor AM and PM peaks in both directions
- Southbound AM peak and northbound PM peak defined on Saturday and Sunday

2.3.4 Site 04 NC 12 Between E. Sibbern Ave and E. Hayman Blvd (average over two weeks)



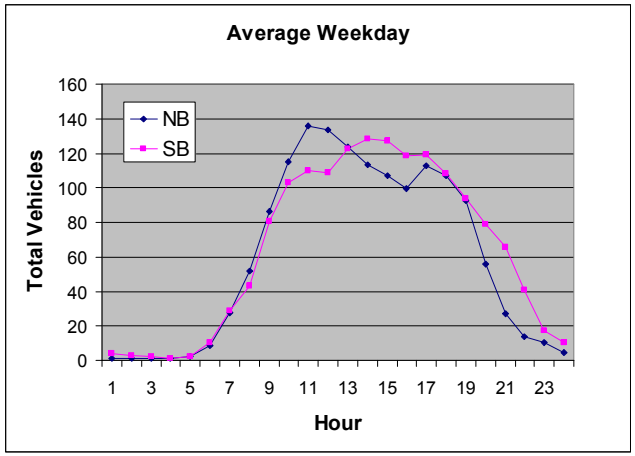


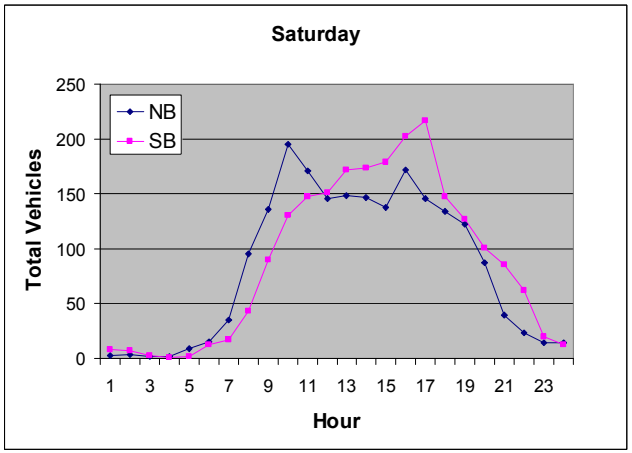


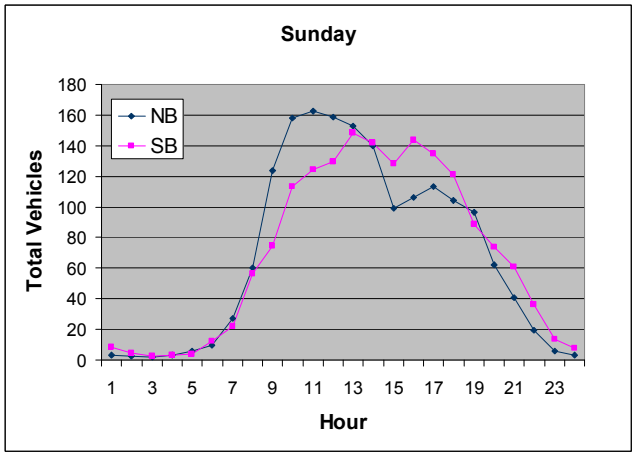
Key points:

- Low traffic volumes
- Peak Saturday traffic volumes 16% higher than average weekday peak
- Sunday traffic volumes similar to average weekday
- No marked weekday peak period
- No clear peak period on Saturday compared with sites to the north

2.3.5 Site 05 NC 12, South of US 264, south of Whalebone (average over two weeks)



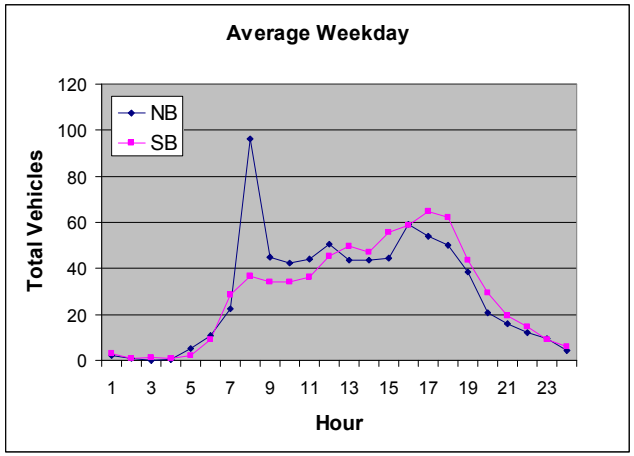


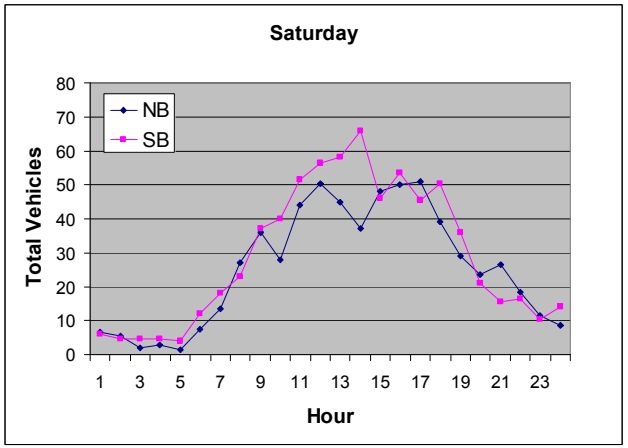


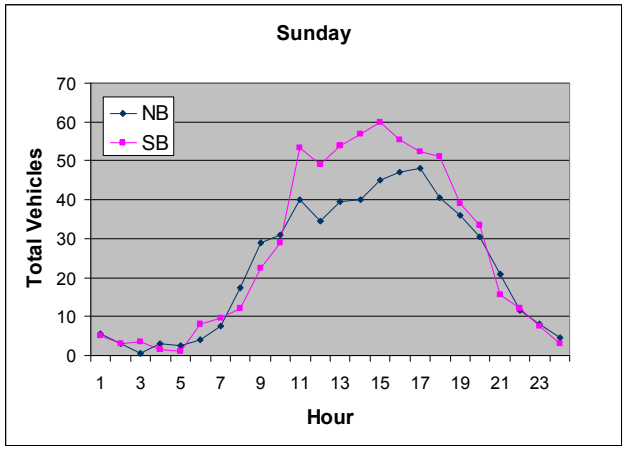
Key points:

- Low traffic volumes
- Peak Saturday traffic 22% higher than average weekday peak
- Peak Sunday traffic volumes similar to average weekday peak
- AM and PM weekday peak northbound; volumes peak southbound during early afternoon
- Saturday flows higher with AM peak northbound, PM peak southbound

2.3.6 Site 06 US 64/264 William B. Umstead Bridge, North of Mann's Harbor (average over two weeks)



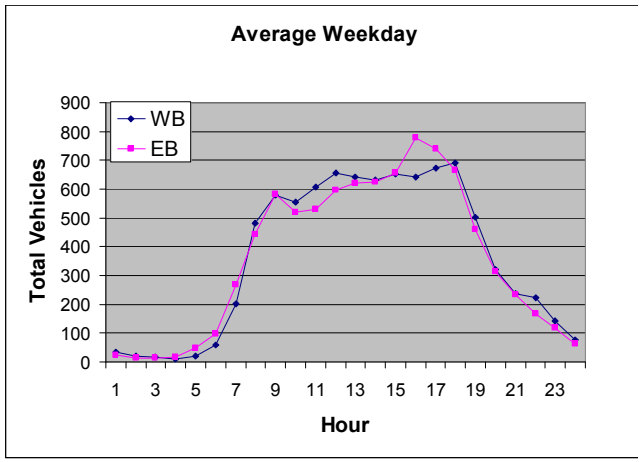


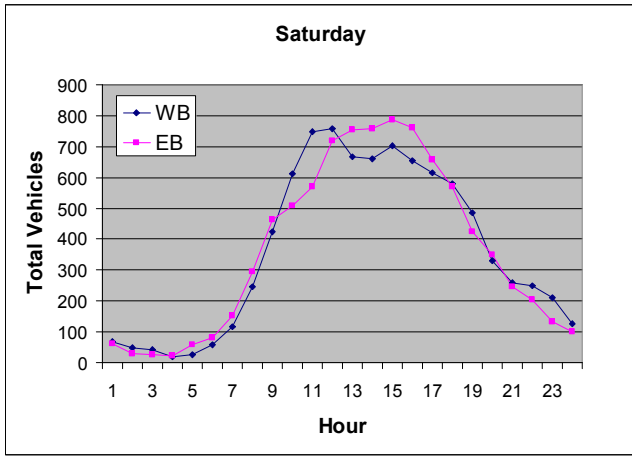


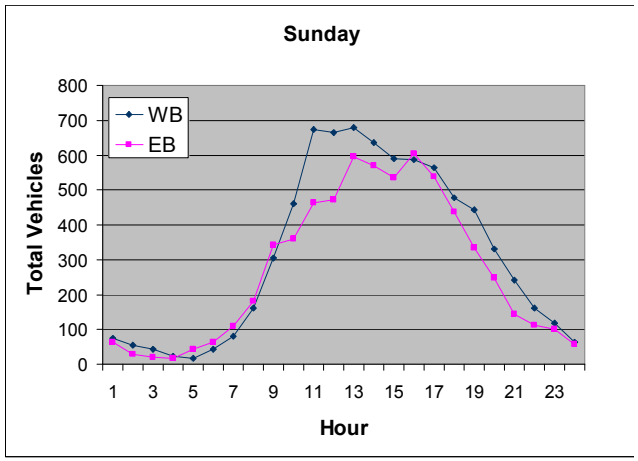
Key points:

- Very low traffic on all days
- Strong AM peak on all weekdays in the NB direction

2.3.7 Site 07 US 64/264 Bypass East of Mann's Harbor (average over two weeks)



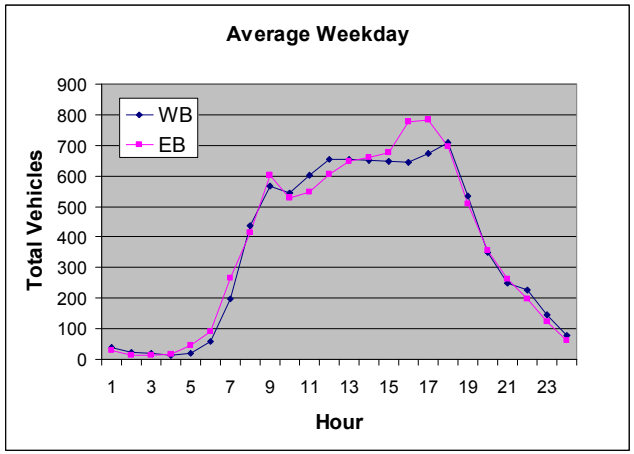


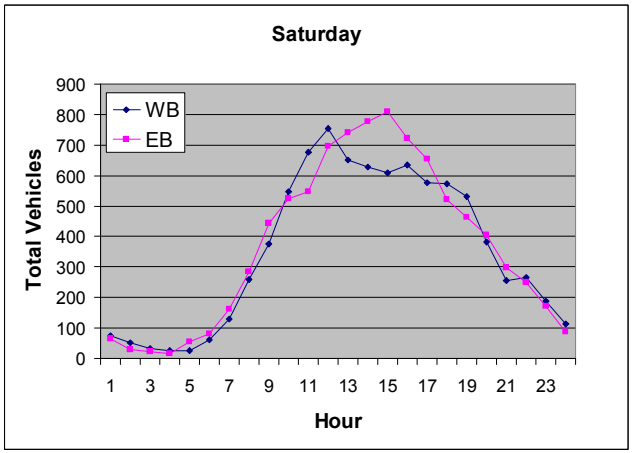


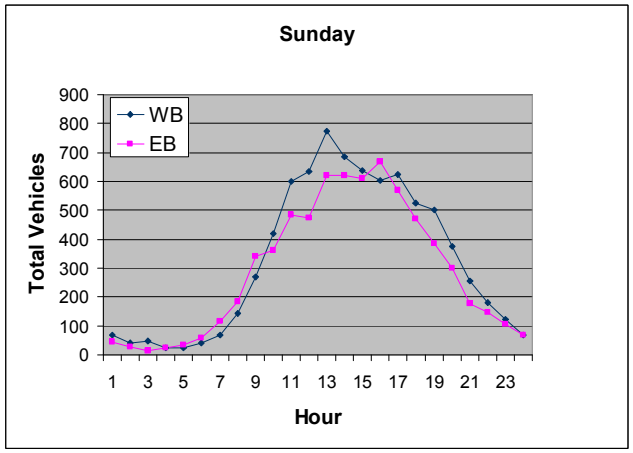
Key points:

- Much higher traffic volumes than parallel Site 06
- Saturday traffic volumes similar to average weekday
- Marked eastbound PM peak observed during average weekday
- Late westbound AM peak and a prolonged eastbound PM peak observed on Saturday and Sunday

2.3.8 Site 08 US 64/264 Just West of Whalebone on S. Virginia Dare Trail (average over two weeks)



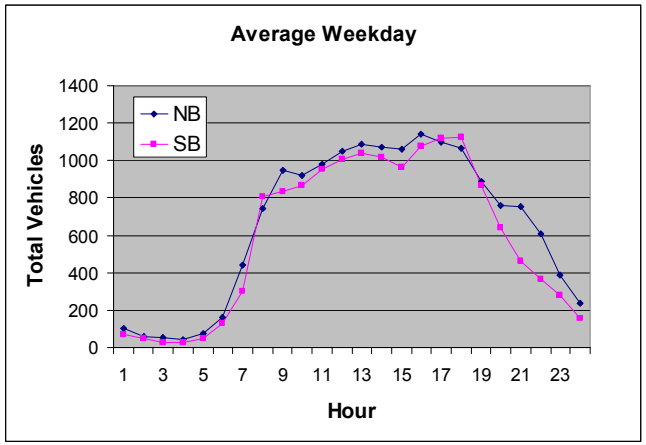


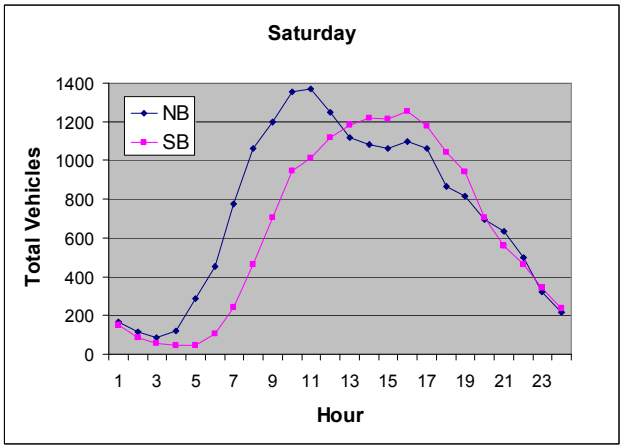


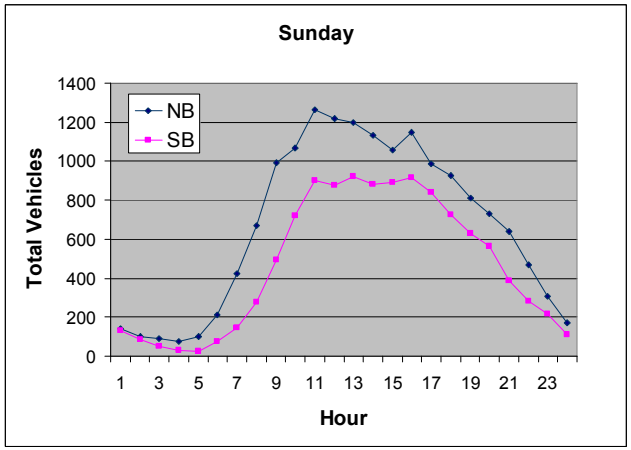
Key points:

- Similar traffic volumes observed on the average weekday, Saturday and Sunday
- Peak Saturday and Sunday traffic slightly lower than average weekday peak (1% and 4% respectively)
- Highest weekday volumes in both directions in PM peak
- Westbound AM peak observed on Saturday and Sunday; PM peak in eastbound direction

2.3.9 Site 09 US 158 Between E. Sibbern Ave and E. Hayman Blvd (average over two weeks)



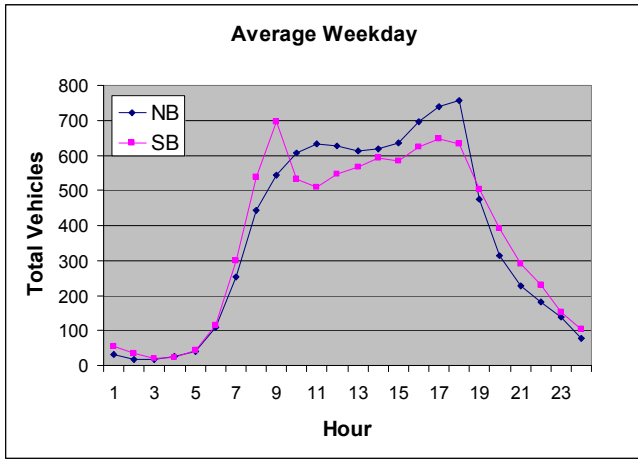


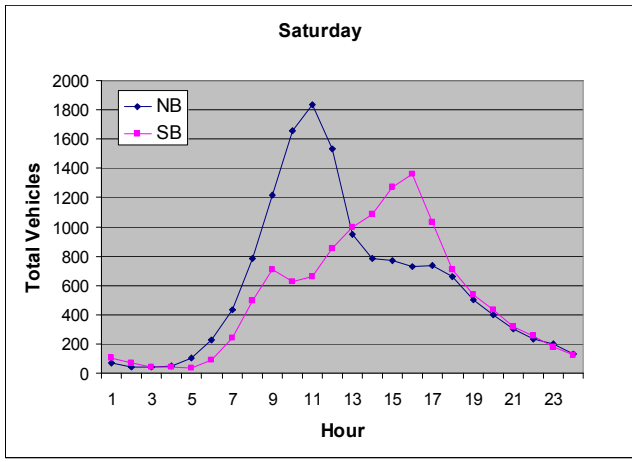


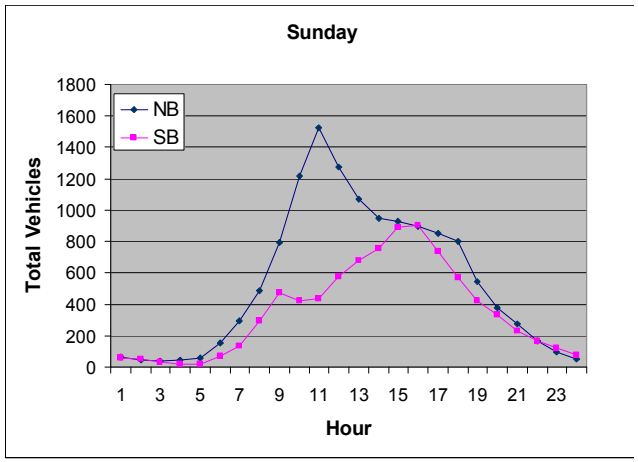
Key points:

- Busiest site on Outer Banks
- Peak Saturday traffic 7% higher than average weekday peak
- Peak Sunday traffic 3% lower than average weekday peak
- Weekday profile comparatively flat with highest volumes in the PM
- Highest volumes recorded on Saturday with late AM peak northbound

2.3.10 Site 10 US 158 Between Harbinger and Point Harbor (average over two weeks)



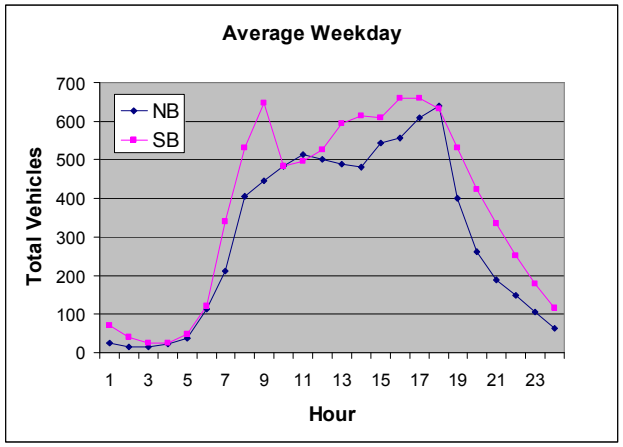


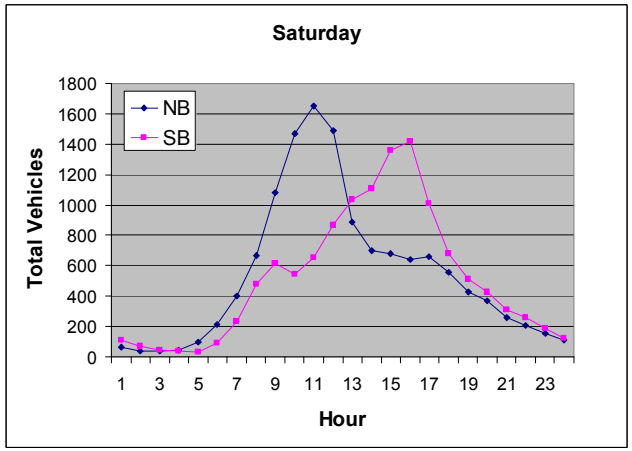


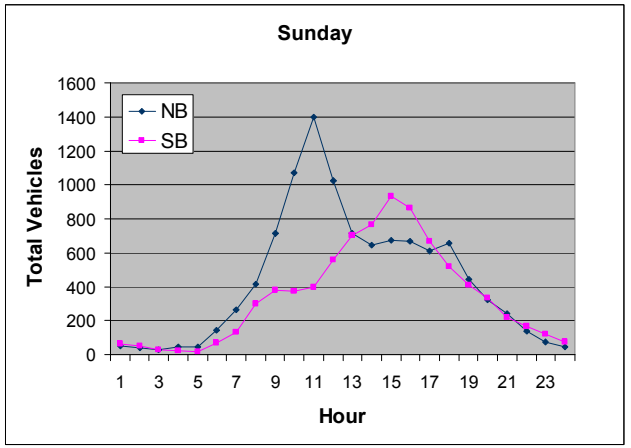
Key points:

- Peak Saturday traffic 80% higher than average weekday peak
- Much greater traffic volumes observed at weekends compared to the average weekday
- Marked AM and PM peaks observed on Saturday and, to a lesser extent, Sunday
- Peak Sunday traffic 41% higher than average weekday peak

2.3.11 Site 11 US 158 Jarvisburg, near Fisher Landing Road (average over two weeks)



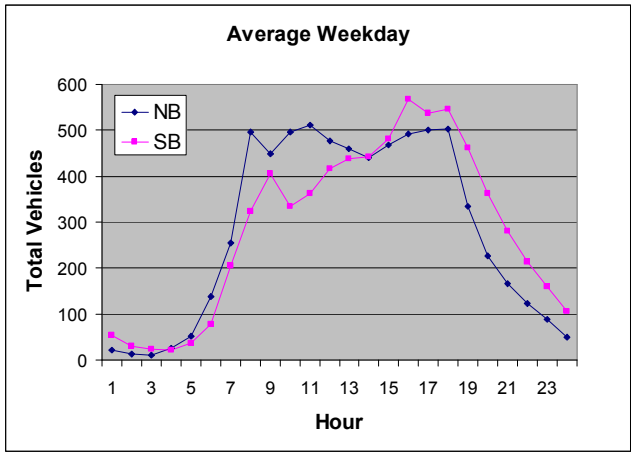


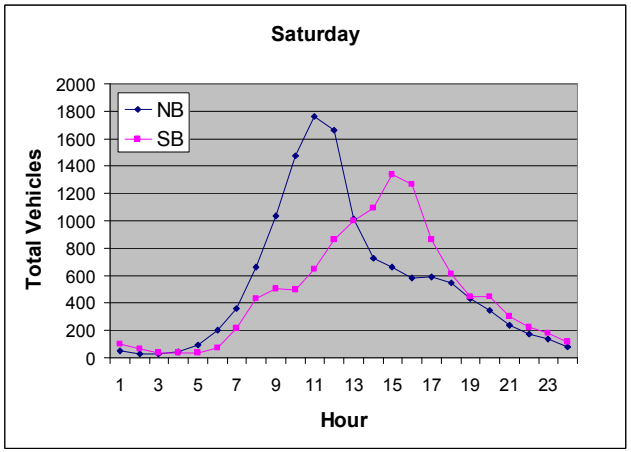


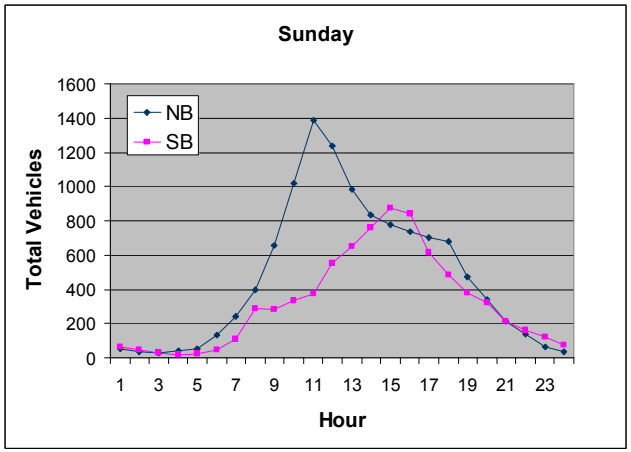
Key points:

- Peak Saturday traffic 86% greater than the average weekday peak
- Peak Sunday traffic 41% greater than the average weekday peak
- Marked AM and PM peaks observed during both Saturday and Sunday
- Flat profile observed throughout average weekday

2.3.12 Site 12 US 158, Bertha, north of Macedonia Church Road (average over two weeks)



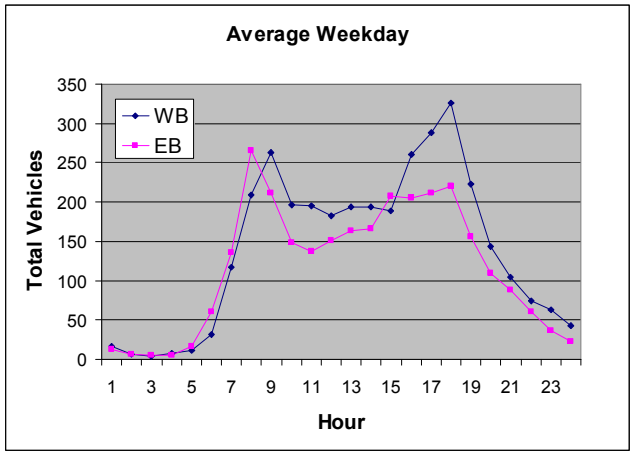


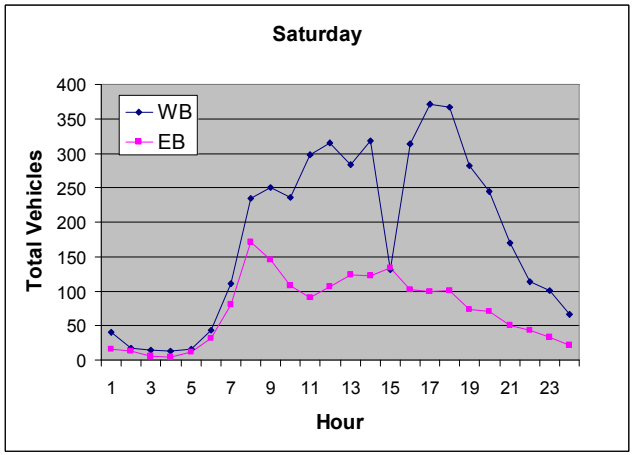


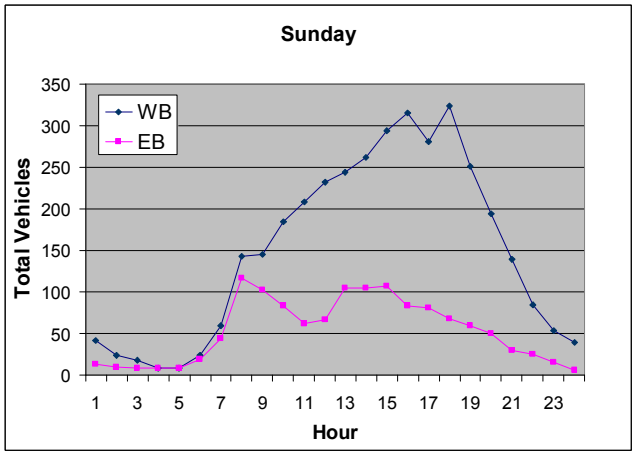
Key points:

- Peak Saturday traffic twice average weekday peak
- Peak Sunday traffic 50% higher than average weekday peak
- Marked AM and PM peaks observed on both Saturday and Sunday
- Flat profile observed throughout average weekday

2.3.13 Site 13 US 158, Just west of Currituck County Airport (average over two weeks)



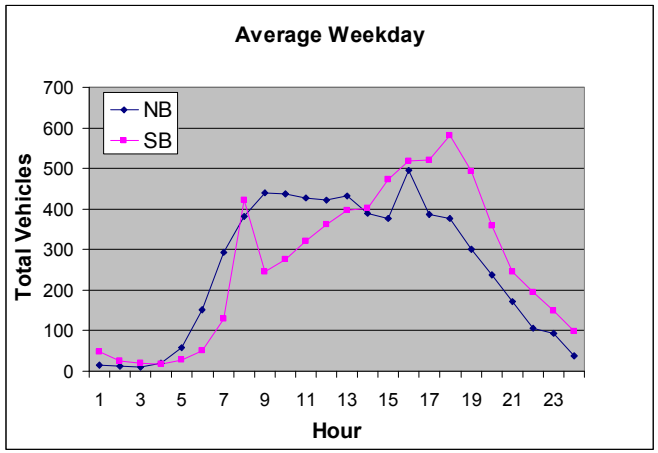


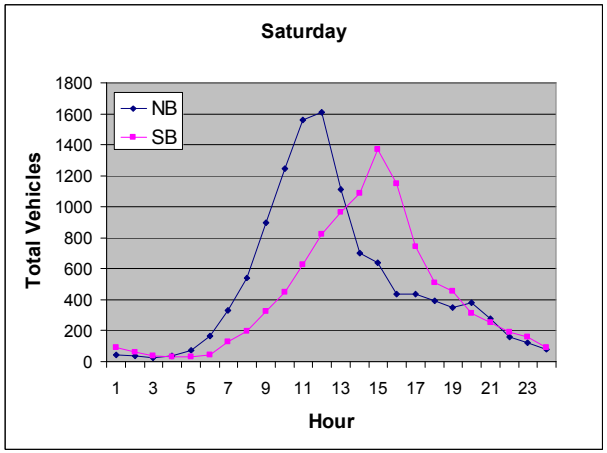


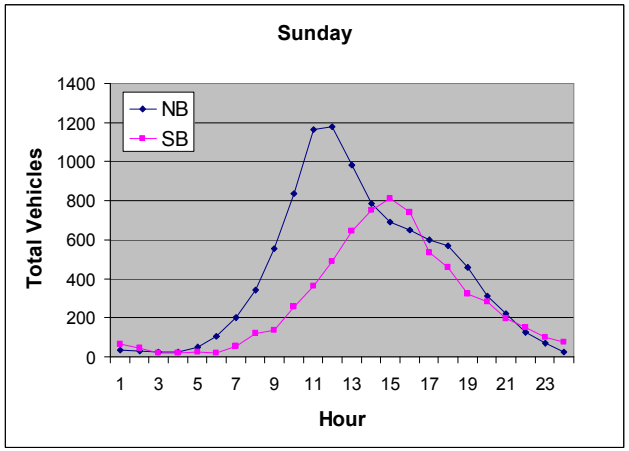
Key points:

- Low volumes compared with alternative Site 14
- Weekday peak periods in AM eastbound and PM westbound
- Peak Saturday traffic 15% lower than average weekday peak
- Peak Sunday traffic volume 27% lower than average weekday peak
- High westbound flow on Saturday and Sunday – inconsistent with eastbound volumes

2.3.14 Site 14 NC 168, North of Currituck, South of Sligo (average over two weeks)







Key points:

- Carries the majority of traffic compared with neighboring Site 13
- Peak Saturday traffic more than double average weekday peak
- Peak Sunday traffic 62% higher than average weekday peak
- Flat profile observed during average weekday
- Northbound peak AM and southbound PM Peak at the weekend

2.4 Comparison with Peak Season Traffic Counts

Table 5 compares the average daily traffic (ADT) observed at each site in the peak and off-peak surveys.

Table 5: Comparison of Peak and Off-Peak ATC Counts

Site	Average Weekday			Saturday			Sunday		
	Peak	Off-Peak	%	Peak	Off-Peak	%	Peak	Off-Peak	%
	ADT	ADT	Difference	ADT	ADT	Difference	ADT	ADT	Difference
1	14,750	5,700	159%	20,240	8,190	147%	14,910	6,350	135%
2	12,400	6,160	101%	18,420	8,860	108%	14,000	7,130	96%
3	19,460	11,490	69%	19,040	14,390	32%	20,550	12,390	66%
4	6,880	5,120	34%	8,440	5,810	45%	6,350	4,580	39%
5	6,720	2,960	127%	8,470	4,110	106%	6,600	3,310	99%
6	1,480	1,410	5%	1,280	1,310	-2%	1,100	1,190	-8%
7	26,890	17,270	56%	26,070	17,430	50%	21,220	13,930	52%
8	28,810	17,660	63%	25,910	17,240	50%	21,100	14,630	44%
9	30,120	29,980	0%	33,170	33,030	0%	28,860	27,110	6%
10	32,390	17,560	84%	37,140	26,630	39%	34,520	21,490	61%
11	22,410	16,230	38%	44,210	25,130	76%	36,200	18,640	94%
12	25,210	13,690	84%	43,830	24,310	80%	33,690	18,900	78%
13	6,490	6,150	6%	15,090	6,100	147%	6,320	4,860	30%
14	19,370	12,450	56%	35,520	21,790	63%	26,160	16,740	56%

All locations with the exception of sites 6 and 9 exhibited considerable growth between the off-peak and peak seasons. The lack of variation and low traffic volumes at site 6 are indicative of this route primarily serving local trips as opposed to those associated with the tourist season. Site 9 is the busiest site on the Outer Banks, and the lack of variation indicates that this route is currently operating at capacity.

3 2009 Off-Peak Turning Movement Counts

Turning movement counts were undertaken at two adjoining intersections:

- NC-12/ Virginia Dare Trail
- US 158/ North Croatan Highway.

The counts were classified between passenger vehicles, trucks, and pedestrians and were undertaken on a Friday, Saturday, Sunday and Monday from 7 am to 7 pm each day.

An initial analysis of the turning movement counts has concentrated upon movements onto North Croatan Highway/Virginia Dare Trail westbound, as these should provide a good estimate of the origins of traffic crossing the Wright Memorial Bridge in the off-peak season. This is summarized in Table 6 for the 12 hour period.

Table 6: Off-Peak Turning Movement Summary

From	To N. Croatan Hwy / Virginia Dare Trail (WB)							
	Friday		Saturday		Sunday		Monday	
Ocean Boulevard (SB)	2,929	23%	4,243	29%	3,172	24%	2,516	20%
Virginia Dare Trail (NB)	1,066	8%	1,236	8%	1,101	8%	943	8%
N. Croatan Hwy (NB)	8,756	69%	9,352	63%	9,091	68%	9,035	72%
Total	12,751	100%	14,831	100%	13,364	100%	12,494	100%

Southbound traffic from Ocean Boulevard is highest on Saturday and Sunday, and constitutes between 20% and 30% of all traffic destined for the Wright Memorial Bridge. 8% of vehicles headed for the bridge travel from NC-12 (Virginia Dare Trail), whilst all remaining traffic, constituting between 63% and 72%, access the intersection from US-158 (North Croatan Highway).

The proportion of trucks is low (between 2 and 5 percent) at both intersections.

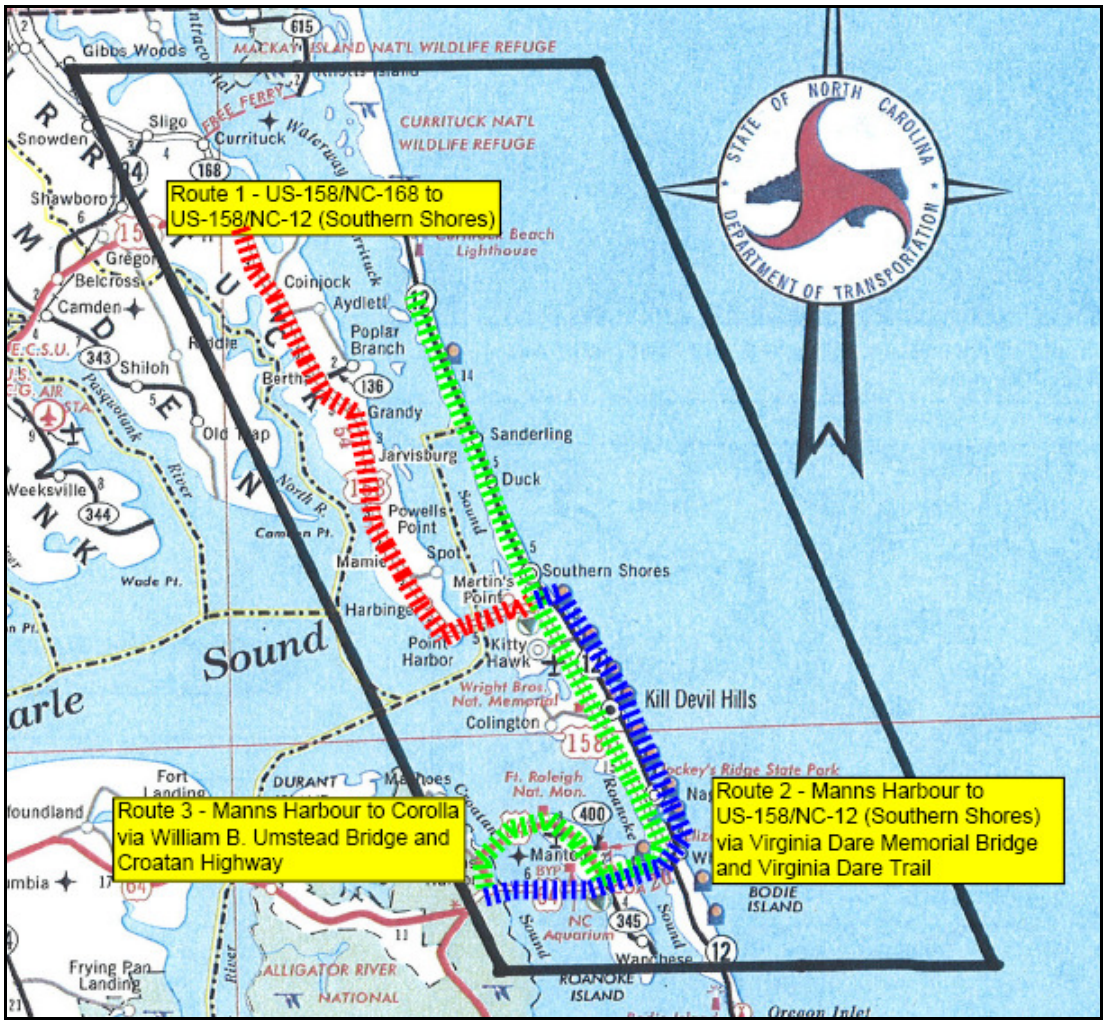
4 2009 Off-Peak Journey Time Survey

4.1 Journey Time Routes

Journey time surveys were undertaken along the following routes as shown in Figure 3.

- Route 1 – US-158/NC-168 to US-158/NC-12 (Southern Shores)
- Route 2 – Manns Harbor to US-158/NC-12 (Southern Shores) via Virginia Dare Memorial Bridge and Virginia Dare Trail
- Route 3 – Manns Harbor to Corolla via William B. Umstead Bridge and Croatan Highway.

Figure 3: Journey Time Routes



During weekdays, surveys were conducted in each direction on each route during each of the following time periods:

a. AM peak - between 8am and 10am;

b. Inter-peak – between 10am and 4pm; and

c. PM peak – between 4pm and 6pm.

During weekends, surveys were conducted in each direction on each route during each of the following time periods:

a. Weekend AM peak - between 9am and 11am;

b. Weekend PM peak – between 3pm and 6pm; and

c. Weekend Inter-peak – between 11am and 3pm.

4.2 Route 1: US-158/NC-168 to US-158/NC-12 (Southern Shores)

Route 1 was surveyed on the weekdays of September 22nd - 29th, and during the weekends of 27th September, and 3rd and 4th October 2009.

The weekday journey time data for Route 1 are summarized in Table 7 and the weekend journey time data for Route 1 are summarized in Table 8.

Table 7: Route 1 Weekday Journey Time Survey Results

Direction	Period	Number of Runs	Minimum (mins)	Maximum (mins)	Average (mins)	Standard Deviation (mins)	Average Speed (mph)
Northbound	0800-1000	3	30	31	31	0.6	57
	1000-1600	3	31	31	31	0.0	56
	1600-1800	3	31	32	31	0.6	56
Southbound	0800-1000	3	32	32	32	0.0	54
	1000-1600	3	31	32	31	0.6	56
	1600-1800	3	25	31	29	3.5	60

Table 8: Route 1 Weekend Journey Times Survey Results

Direction	Period	Number of Runs	Minimum (mins)	Maximum (mins)	Average (mins)	Standard Deviation (mins)	Average Speed (mph)
Northbound	0900-1100	3	30	34	32	2.1	55
	1100-1500	3	30	33	32	1.7	54
	1500-1800	3	30	33	32	1.5	55
Southbound	0900-1100	3	30	32	31	1.0	56
	1100-1500	3	31	34	33	1.5	53
	1500-1800	3	31	31	31	0.0	56

Very little variation was observed in the weekday and weekend journey time surveys on route 1.

4.3 Route 2: Manns Harbor to US-158/NC-12 (Southern Shores) via Virginia Dare Memorial Bridge and Virginia Dare Trail

Route 2 was surveyed on the weekdays of September 23rd to 24th, and September 29th to October 1st, and on the weekends of September 19th - 20th and 26th - 27th, 2009.

The weekday journey time data for Route 2 are summarized in Table 9 and the weekend journey time data for Route 2 are summarized in Table 10.

Table 9: Route 2 Weekday Journey Time Survey Results

Direction	Period	Number of Runs	Minimum (mins)	Maximum (mins)	Average (mins)	Standard Deviation (mins)	Average Speed (mph)
Northbound	0800-1000	3	33	36	35	1.7	43
	1000-1600	3	37	39	38	1.0	39
	1600-1800	3	34	36	35	1.2	43
Southbound	0800-1000	3	35	37	36	1.2	42
	1000-1600	3	35	41	37	3.2	40
	1600-1800	3	35	37	36	1.0	42

Table 10: Route 2 Weekend Journey Time Survey Results

Direction	Period	Number of Runs	Minimum (mins)	Maximum (mins)	Average (mins)	Standard Deviation (mins)	Average Speed (mph)
Northbound	0900-1100	3	37	39	38	1.2	39
	1100-1500	3	40	60	47	11.0	32
	1500-1800	3	37	38	38	0.6	40
Southbound	0900-1100	3	35	37	36	1.0	42
	1100-1500	3	38	44	40	3.2	37
	1500-1800	3	38	41	39	1.5	38

There was comparatively little variation in the journey times on this Route. The northbound and southbound weekend runs between 1100 and 1500 showed some internal variation in comparison with the other time periods.

4.4 Route 3: Manns Harbor to Corolla via William B. Umstead Bridge and Croatan Highway

Route 3 was surveyed on the weekdays of September 24th, September 29th to October 1st, and October 6th - 8th 2009. The weekend surveys were conducted on September 19th - 20th, 26th - 27th and October 3rd, 2009.

The weekday journey time data for Route 3 are summarized in Table 11 and the weekend journey time data for Route 3 are summarized in Table 12.

Table 11: Route 3 Weekday Journey Time Survey Results

Direction	Period	Number of Runs	Minimum (mins)	Maximum (mins)	Average (mins)	Standard Deviation (mins)	Average Speed (mph)
Northbound	0800-1000	3	60	64	62	2.0	46
	1000-1600	3	62	65	63	1.5	45

	1600-1800	3	64	66	65	1.0	44
Southbound	0800-1000	3	60	63	62	1.5	47
	1000-1600	3	62	65	63	1.7	46
	1600-1800	3	61	64	62	1.5	46

Table 12: Route 3 Weekend Journey Time Survey Results

Direction	Period	Number of Runs	Minimum (mins)	Maximum (mins)	Average (mins)	Standard Deviation (mins)	Average Speed (mph)
Northbound	0900-1100	3	63	65	64	1.2	45
	1100-1500	3	65	68	67	1.5	43
	1500-1800	3	64	109	80	25.2	36
Southbound	0900-1100	3	62	67	65	2.5	45
	1100-1500	3	66	66	66	0.0	44
	1500-1800	3	62	66	64	2.1	45

There is little variation in both the weekday and weekend journey times on Route 3. The one exception is the northbound weekend surveys between 1500 and 1800, where one survey was subjected to a 40 minute delay following a road traffic accident en-route.

4.5 Supplemental Route 4 – US-158/NC-168 to Corolla

Data from the survey logs provided by Arcadis indicate that journey times on Route 3 between the intersection of US-158 / NC-12 at Southern Shores to Mann's Harbor via William B. Umstead Bridge approximated 38 minutes regardless of time of day, season or direction. Using this information, journey times between US-158/NC-168 and Corolla have been calculated by combining the southbound Route 1 data with the northbound Route 3 data (and vice versa), to create supplemental Route 4.

These journey times have been calculated using data collected on the following dates:

- Weekdays: September 22nd to October 1st, October 6th – 8th 2009
- Weekends: September 19th – 20th, 26th-27th, and October 3rd – 4th 2009

Table 13: Supplemental Route 4 Weekday Journey Time Survey Results

Direction	Period	Number of Runs	Minimum (mins)	Maximum (mins)	Average (mins)	Standard Deviation (mins)	Average Speed (mph)
Northbound	0900-1100	3	54	58	56	2.0	54
	1100-1500	3	55	58	57	1.5	54
	1500-1800	3	53	58	56	2.6	54
Southbound	0900-1100	3	53	55	54	1.2	56
	1100-1500	3	55	58	56	1.7	54
	1500-1800	3	54	57	56	1.5	55

Table 14: Supplemental Route 4 Weekday Journey Time Survey Results

Direction	Period	Number of Runs	Minimum (mins)	Maximum (mins)	Average (mins)	Standard Deviation (mins)	Average Speed (mph)
Northbound	0900-1100	3	57	58	57	0.6	53
	1100-1500	3	60	63	61	1.5	50
	1500-1800	3	57	102	73	25.2	42
Southbound	0900-1100	3	54	61	58	3.8	52
	1100-1500	3	58	61	60	1.7	51
	1500-1800	3	54	60	58	3.5	52

There is little variation between the weekend and weekday journey times with the exception of the northbound PM weekend surveys. Heading towards Corolla from US-158/NC-168, the average journey time in the weekend PM peak is approximately 40 minutes greater than that observed throughout the rest of the day. There is little other variation observed within the rest of the data.

4.6 Comparisons with Peak Season Journey Time Surveys

Table 15, Table 16 and Table 17 compare the peak and off-peak journey time survey results. It is widely observed that the peak season journey times are greater than those observed in the off-peak season, primarily due to the additional volume of traffic associated with the peak tourism season.

Route 1 showed the least variation between the two seasons, with the weekday journey times broadly comparable between the peak and off-peak surveys. The weekend surveys, especially in the southbound PM peak, however, show considerable delays in the peak season when compared to the off-peak. This corresponds to southbound vacation traffic accessing the Outer Banks via US-158.

Routes 2 and 3 show additional delays throughout the peak season, and this is most pronounced on route 3. Route 3 includes NC-12 to Corolla, a heavily trafficked single lane highway which provides access to the northern Outer Banks. The peak and off-peak traffic count comparisons highlight this section of highway has much higher traffic levels during the peak season, which translated into additional delay on this route. This is associated with vacation traffic during the peak season.

Supplemental Route 4 shows considerable delays during the peak season in comparison to the off-peak. This can be attributed to vacation traffic, especially during the weekend where all surveys are between 13 and 132% higher in the peak season.

Table 15: Peak and Off-Peak Journey Time Comparisons – Route 1

Route / Day		Average Journey Time		
Route 1 - Weekday		Peak	Off-Peak	% Difference
Northbound	0800-1000	31	31	-0.5%
	1000-1600	33	31	6.0%
	1600-1800	30	31	-4.3%
Southbound	0800-1000	31	32	-2.1%
	1000-1600	32	31	2.1%
	1600-1800	32	29	11.5%
Route 1 - Weekend		Peak	Off-Peak	% Difference
Northbound	0900-1100	32	32	0.5%
	1100-1500	31	32	-1.8%
	1500-1800	33	32	5.3%
Southbound	0900-1100	35	31	12.5%
	1100-1500	33	33	2.0%
	1500-1800	76	31	144.2%

Table 16: Peak and Off-Peak Journey Time Comparisons – Route 2

Route 2 - Weekday		Peak	Off-Peak	% Difference
Northbound	0800-1000	37	35	6.7%
	1000-1600	42	38	9.4%
	1600-1800	43	35	23.6%
Southbound	0800-1000	38	36	6.5%
	1000-1600	40	37	7.7%
	1600-1800	44	36	22.7%
Route 2 - Weekend		Peak	Off-Peak	% Difference
Northbound	0900-1100	40	38	5.2%
	1100-1500	43	47	-9.9%
	1500-1800	41	38	9.3%
Southbound	0900-1100	42	36	16.7%
	1100-1500	42	40	3.7%
	1500-1800	40	39	2.1%

Table 17: Peak and Off-Peak Journey Time Comparisons – Route 3

Route 3 - Weekday		Peak	Off-Peak	% Difference
Northbound	0800-1000	70	62	13.4%
	1000-1600	75	63	17.9%
	1600-1800	72	65	11.3%
Southbound	0800-1000	67	62	7.8%
	1000-1600	73	63	15.3%
	1600-1800	76	62	22.2%
Route 3 - Weekend		Peak	Off-Peak	% Difference
Northbound	0900-1100	81	64	26.4%
	1100-1500	86	67	29.3%
	1500-1800	102	80	27.5%
Southbound	0900-1100	88	65	35.6%
	1100-1500	75	66	13.1%
	1500-1800	74	64	15.5%

Table 18: Peak and Off-Peak Journey Time Comparisons – Supplemental Route 4

Route 4 - Weekday		Peak	Off-Peak	% Difference
Northbound	0800-1000	64	56	13.7%
	1000-1600	69	57	21.2%
	1600-1800	67	56	19.0%
Southbound	0800-1000	59	54	8.6%
	1000-1600	67	56	19.9%
	1600-1800	68	56	22.5%
Route 4 - Weekend		Peak	Off-Peak	% Difference
Northbound	0900-1100	78	57	35.2%
	1100-1500	82	61	32.9%
	1500-1800	170	73	132.2%
Southbound	0900-1100	82	58	39.7%
	1100-1500	68	60	13.1%
	1500-1800	70	58	20.1%

4.1 Journey Time Matrices

Journey time matrices have been constructed using the survey data outlined above. These are detailed below in Table 19 to Table 24. The matrices are color-coded, highlighting those observed journey times (Routes 1 to 3), and those calculated based on the Arcadis journey time logs (Supplemental Route 4 and others).

Table 19: Weekday AM Peak Journey Time Matrix

Average Journey Time (Minutes) – Weekday AM	From / To	US-158/NC-168	US-158/NC-12 (Southern Shores)	Mann's Harbor (via William B. Umstead Bridge & US-158)	Mann's Harbor (via Virginia Dare Memorial Bridge & Virginia Dare Trail)	Corolla
Route 1	**US-158/NC-168**	-	32	70	-	56
Route 2	**US-158/NC-12 (Southern Shores)**	31	-	38	36	24
Route 3	**Mann's Harbor (via William B. Umstead Bridge & US-158)**	69	38	-	-	62
Route 4	**Mann's Harbor (via Virginia Dare Memorial Bridge & Virginia Dare Trail)**	-	35	-	-	-
Calculated using Journey Time Survey Logs	**Corolla**	54	24	62	-	-

Table 20: Weekday Inter Peak Journey Time Matrix

Average Journey Time (Minutes) – Weekday Inter Peak	From / To	US-158/NC-168	US-158/NC-12 (Southern Shores)	Mann's Harbor (via William B. Umstead Bridge & US-158)	Mann's Harbor (via Virginia Dare Memorial Bridge & Virginia Dare Trail)	Corolla
Route 1	**US-158/NC-168**	-	31	69	-	57
Route 2	**US-158/NC-12 (Southern Shores)**	31	-	38	37	25
Route 3	**Mann's Harbor (via William B. Umstead Bridge & US-158)**	69	38	-	-	63
Route 4	**Mann's Harbor (via Virginia Dare Memorial Bridge & Virginia Dare Trail)**	-	38	-	-	-
Calculated using Journey Time Survey Logs	**Corolla**	56	25	63	-	-

Table 21: Weekday PM Peak Journey Time Matrix

Average Journey Time (Minutes) – Weekday PM Peak	From / To	US-158/NC-168	US-158/NC-12 (Southern Shores)	Mann's Harbor (via William B. Umstead Bridge & US-158)	Mann's Harbor (via Virginia Dare Memorial Bridge & Virginia Dare Trail)	Corolla
Route 1	**US-158/NC-168**	-	29	67	-	56
Route 2	**US-158/NC-12 (Southern Shores)**	31	-	38	36	27
Route 3	**Mann's Harbor (via William B. Umstead Bridge & US-158)**	69	38	-	-	65
Route 4	**Mann's Harbor (via Virginia Dare Memorial Bridge & Virginia Dare Trail)**	-	35	-	-	-
Calculated using Journey Time Survey Logs	**Corolla**	56	24	62	-	-

Table 22: Weekend AM Peak Journey Time Matrix

Average Journey Time (Minutes) – Weekend AM Peak	From / To	US-158/NC-168	US-158/NC-12 (Southern Shores)	Mann's Harbor (via William B. Umstead Bridge & US-158)	Mann's Harbor (via Virginia Dare Memorial Bridge & Virginia Dare Trail)	Corolla
Route 1	US-158/NC-168	-	31	69	-	57
Route 2	US-158/NC-12 (Southern Shores)	32	-	38	36	26
Route 3	Mann's Harbor (via William B. Umstead Bridge & US-158)	70	38	-	-	64
Route 4	Mann's Harbor (via Virginia Dare Memorial Bridge & Virginia Dare Trail)	-	38	-	-	-

Calculated using Journey Time Survey Logs	**Corolla**	58	**27**	65	**-**	**-**

Table 23: Weekend Inter Peak Journey Time Matrix

Average Journey Time (Minutes) – Weekend Inter Peak	**From / To**	**US-158/NC-168**	**US-158/NC-12 (Southern Shores)**	**Mann's Harbor (via William B. Umstead Bridge & US-158)**	**Mann's Harbor (via Virginia Dare Memorial Bridge & Virginia Dare Trail)**	**Corolla**
Route 1	**US-158/NC-168**	**-**	33	**71**	**-**	61
Route 2	**US-158/NC-12 (Southern Shores)**	32	**-**	**38**	40	**29**
Route 3	**Mann's Harbor (via William B. Umstead Bridge & US-158)**	**70**	**38**	**-**	**-**	67

Route 4	**Mann's Harbor (via Virginia Dare Memorial Bridge & Virginia Dare Trail)**	-	47	-	-	-
Calculated using Journey Time Survey Logs	**Corolla**	60	**28**	66	-	-

Table 24: Weekend PM Peak Journey Time Matrix

Average Journey Time (Minutes) – Weekend Inter Peak	**From / To**	**US-158/NC-168**	**US-158/NC-12 (Southern Shores)**	**Mann's Harbor (via William B. Umstead Bridge & US-158)**	**Mann's Harbor (via Virginia Dare Memorial Bridge & Virginia Dare Trail)**	**Corolla**
Route 1	**US-158/NC-168**	-	31	**69**	-	73
Route 2	**US-158/NC-12 (Southern Shores)**	32	-	**38**	39	**42**

Route 3	**Mann's Harbor (via William B. Umstead Bridge & US-158)**	**70**	**38**	**-**	**-**	**80**
Route 4	**Mann's Harbor (via Virginia Dare Memorial Bridge & Virginia Dare Trail)**	**-**	**38**	**-**	**-**	**-**
Calculated using Journey Time Survey Logs	**Corolla**	**58**	**26**	**64**	**-**	**-**

5 Comparison with 2006 Traffic Count Data

5.1 Introduction

A number of the 2009 count locations correspond with those used in the WSA 2006 Preliminary Traffic and Revenue Study. Where this is the case, a comparison has been undertaken between the 2006 and 2009 data, to check consistency and to examine traffic growth in recent years. The sites for which comparison was possible are:

- Site 1 WSA 13
- Site 2 WSA 10
- Site 3 WSA 9
- Site 4 WSA 5
- Site 9 WSA 4
- Site 12 WSA 1

The comparison for the average weekday traffic by site is shown in Table 25 whilst the comparison for Saturday traffic by site is shown in Table 26. Table 27 shows the comparison for Sunday traffic by site.

Table 25: Average weekday traffic Comparison with 2006 data

Weekday	2009	2006	Percentage	Average
Site	Vehicles	Vehicles	Difference	Annual Change
1	5,700	7,368	-23%	-8.2%
2	6,165	9,203	-33%	-12.5%
3	11,492	11,502	0%	0.0%
4	5,123	4,520	13%	4.3%
9	29,980	33,153	-10%	-3.3%
12	13,687	17,055	-20%	-7.1%
Total	72,146	82,799	-13%	-4.5%

Table 26: Saturday traffic Comparison with 2006 data

Saturday	2009	2006	Percentage	Average
Site	Vehicles	Vehicles	Difference	Annual Change
1	8,193	8,789	-7%	-2.3%
2	8,860	11,351	-22%	-7.9%
3	14,389	13,584	6%	1.9%
4	5,812	5,016	16%	5.0%
9	33,026	34,146	-3%	-1.1%
12	24,313	23,396	4%	1.3%
Total	94,591	96,282	-2%	-0.6%

Table 27: Sunday traffic Comparison with 2006 data

Sunday	2009	2006	Percentage	Average
Site	Vehicles	Vehicles	Difference	Annual Change
1	6,351	6,600	-4%	-1.3%
2	7,134	9,023	-21%	-7.5%
3	12,390	11,237	10%	3.3%
4	4,577	3,909	17%	5.4%
9	27,108	27,422	-1%	-0.4%
12	18,899	21,542	-12%	-4.3%
Total	76,458	79,733	-4%	-1.4%

In all cases, the new counts are broadly consistent with those undertaken for the 2006 study. The new counts were undertaken for 14 days and the 2006 counts for 7 days and, whilst the survey periods and locations did not necessarily correspond exactly between years, they were deemed similar enough for comparison.

There is evidence of traffic reductions on weekdays, while Saturdays and Sunday counts show a broadly consistent traffic total overall. The weekday reductions are most pronounced in the northern Outer Banks (sites 1 and 2), and on US-158 (site 12). It is not possible to comment on the nature of this reduction given the degree of variation expected within the two sets of count data.

6 Wright Memorial Bridge Traffic Data

6.1 Introduction

The pattern of off-peak season traffic flows on the Wright Memorial Bridge has been analyzed using data from North Carolina Department of Transport (NCDoT) Automatic Traffic Recorder Station A2703 located on US 158 east of the bridge.

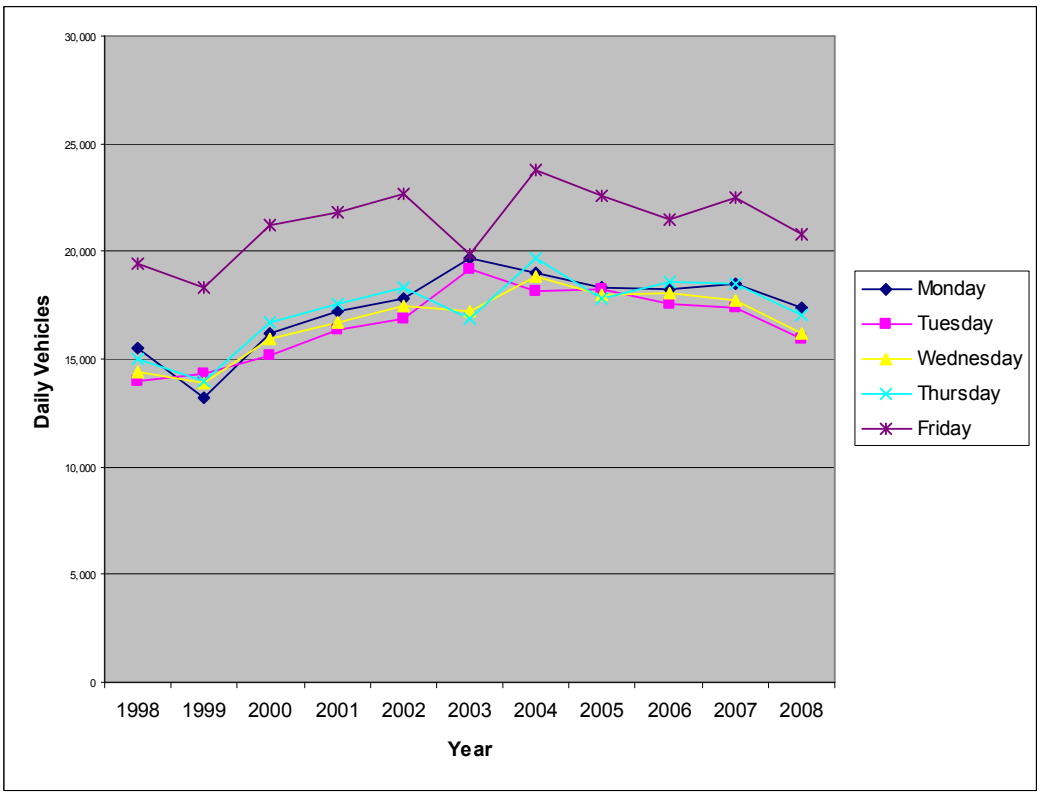
Traffic data are available from 1998 to August 2009. The off-peak season analysis was therefore based upon September and October counts for 1998 to 2008. Additionally, an analysis of daily traffic flow profiles was undertaken using the 2008 data.

6.2 Historical Data 1998 to 2008

September and October weekday traffic across the Wright Memorial Bridge for the period 1998 to 2008 is shown graphically in Figure 4. Weekday traffic over the period has grown by 9%, an average rate of 0.9% per annum, although traffic peaked in 2004 and has since reduced slightly. This has been driven by a 13% growth in Monday to Thursday traffic. Friday traffic has increased by 7% over the same period. This growth primarily occurred between 1998 and 2004, with a decline in traffic volumes in subsequent years.

Friday traffic averaged around 30% higher than Monday-Thursday traffic between 1998 and 2002. Between 2004 and 2008, this proportion decreased to 25%. Counts between Monday and Thursday are consistent throughout the period of analysis.

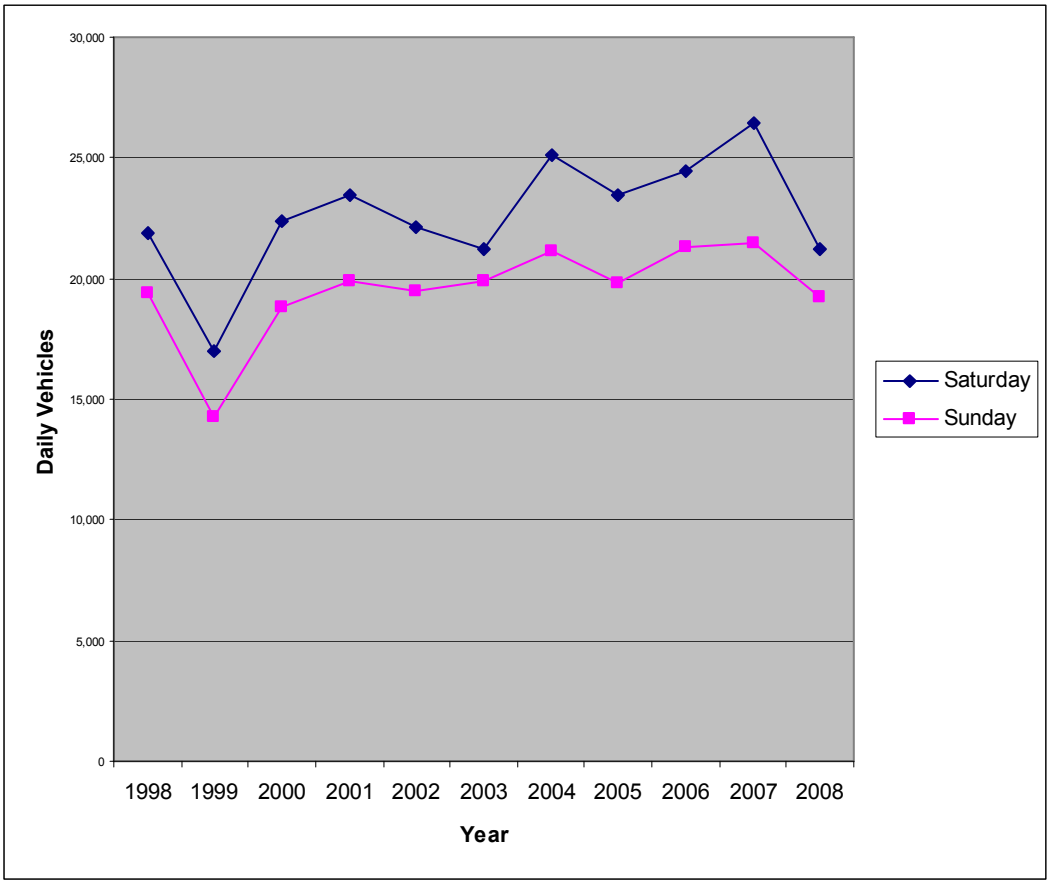
Figure 4: Wright Memorial Bridge September / October Weekday Traffic 1998-2008



September and October weekend traffic across the Wright Memorial Bridge for the period 1998 to 2008 is shown graphically in Figure 5. Saturday traffic over the period has declined by 3%, although the decline has not been consistent. Considerable growth was observed between 1999 and 2001, and again between 2003 and 2007. 2008 volumes have declined by 20% compared to 2007. Sunday traffic has followed a similar pattern, although the fluctuations have not been as pronounced. 2008 volumes are 1% lower than observed in

1998. Saturday traffic volumes have varied between 7% and 19% higher than Sunday levels.

Figure 5: Wright Memorial Bridge September / October Weekend Traffic 1998-2008



6.3 Annual Flow Profile

The annual flow profile for the Wright Memorial Bridge has been analyzed using 2008 data. The average weekday and weekend flows are shown in Table 28 and graphically in Figure 6.

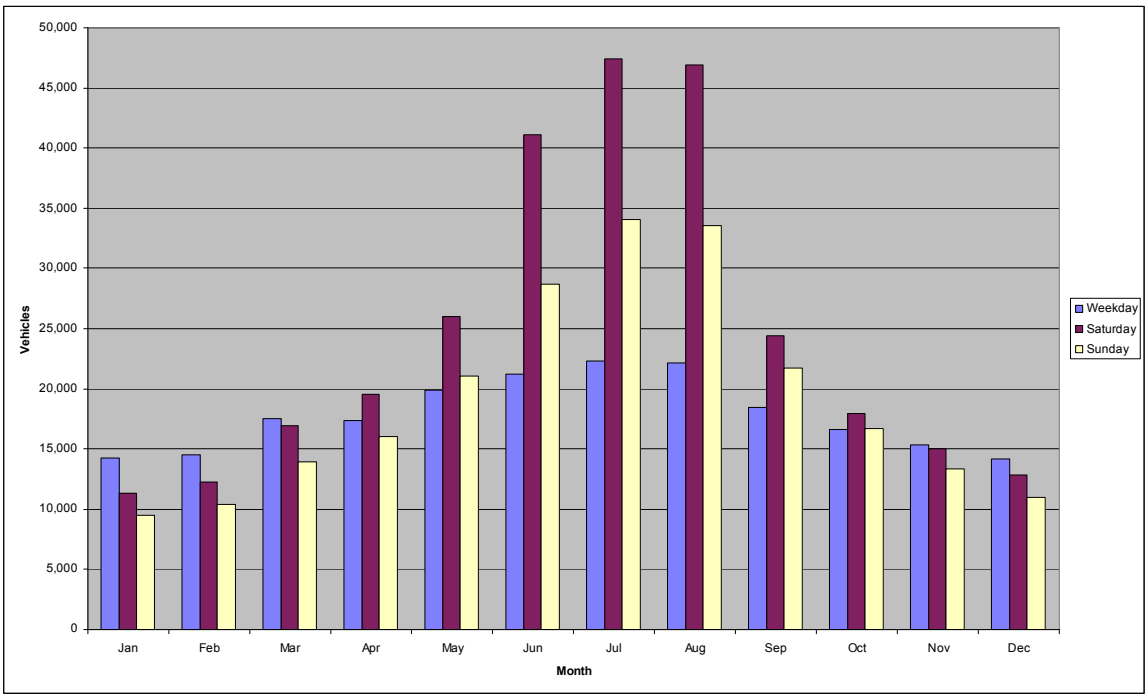
During September, weekday traffic was around 4% higher than the annual average weekday. Saturday traffic was almost equal to the annual average Saturday and Sunday traffic was around 13% higher than the annual average Sunday. October weekday volumes were 7% lower than the annual average weekday, while Saturday and Sunday volumes were 26% and 13% lower respectively.

Table 28: Wright Memorial Bridge 2008 Average Traffic Flows

Month	Weekday	Saturday	Sunday
Jan	14,246	11,331	9,483
Feb	14,487	12,224	10,369
Mar	17,534	16,941	13,901
Apr	17,403	19,544	16,065
May	19,864	25,982	21,028
Jun	21,255	41,123	28,704
Jul	22,341	47,441	34,093
Aug	22,162	46,902	33,526
Sep	18,481	24,444	21,746

Oct	16,580	17,968	16,666
Nov	15,392	15,043	13,377
Dec	14,165	12,823	10,963
Total	17,826	24,314	19,160

Figure 6: Wright Memorial Bridge 2008 Average Traffic Flows



6.4 Daily Flow Profile

Using the latest available off-peak season traffic data for the Wright Memorial Bridge (September / October 2008) the daily flow profiles have been examined.

The weekday daily profile is shown in Figure 7 (westbound) and Figure 8 (eastbound). Tuesday to Thursday profiles are very similar in the westbound direction, with a marked PM peak. Monday and Friday have higher traffic volumes (18% and 40% more vehicles per day respectively), and on Friday the PM peak is observed several hours earlier. In the eastbound direction, a marked AM peak is observed throughout the week. Monday to Thursday have a fairly flat profile for the remainder of the day, whilst a PM peak is observed on Fridays.

For an average weekday in September and October 2008, the peak westbound flow of 806 vehicles occurs between 1600 and 1700 and the peak eastbound flow of 739 vehicles occurs between 0800 and 0900.

Figure 7: Wright Memorial Bridge September / October Average, 2008 Weekday Traffic Profile - Westbound

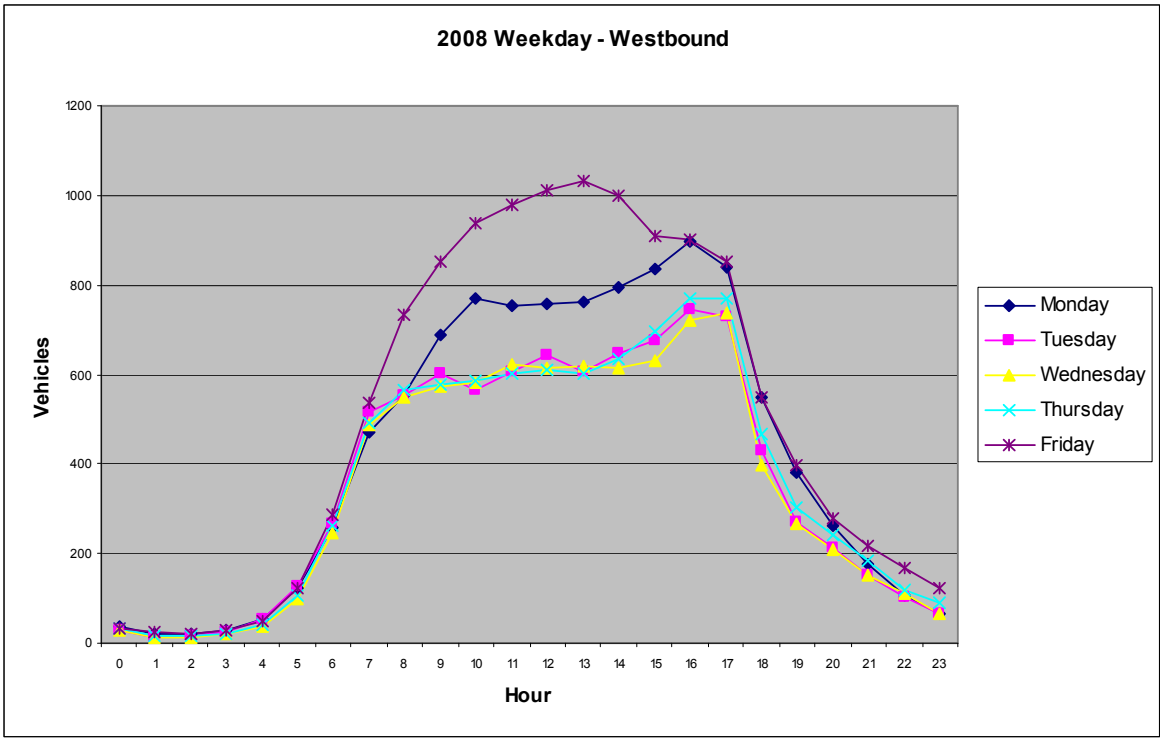
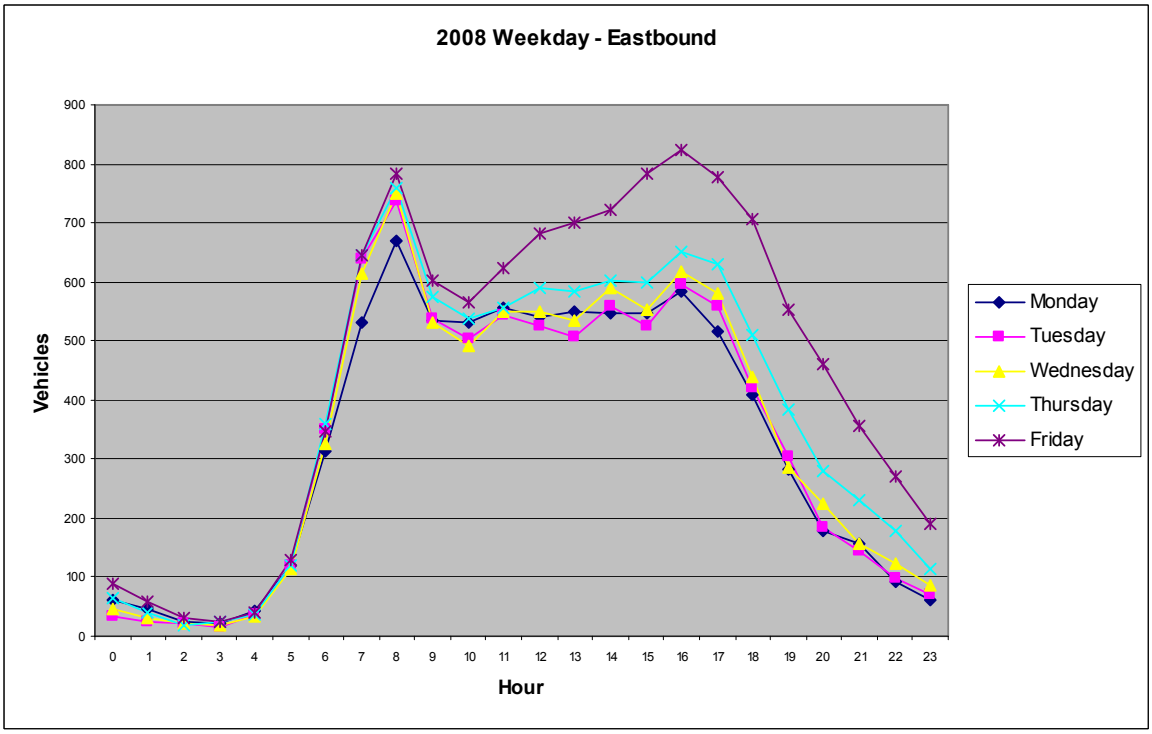


Figure 8: Wright Memorial Bridge September / October Average, 2008 Weekday Traffic Profile - Eastbound



The westbound weekend daily profile is shown in Figure 9, while the eastbound profiles are shown in Figure 10. The westbound direction shows a marked AM peak on both Saturday and Sunday. The average peak westbound volume on Saturday was 1,461 between 1000 and 1100 and the peak westbound volume on Sunday was 1,349 between 1000 and 1100. Traffic volumes in the PM are higher on Sunday than Saturday, although the profile is flat on both days following the AM Peak.

The profile is reversed in the eastbound direction, with lower morning traffic volumes and correspondingly more traffic in the afternoon and evening. Saturday volumes are again higher than on Sunday. The average peak eastbound volume on Saturday was 1,579 between 1500 and 1600 and the peak eastbound volume on Sunday was 1,141 between 1500 and 1600.

Figure 9: Wright Memorial Bridge September / October Average, 2008 Weekend Traffic Profile - Westbound

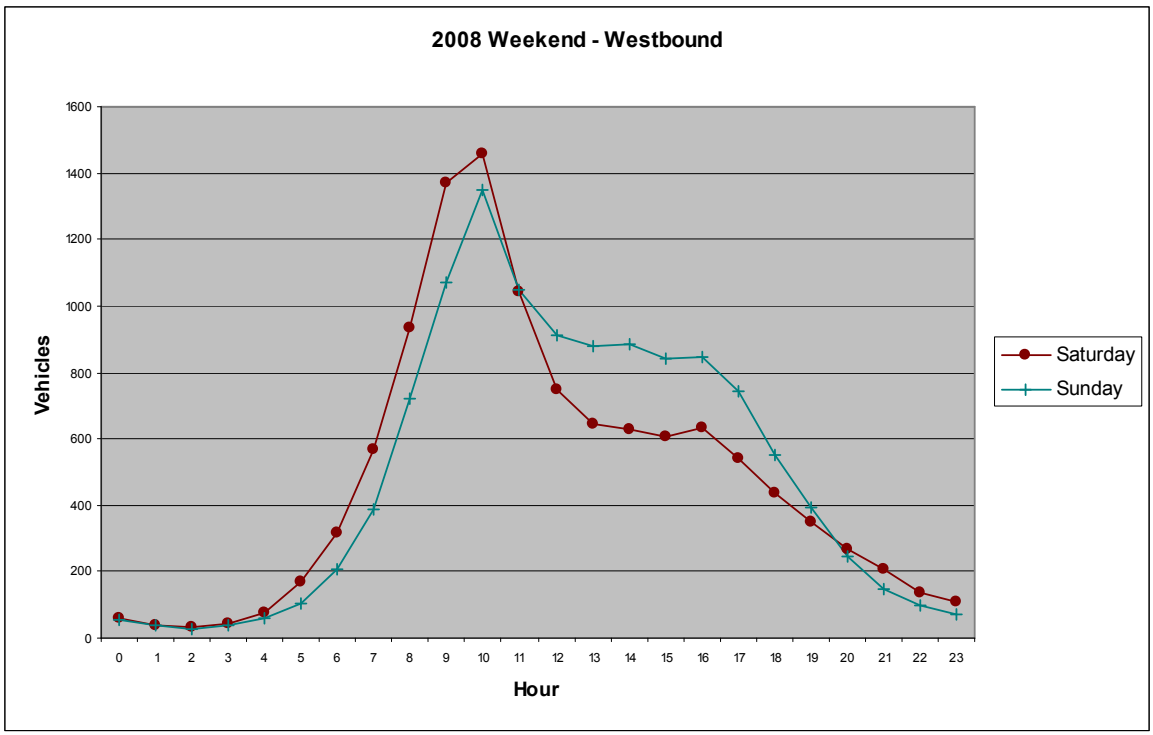
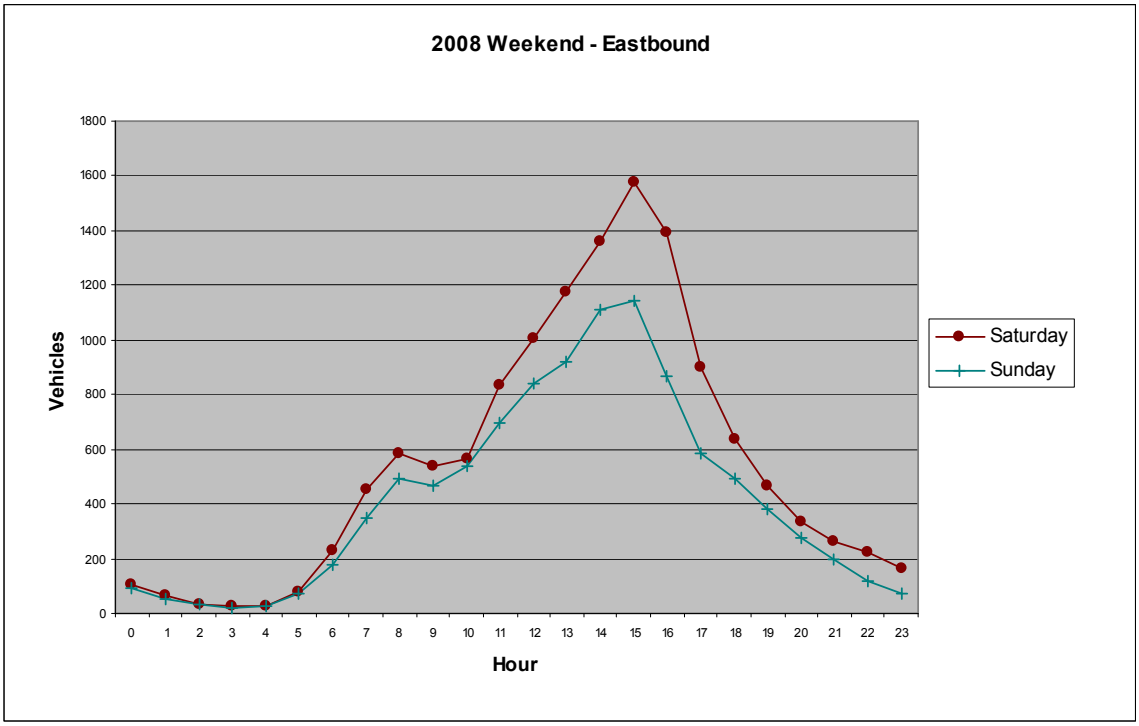


Figure 10: Wright Memorial Bridge September / October Average, 2008 Weekend Traffic Profile - Eastbound



Appendix G

Willingness to Pay Survey Report

NORTH CAROLINA TURNPIKE AUTHORITY

MID-CURRITUCK BRIDGE
STATED PREFERENCE SURVEY

FINAL REPORT

January 2010

NuStats

206 Wild Basin Rd., Building A, Suite 300 ▪ Austin, Texas 78746
(512) 306-9065 ▪ fax (512) 306-9077 ▪ *www.nustats.com*

Contact: Chris Simek, *Project Manager*

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EXECUTIVE SUMMARY

In the Summer of 2009, NuStats, under subcontract to ARUP, on behalf of CDG and the North Carolina Turnpike Authority (NCTA), conducted a survey of visitors and residents to the Outer Banks region of North Carolina identified as potential users of a planned toll bridge that will connect the Outer Banks (NC-12) to the North Carolina mainland (US-158) in Currituck County. More specifically, the survey of visitors and local residents was designed to measure sensitivity to tolling and travel time changes in the study area, in relation to the proposed facility.

In order to maximize the likelihood of collecting travel behavior information from these two unique respondent types, different methods of data collection were used for each. Hand-held PDAs were used to conduct intercept interviews as the primary means of data collection with regional visitors, while a web survey was the primary means of data collection for regional residents. Despite two different data collection methodologies, the same base instrument was used for both visitors and residents.[1] This facilitated the combination of both data sets into one overall database that was used as the foundation for the Value of Time (VOT) and willingness to pay analysis.

The base instrument was designed collaboratively between all members of the project team and contained four specific modules: screening questions, reference trip questions, stated preference trade off questions, and demographic questions. A team of trained interviewers was used to conduct the visitor intercepts at several popular visitor locations in the Outer Banks region from August 13 to September 2, 2009. A total of 1,383 visitor questionnaires were completed. The web survey was administered with the help of local Chambers of Commerce, who agreed to send an explanatory e-mail to several hundred local establishments on their chamber list serves. These establishments, in turn, sent the e-mail to their employees, who then completed the on-line survey. A total of 750 regional residents completed the web survey.

The analysis provides important insights into the factors that affect the decision of residents and visitors to use the proposed tolled Mid-Currituck Bridge in the Outer Banks versus the existing untolled Wright Memorial Bridge. In addition, the findings provide reliable estimates of the behavioral VOT by trip purpose and household income bands. VOT ranged from a low of $7.12/hour (by households reporting an annual household income of less than $50k for the "commute" trip purpose) to a high of $17.63/hour (by households reporting an annual household income of greater than or equal to $150k for the "vacation" trip purpose). Furthermore, the findings provide reliable estimates of a toll road constant significant to represent improved journey quality, increased reliability, etc., in comparison to the existing untolled facility, and estimates of a penalty constant for stop/start conditions on the existing highway network.

[1] Some resident surveys were conducted via PDA intercept during the visitor field collection. Likewise, some visitor survey were conducted via the web.

DOCUMENTATION OF METHODS

The following is technical documentation of the methods used to conduct the Mid-Currituck Bridge Stated Preference (SP) Survey for ARUP, on behalf of the North Carolina Turnpike Authority (NCTA).

STUDY PURPOSE

The purpose of the study was to collect travel behavior data from potential users of a planned toll bridge that will connect the Outer Banks (NC-12) to the North Carolina mainland (US-158) in Currituck County. More specifically, the survey of visitors and local residents was designed to measure sensitivity to tolling and travel time changes in the study area, in relation to the proposed facility.

SURVEY POPULATION

The survey population consisted of two unique respondent types: (1) local residents of Camden, Currituck, Dare, and Pasquotank Counties, NC, who live and work in the area, and (2) visitors, who were defined as "all other respondents who are not permanent residents" of the aforementioned counties. Both of these groups represent potential users of the tolled facility.

The study area included Currituck County, including the northern communities of North Carolina's Outer Banks, and Dare County.

SAMPLE SIZES, TARGETS, AND QUOTAS

Tables 1 and 2 below identify the sample targets that were initially established for the study. Key stratification variables include trip purpose, annual household income, and respondent type.

TABLE 1: INITIAL SAMPLE TARGETS – INCOME BAND BY TRIP PURPOSE

TRIP PURPOSE	INCOME BAND				TOTAL
	INCOME BAND 1	INCOME BAND 2	INCOME BAND 3	INCOME BAND 4	
Business	100	100	100	100	400
Commute	100	100	100	100	400
Vacation	100	100	100	100	400
Other	100	100	100	100	400
Total	400	400	400	400	1600

TABLE 2: INITIAL SAMPLE TARGETS – INCOME BAND BY RESPONDENT TYPE

RESPONDENT TYPE	INCOME BAND				TOTAL
	INCOME BAND 1	INCOME BAND 2	INCOME BAND 3	INCOME BAND 4	
Resident	200	200	200	200	800
Visitor	200	200	200	200	800
Total	400	400	400	400	1600

In order to maximize efficiency of data collection, ARUP and NuStats agreed that specific income bands would not be established until a substantial number of cases were collected, providing a robust sample size for an exploratory analysis. The final sample distributions for both visitors and residents are presented in Tables 3 and 4.

TABLE 3: FINAL VISITOR SAMPLE DISTRIBUTION – INCOME BAND BY TRIP PURPOSE

TRIP PURPOSE	INCOME BAND				TOTAL
	LESS THAN $50K	$50K TO LESS THAN $100K	$100K TO LESS THAN $150K	$150K AND GREATER	
Business	9	9	4	7	29
Commute	2	0	2	0	4
Vacation	199	402	267	431	1,299
Other	14	10	15	12	51
Total	224	421	288	450	1,383

TABLE 4: FINAL RESIDENT SAMPLE DISTRIBUTION – INCOME BAND BY TRIP PURPOSE

TRIP PURPOSE	INCOME BAND				TOTAL
	LESS THAN $75K	$75K TO LESS THAN $100K	$100K TO LESS THAN $150K	$150K AND GREATER	
Business	88	40	37	33	198
Commute	62	18	17	15	112
Vacation	27	33	29	51	140
Other	129	73	65	33	300
Total	306	164	148	132	750

The reader will note slight differences in the income bands established for visitors and residents. This is the result of a slightly different annual household income distribution encountered for each unique respondent type. See Table 5 below for the final distribution of all surveyed respondents by respondent type and method of data collection.

It should also be noted that the final model used to estimate Value of Time (VOT) and willingness to pay aggregated both residential and visitor responses. As such, the income bands that were used in the final model are different from the income bands established for sampling purposes.[2]

[2] The income bands used for modeling purposes were as follows: $50K to less than $100K, $100K to less than $150K, and $150K or more.

TABLE 5: FINAL OVERALL SAMPLE DISTRIBUTION – RESPONDENT TYPE BY METHOD OF DATA COLLECTION

RESPONDENT TYPE	METHOD OF DATA COLLECTION		TOTAL
	INTERCEPT	WEB	
Visitor	1,125	358	1,383
Resident	130	620	750
Total	1,255	878	2,133

SAMPLING

The following section describes the sampling methodology implemented to facilitate the efficient collection of data from the two survey populations of interest—visitors and residents. It should be noted that, even though two different sampling methods were implemented (as well as two different data collection methods), only one survey was conducted overall. As such, the final visitor and resident data sets could be combined for a definitive analysis to identify both VOT and willingness to pay.

VISITOR SAMPLING

Early in the project, a decision was made to implement an intercept survey methodology as the most efficient means of data collection for the visitor population. Prior to data collection, NuStats, CDG, ARUP, and NCTA collaborated on a list of potential intercept locations in the survey area. Shortly after this list was finalized, a NuStats field coordinator traveled to the survey area and conducted field assessments of each location. The goals of the field assessment included the following:

- Identify a site contact,
- Provide survey-specific details to the site contact (including a project letter signed by NCTA personnel),
- Secure permission to conduct intercept interviewing at the site,
- Conduct a site assessment of facility to identify the best intercept locations,
- Provide a project schedule to the site contact,
- Provide NuStats and NCTA contact information to facility personnel, and
- Answer any questions the site contact might have at the time of the field assessment.

The field assessments were conducted from July 19–22, 2009. During this time, approximately 20 facilities were visited. Those facilities that either (1) were not visited or (2) were visited but the appropriate personnel were not present were contacted via telephone shortly after the field assessments were completed. See Appendix C for a table of all facilities initially identified as potential intercept sites. In addition to facility name and location, the list also contains primary site type (visitor or residential[3]), details gleaned during the site assessment, and if intercepts were ultimately conducted at each facility.

See Appendix D for a copy of the letter provided to each establishment during the field assessment.

[3] Although the field data collection primarily targeted visitors, it was assumed that some residents would be encountered in the field. As such, the field instrument was designed to capture the responses of both residents and visitors.

RESIDENTIAL SAMPLING

At the onset of the project, a decision was made to employ a multi-modal data collection methodology for residents, including a web survey as the primary means of data collection, supplemented by intercept, and, if need be, a random digit dial (RDD) computer assisted telephone interview (CATI) survey. The sampling for each of these modes is discussed below.

Intercept

Although the field data collection primarily targeted visitors, it was assumed that some residents would be encountered in the field. As such, the field instrument (described in detail below) was designed to capture the responses of both residents and visitors. During the field data collection, approximately 130 residents completed the survey (in addition to the 1,125 visitors who also participated).

Web

Sampling for the web survey was made possible through a close collaboration with Chambers of Commerce in the survey area. Prior to going live with the web survey, the NuStats project manager contacted representatives of the Outer Banks Chamber of Commerce, the Elizabeth City Chamber of Commerce, and the Currituck Chamber of Commerce. After a personal and project-specific introduction, each Chamber was asked if they would provide assistance by sending (1) a brief e-mail describing the survey effort and (2) a link to the web survey to the establishments on their internet list serves, who, in turn, would then distribute the letter and link to their employees for self-administration (see Appendix E for a copy of the e-mail distributed to participating establishments). Using this sampling methodology proved very successful and resulted in the collection of 878 residential surveys.

Computer Assisted Telephone Interview (CATI)

Due to the higher-than-expected response to the web survey, the CATI survey was not necessary.

QUESTIONNAIRE

NuStats, Mark Bradley, CDG, ARUP, and NCTA collaboratively designed the base survey instrument. The base survey consisted of the following four question modules:

1. Screening Questions: A series of five questions that established respondent eligibility based on a series of characteristics including respondent type, travel behavior, and household income.

2. Reference Trip Questions: A series of eleven questions that collected information about a recent trip using the Wright Memorial Bridge (occupancy, vehicle type, day of week, departure time, origin, destination, arrival time, and travel delays).

3. Stated Preference Trade Off Questions: A series of five stated preference questions with each question presenting a hypothetical travel scenario that incorporated (1) characteristics of the reference trip and (2) varying toll levels and time savings that change in response to the respondent's willingness to pay.

4. Demographic Questions: A series of eleven questions that collected information about the respondent's preferred method of toll payment and demographics.

Upon approval, the instrument was programmed for field administration. See Appendix F for a copy of the base instrument.

FIELD ADMINISTRATION – HAND-HELD PDA

GeoStats programmed and loaded the Mid-Currituck interview instrument into PocketPC devices using GeoSurvey™, which is a flexible platform for implementing instruments, supporting multiple question types (e.g., text capture, number input, pick one, pick multiple, date/time capture) with complex skip patterns, computed questions, data lookups, and validation. The application uses a relational data model that has no question or answer number limits and can store survey results in an efficient manner.

The programmed instrument consisted of 95 questions, which utilized 237 response options. Random numbers, together with data from three external lookup tables, were used to drive the five scenarios in Stated Preference (SP) experiments. Data from GeoSurvey™ were exported to cumulative text files, containing comma-separated values (CSV), on a regular basis and transferred to laptop PCs, where they were combined into unified data sets and transmitted to NuStats for review and tracking.

WEB ADMINISTRATION

The base survey instrument was programmed into a web environment using the web module of VOXCO. Once the instrument had been tested by several members of the project team to ensure proper functionality, it was posted to the web, and the previously mentioned e-mail was distributed to the local Chambers of Commerce. At this point, the web survey went live. See Figures 1 and 2 below for screen shots of the initial survey web pages.

FIGURE 1: MID-CURRITUCK WEB SURVEY WELCOME PAGE

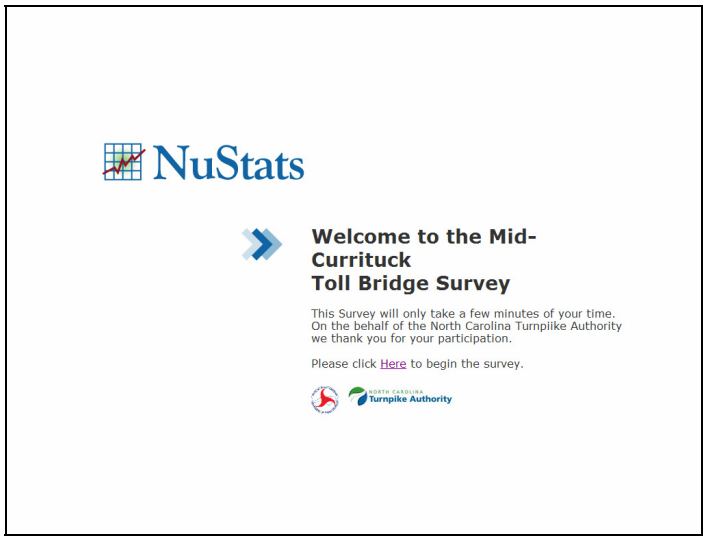
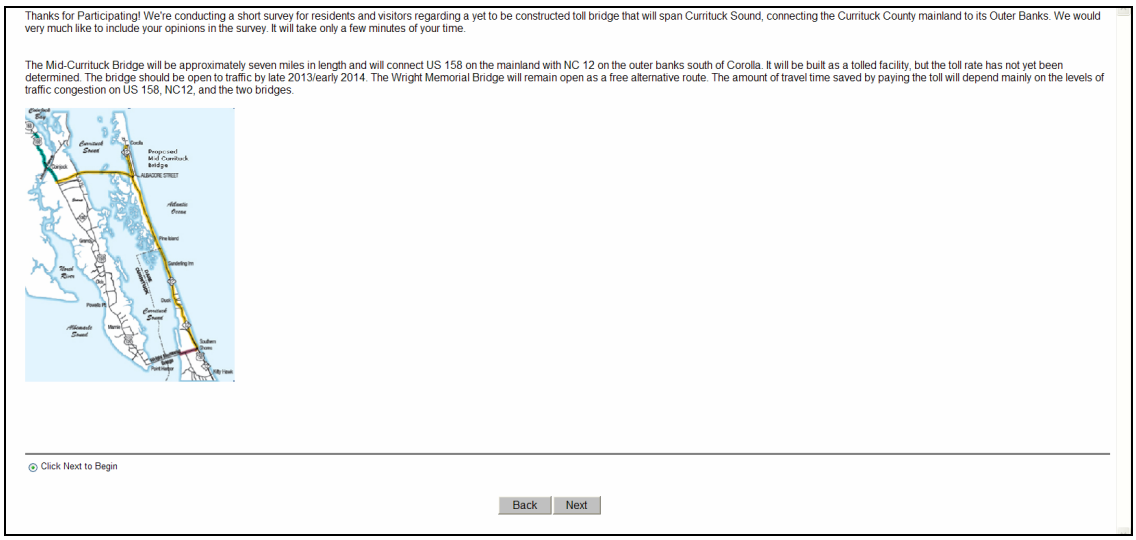


FIGURE 2: MID-CURRITUCK WEB SURVEY INTRODUCTORY PAGE



DATA COLLECTION

FIELD ADMINISTRATION

NuStats elicited the assistance of Coastal Staffing, a local temporary staffing firm, for the recruitment of surveyors. Prior to recruitment, NuStats provided Coastal Staffing with a list of interview roles and responsibilities to use when reviewing candidates for the position. These roles and responsibilities are summarized below:

- Must be punctual (report to assignment at various locations on time),
- Must have a flexible schedule to work various shifts ranging from as early as 8 a.m. to as late as 8 p.m.,
- Must be available to work Monday through Sunday,

- Must be agreeable to work shifts averaging eight hours in length,
- Must be able to get to survey sites at various locations throughout the Outer Banks region,
- Must be attentive to details,
- Must attend a paid training session that will prepare surveyors for survey administration,
- Administer an intercept survey to visitors and residents collecting travel behavior data,
- Approach respondent(s) with courtesy and respect, and
- Encourage respondent(s) to complete the survey through interaction.

A total of 21 surveyors were trained for the survey effort.

Two separate interviewer training sessions were conducted. The first was conducted on August 13, 2009, and the second on August 21, 2009. The following key topics were covered in detail during the training sessions:

- Orientation and project background,
- Work schedule,
- Dress code,
- Project supplies,
- Study design,
- Work tasks,
- Administrative tasks, and
- Contact information.

During the training, the surveyors went through the questionnaire interactively and asked any questions they had during the session. Once the surveyors felt comfortable with the instrument, they paired up and conducted mock interviews with each other—one acting as the respondent and one acting as the surveyor. This concluded the training session, and, at this time, surveying began. The NuStats field coordinators remained in the field throughout the data collection effort, moving from site to site on an as-needed basis. They were constantly available for communication via cell phone.

Field data collection took place from August 13, 2009, to September 2, 2009. During this time, a total of 1,255[4] surveys were completed, of which 1,125 were visitor surveys and 130 were residential surveys. An overall field CPH (complete per hour, an estimate of survey productivity) of 0.7 was observed. This was lower than the expected 1.0, which resulted in the extension of the field period from 10 days to 21 days. This low CPH was a direct result of a higher-than-expected refusal rate (approximately 70%). This high refusal rate can most likely be attributed to the (1) controversial nature of tolled facilities and (2) the desire for respondents not wanting to be bothered during their vacation.

The average length of the survey was 14 minutes.

WEB ADMINISTRATION

The web survey went live on September 21, 2009 and was closed on October 21, 2009. During the field period, a total of 878 surveys were collected.

[4] Due to the need to fill specific sample targets (see Tables 1 and 2), more than 800 visitor surveys were completed.

EDIT CHECKS

Prior to any data analysis, NuStats performed a comprehensive edit check for each completed interview. During this phase, each interview was required to pass a routine edit check program before it could be included in the final data set. Routine edit checks included such items as data range limitations, skip patterns, logic checks, coding of open-end responses, and checks of calculated variables. Prior to passing the edit check, the data were formatted for modeling with ALOGIT software.

After the data had been processed, the final visitor data set included 1,383 cases, and the final residential data set included 750 cases.

ISSUES ENCOUNTERED

As is the case with most survey research projects, there are a number of issues that are encountered along the way that must be dealt with quickly and effectively. Listed below are the issues that were encountered during the life cycle of this project.

OPPOSITION TO SURVEY PARTICIPATION FROM LOCAL ESTABLISHMENTS

During the field assessments, many establishments initially identified as potential intercept locations declined to participate. Some of the larger corporate facilities (such as grocery and department stores) reported that corporate policy prevented surveying for any reason to take place on the property. Other facilities chose not to participate, commenting that they did not want to bother their patrons while they were on vacation.

HIGH SURVEYOR ATTRITION RATE

Intercept surveys are often characterized by high surveyor attrition rates. During the course of the field data collection, several surveyors found full-time employment. Furthermore, a few surveyors were excused from the project, as they were not following the procedures that had been established for the project.

HIGH RESPONDENT REFUSAL RATE

The 70 percent refusal rate observed during the visitor field period was significantly higher than that which had been experienced in other similar visitor intercept surveys conducted by NuStats. As a result, the realized CPH was much lower than estimated, and the project schedule had to be extended to provide sufficient time to collect the necessary number of surveys.

VISITOR FIELD INSTRUMENT PROGRAMMING ISSUES

During the course of processing the visitor data, two programming errors were identified with the PDA device that was used for implementing the visitor field survey. The result of this programmatic error was the miscalculation of values that were presented to the respondents in a subset of the stated preference questions. As such, some of the survey data collected during the field period had to be disqualified (1,358 of the 5,400 originally collected SP scenarios, or 25 percent, were disqualified). However, because more than the required number of visitor surveys had been completed, a robust sample size was still available for analytical purposes. Furthermore, a number of checks were performed to ensure the consistency of the database and the impact of the error. All analyses confirmed that the sample size is robust and sufficient for the purpose of this study.

VISITOR PARTICIPATION IN RESIDENTIAL WEB SURVEY

Similar to the PDA version of the instrument, the web survey was designed to collect information from both residents and visitors.[5] However, as the web survey link was only sent to Chambers of Commerce, who, in turn, distributed the link to local employers, NuStats did not suspect that visitors would use the web survey as a means to provide their data. As such, after NuStats initially tested the survey instrument, the data were verified for a number of completed surveys by income band and trip purpose, but not for respondent type (visitor or resident). When the number of web completes reached 878, NuStats, CDG, ARUP, and NCTA mutually agreed that a sufficient number of surveys had been collected for analytical purposes. Upon review of the data, NuStats found that 258 of the 878 web surveys were completed by visitors. It is suspected that visitors saw an article printed in the September 30, 2009 edition of *The Daily Advance*, a local newspaper. The article was intended to inform local residents of the survey, but it appears that some visitors also learned of the survey in this manner. As such, the target goal of 800 residential surveys was not achieved.

"SEASONAL RESIDENTS" SELF REPORTING AS PERMANENT RESIDENTS

During the data processing phase, it was noticed that several respondents who self reported as residents provided residential zip codes that were out of the survey area. Upon further review, it was concluded that these respondents are most likely seasonal residents, owning a vacation home in the Outer Banks region, but spending the majority of the year at their primary residence, which is out of area.

Since the ultimate model developed for estimating value of time and willingness to pay combines all responses from both residents and visitors, this phenomena has little impact on this facet of the analysis, but it is very important regarding the ownership of a toll tag.

Table B12 (Appendix B) suggests that 47 percent of residents have a toll tag in their vehicle. Residents that took the web survey reported tag ownership at a much higher proportion than did those that participated via the PDA intercept survey (52 percent versus 22 percent, respectively).

Upon examination of several other data sources[6], 47 percent does not seem to be an accurate estimate for the residential population. The project team believes that the actual percentage of residents that own toll tags is much closer to 22 percent than 47 percent.

[5] The web survey was designed in this manner so that in the event that the field effort did not yield a sufficient number of visitor surveys, the web instrument could be used to collect additional visitor surveys.
[6] 2007 North Carolina Turnpike Authority Automatic Vehicle Identification Study.

STATED PREFERENCE ANALYSIS

Stated preference questions were used to measure respondents' likelihood of using the Mid-Currituck Toll Bridge as a function of the toll level, time savings, and other factors. The questions were asked of 2,133 respondents, whose reference trip was made using the Wright Memorial Bridge. The introduction and wording of the questions are shown below.

To avoid bias due to ordering effects, the questions were asked in two different ways. Versions Order A and Order B below differ only in the order in which the toll and non-toll options are described to the respondent. Each respondent was randomly assigned one of the two orders for all SP questions.

> Now assume you're making a future trip just like the one that you just told me about. It's a trip on the same day, at the same time of day, for the same purpose, and you're under the same time pressures. When traveling over Currituck Sound, you have the option of using the new Mid-Currituck Toll Bridge if you want to. Compared to the existing Wright Memorial Bridge, the new toll bridge would save you a certain amount of driving distance and travel time, depending on your destination on the Outer Banks. In some of the scenarios that follow, you can imagine that there will be additional traffic congestion on the current bridge, in which case the new toll bridge would save you even more time. Let's start with the first choice scenario….
>
> ***SP1 Trade-off Version A***
>
> If you were to use the Wright Memorial Bridge, your trip would take ..... minutes and be free. If you used the new Mid-Currituck Bridge, you would pay $Y and your trip would take ..... minutes, saving ..... minutes. The journey via the new bridge would be ..... miles shorter avoiding Route 158 through the Currituck peninsula.
>
> Now under these conditions, would you choose to:
>
Use the new Mid-Currituck Bridge, pay [$Y] and save [X] minutes	*1*
Use the Wright Memorial Bridge for free	*2*
Don't Know	*9*

> ***SP 1 Trade-off Version B***
>
> If you were to use the new Mid-Currituck Bridge you would pay $Y and your trip would take ..... minutes. If you used the Wright Memorial Bridge, your trip would take ..... minutes, ... minutes longer than the toll bridge, but it would be free. The journey via the Wright Memorial Bridge would be ..... miles longer using Route 158 through the Currituck peninsula.
>
> Now, under these conditions, would you choose to:
>
Use the Wright Memorial Bridge for free	*2*
Use the new Mid-Currituck Bridge, pay [$Y] and save [X] minutes	*1*
Don't Know	*9*

For each respondent, regardless of whether they were given SP Set A or B, there are three random draws for each of the five questions in the set (see Tables 6, 7, 8, and 9): RANDZ = 1 through 3, RANDX = 1 through 4, and RANDY = 1 through 5. These random draws dictated the time savings and toll values displayed to the respondent in each scenario.

TABLE 6: VALUES USED IN SP SCENARIOS[7]

SCENARIO	SP1	SP 2	SP 3	SP 4	SP 5
Toll cost	(TOLL) from Table 8	(TOLL) from Table 8	(TOLL) from Table 8	(TOLL) from Table 8	(TOLL) from Table 8
Distance saved	(DSAVED) from Table 6	(DSAVED) from Table 6	(DSAVED) from Table 6	(DSAVED) from Table 6	(DSAVED) from Table 6
Time via existing bridge	Actual (R7 – R4)	Free flow (R7 – R4 – R11)	Random extra (R7 – R4 – R11 + TEXTRA from Table 7)	Random extra (R7 – R4 – R11 + TEXTRA from Table 7)	Random extra (R7 – R4 – R11 + TEXTRA from Table 7)
Time via new bridge	Free flow (R7 – R4 – R11 - TSAVED) from Table 6	Free flow (R7 – R4 – R11 - TSAVED) from Table 6	Free flow (R7 – R4 – R11 - TSAVED) from Table 6	Free flow (R7 – R4 – R11 - TSAVED) from Table 6	Free flow (R7 – R4 – R11 - TSAVED) from Table 6
Total time saved	TSAVED + R11	TSAVED	TSAVED + TEXTRA	TSAVED + TEXTRA	TSAVED + TEXTRA

TABLE 7: VALUES FOR DSAVED AND TSAVED AS A FUNCTION OF R6[8] AND RANDZ

DESTINATION	DISTANCE SAVED	TIME SAVED, RANDZ = 1	TIME SAVED, RANDZ = 2	TIME SAVED, RANDZ = 3
Corolla	35 miles	50 min	55 min	60 min
Sanderling	20 miles	25 min	30 min	35 min
Duck	10 miles	5 min	10 min	15 min
Southern Shores	3 miles	0 min	5 min	5 min
Kitty Hawk	1 mile	0 min	0 min	5 min
Kill Devil Hills	1 mile	0 min	0 min	5 min
Collington	1 mile	0 min	0 min	5 min
Nags Head	1 mile	0 min	0 min	5 min
Whale Bone	1 mile	0 min	0 min	5 min

TABLE 8: VALUES FOR TEXTRA AS A FUNCTION OF RANDX

RANDX	SP 1	SP 2	SP 3	SP 4	SP 5
1	0	0	20	10	40
2	0	0	30	40	10
3	0	0	10	20	30
4	0	0	40	30	20

TABLE 9: VALUES OF TOLL AS A FUNCTION OF RANDY

RANDY	SP 1	SP 2	SP 3	SP 4	SP 5
1	5	20	15	10	30
2	16	8	4	24	12
3	9	21	15	3	6
4	12	18	30	24	6
5	25	5	10	15	20

[7] Please refer to Appendix F for a description of the actual questions referenced by the variable names in this table.
[8] See Appendix F.

SAMPLE CHARACTERISTICS

The survey data used for modeling consists of 8,823 SP responses. Tables 10 and 11 show the number of valid SP responses for SP combinations of toll for the proposed Mid-Currituck Bridge and the time savings provided by the proposed bridge in the residents' and visitors' survey, respectively. In total, there are 3,511 valid SP responses for residents and 5,312 valid SP responses for visitors.

TABLE 10: DISTRIBUTION OF TIME SAVINGS AND TOLL LEVELS IN SP QUESTIONS IN THE RESIDENTS' SURVEY

	0 MIN	1-9 MIN	10 MIN	11-19 MIN	20 MIN	21-29 MIN	30-35 MIN	40 MIN	41-50 MIN	51-60 MIN	>60 MIN	TOTAL
$3.00	0	0	27	1	36	4	6	55	3	8	40	180
$4.00	0	0	43	2	41	5	43	5	1	6	30	176
$5.00	97	12	3	4	6	2	4	0	15	18	11	172
$6.00	0	0	107	3	5	1	78	66	6	15	74	355
$8.00	130	9	1	2	0	0	0	0	16	18	0	176
$9.00	98	11	1	6	4	4	4	0	15	21	16	180
$10.00	0	0	38	3	34	4	9	38	3	8	35	172
$12.00	105	7	43	8	3	5	49	43	24	23	39	349
$15.00	0	0	69	7	67	4	101	7	7	9	80	351
$16.00	101	8	6	6	5	0	6	0	14	16	14	176
$18.00	127	6	0	1	0	1	0	0	18	22	0	175
$20.00	108	7	1	2	1	2	5	4	18	19	5	172
$21.00	119	11	2	0	0	0	0	0	25	23	0	180
$24.00	0	0	78	6	77	2	14	94	6	11	63	351
$25.00	6	3	1	0	1	0	0	0	1	0	6	18
$30.00	0	0	73	1	39	4	91	38	5	15	62	328
Total	891	74	493	52	319	38	410	350	177	232	475	3511

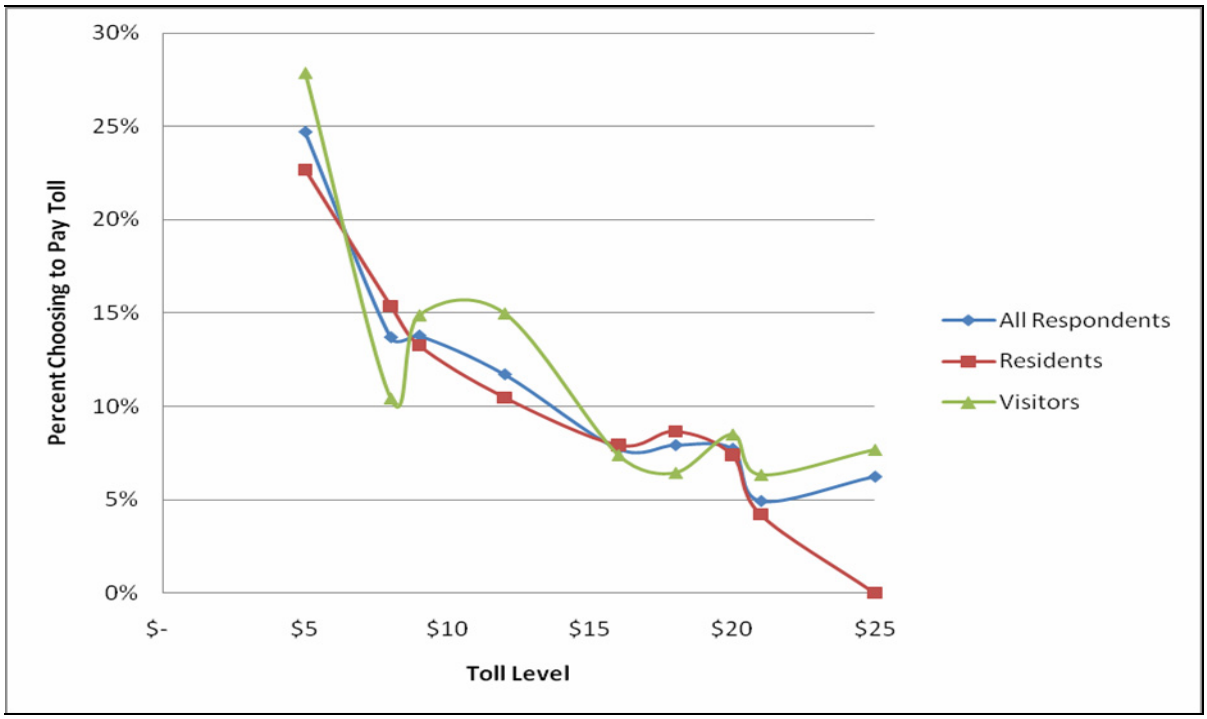
TABLE 11: DISTRIBUTION OF TIME SAVINGS AND TOLL LEVELS IN SP QUESTIONS IN THE VISITORS' SURVEY

	0 MIN	1-9 MIN	10-14 MIN	15 MIN	20 MIN	21-29 MIN	30 MIN	31-39 MIN	40 MIN	41-49 MIN	50-60 MIN	61-75 MIN	>75 MIN	TOTAL
$3.00	0	0	13	9	22	8	17	7	14	10	21	43	59	223
$4.00	0	0	17	11	21	11	24	15	16	14	19	46	46	240
$5.00	61	67	20	1	1	2	9	5	4	2	144	11	36	363
$6.00	0	0	30	20	36	15	34	21	36	21	41	69	138	461
$8.00	67	51	9	0	0	1	4	2	0	0	105	0	0	239
$9.00	47	24	4	1	1	7	7	5	3	1	77	10	28	215
$10.00	0	0	20	25	31	27	21	17	29	13	30	68	88	369
$12.00	40	33	30	16	16	14	25	15	26	20	88	41	105	469
$15.00	0	0	45	34	44	34	50	22	35	25	39	119	146	593
$16.00	54	43	5	1	1	5	7	5	1	0	73	11	24	230
$18.00	62	41	11	0	0	3	1	0	0	0	118	0	0	236
$20.00	47	48	25	10	7	14	16	3	10	9	117	25	41	372
$21.00	63	32	6	0	0	3	4	0	0	0	116	0	0	224
$24.00	0	0	33	22	39	20	28	27	45	27	37	100	99	477
$25.00	26	20	9	1	2	2	3	2	2	3	40	12	20	142
$30.00	0	0	28	20	30	25	37	22	35	27	37	80	118	459
Total	467	359	305	171	251	191	287	168	256	172	1102	635	948	5312

More than one-tenth of the time savings/cost combinations (or, 1,358 choices) pertained to zero travel time savings. These SP combinations were provided to assess the respondent's willingness to pay toll in case of zero travel time savings. The results indicate that about 11 percent of these respondents (i.e., 153 out of 1,358 choices) were willing to pay toll with zero travel time savings.

Figure 3 plots the percent of respondents willing to pay different levels of toll for zero time savings. As expected, the percent willing to pay toll decreases with increasing toll cost. A closer examination of the respondents also indicated that those who make vacation trips are generally more willing to pay toll with zero travel time savings.

FIGURE 3: PERCENT OF RESPONDENTS WILLING TO PAY TOLL WITH ZERO TRAVEL TIME SAVINGS



Figures 4 to 6 plot the cumulative distributions of respondents willing to pay toll for each cost/time tradeoff point (which is shown as a separate point in an XY plot). Note that the range of cost/time tradeoff points or individual level VOT has been limited to $ 60/hour.

Figure 4 plots the cumulative distribution of residents willing to pay toll for each cost/time tradeoff point by household income bands. Figure 5 provides a similar plot for the visitors. As shown in the figures, respondents that belong to higher income households are more likely to have a higher VOT.

Figure 6 plots the cumulative distributions of all respondents willing to pay toll for each cost/time tradeoff point by trip purpose. The figure shows that respondents who make vacation trips are more likely to have a higher VOT.

FIGURE 4: CUMULATIVE DISTRIBUTION OF RESIDENTS WILLING TO PAY TOLL BY VOT FOR EACH HOUSEHOLD INCOME BAND

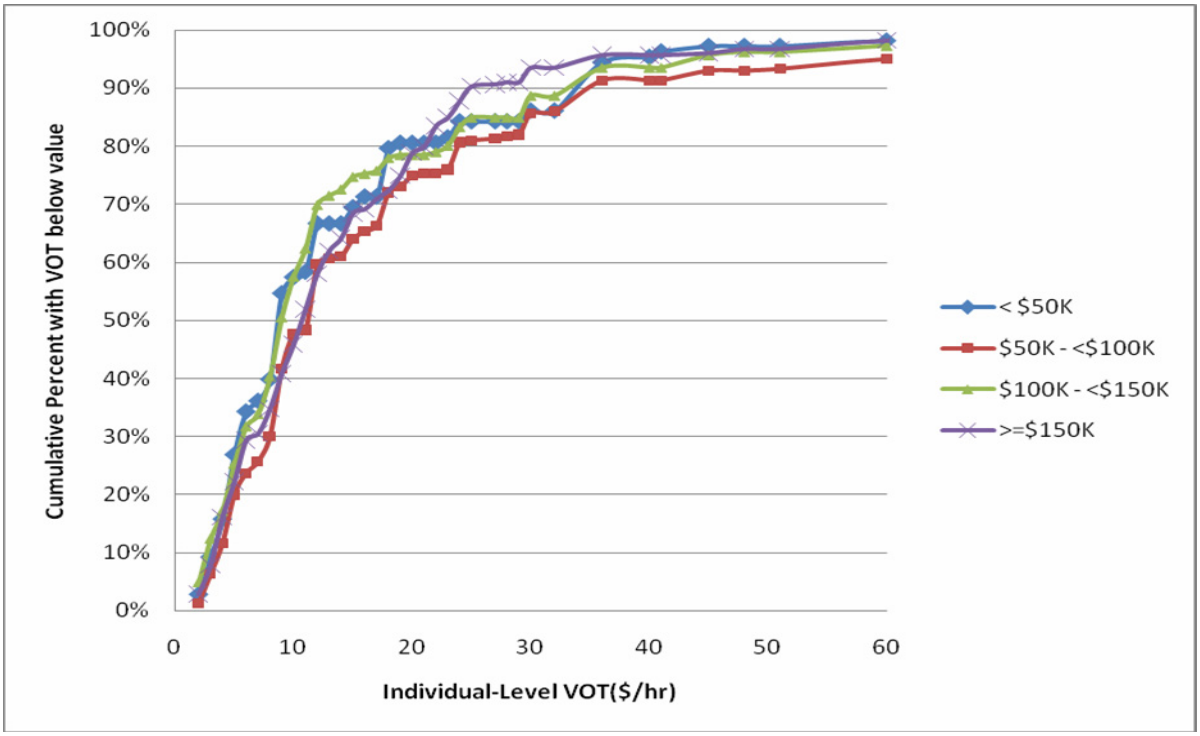


FIGURE 5: CUMULATIVE DISTRIBUTION OF VISITORS WILLING TO PAY TOLL BY VOT FOR EACH HOUSEHOLD INCOME BAND

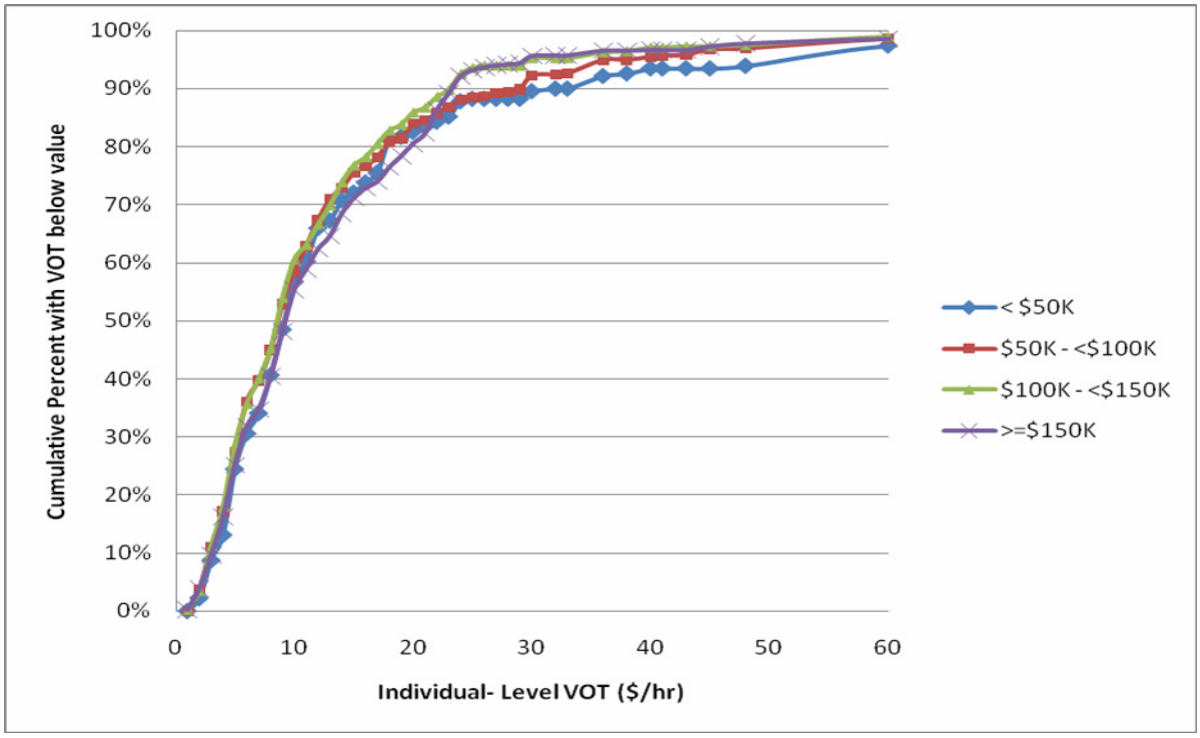


FIGURE 6: CUMULATIVE DISTRIBUTION OF RESPONDENTS WILLING TO PAY TOLL BY VOT FOR EACH TRIP PURPOSE

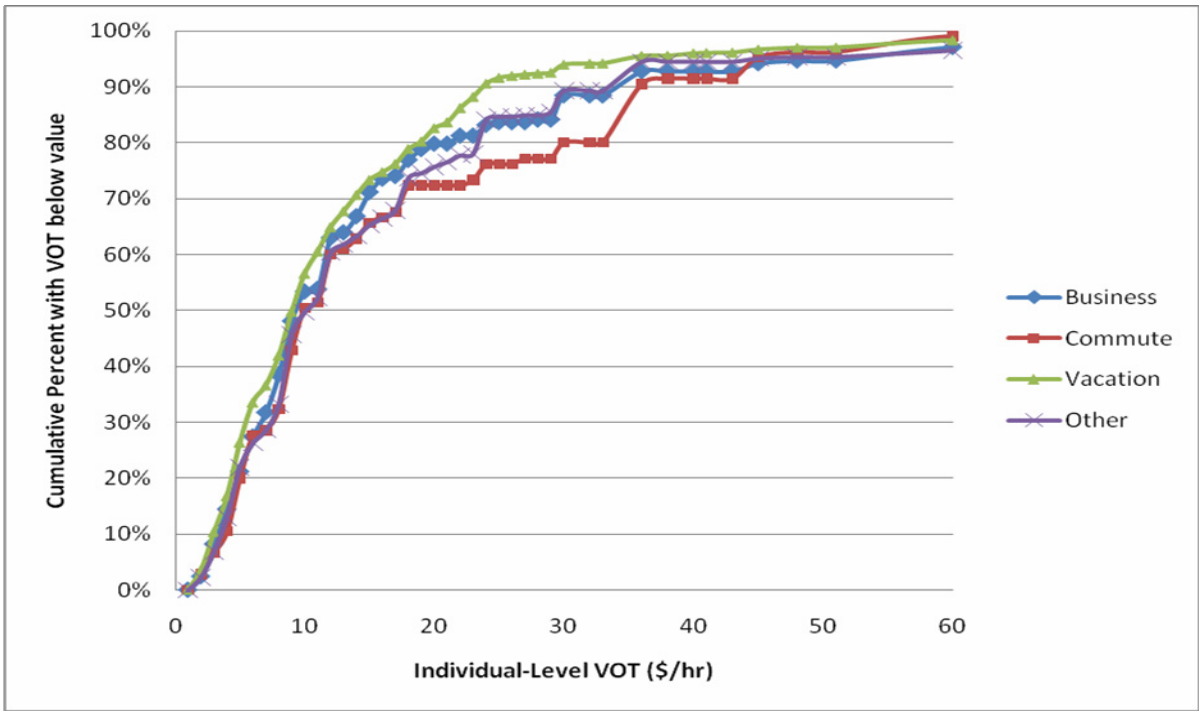


Table 12 presents the distribution of SP responses by trip purpose and household income bands for all respondents. The confidence intervals at 95% confidence level are small for most of the trip purpose and household income band segments, which reflects robust sample sizes for modeling.

TABLE 12: DISTRIBUTION OF SP RESPONSES BY TRIP PURPOSE AND HOUSEHOLD INCOME BAND

TRIP PURPOSE	HOUSEHOLD INCOME BAND	COUNT	PERCENT	CONFIDENCE INTERVAL AT 95% CONF. LEVEL (+/-)
Business	<$50K	230	3%	6.46
	$50K–<$100K	414	5%	4.82
	$100K–<$150K	195	2%	7.02
	>=$150K	194	2%	7.04
Commute	<$50K	129	1%	8.63
	$50K–<$100K	230	3%	6.46
	$100K–<$150K	90	1%	10.33
	>=$150K	64	1%	12.25
Vacation	<$50K	826	9%	3.41
	$50K–<$100K	1,749	20%	2.34
	$100K–<$150K	1,162	13%	2.87
	>=$150K	1,893	21%	2.25
Other	<$50K	330	4%	5.39
	$50K–<$100K	732	8%	3.62
	$100K–<$150K	385	4%	4.99
	>=$150K	200	2%	6.93
		8,823	100%	1.04

DISCRETE CHOICE MODEL RESULTS

A binary logit model was used to examine the decision of residents and visitors to use the proposed tolled Mid-Currituck Bridge in the Outer Banks versus the existing untolled Wright Memorial Bridge.

Several variables were considered in the utility function for the tolled Mid-Currituck Bridge, including the following:

- Toll cost
- Additive toll cost variables by household income bands (note that lowest income band, 'less than $50K' was used as the base[9] for these variable coefficients)
  - $50K to less than $100K
  - $100K to less than $150
  - $150K or more
- Time saved on the tolled route relative to the untolled facility
- Additive time savings variables by trip purpose (note that 'vacation trip' purpose was used as the base for these variable coefficients)
  - Business
  - Commute
  - Other
- Alternative-specific constant to capture any utility differences not related to cost and travel time
- Constants for business, commute, and other trips
- Constant for residents that make non-vacation trips
- Dummy variable to capture the impact of congestion
- Additive dummy variables for congestion by trip purpose (note that 'vacation trip' purpose was used as the base for these variable coefficients)
  - Business
  - Commute
  - Other

The final model specification results are presented in Table 13. The model produced highly significant estimates of all coefficients, particularly time and cost. The negative sign on toll cost and positive sign on time savings are as expected. This indicates that respondents are more likely to choose the untolled Wright Memorial Bridge if the toll cost increases on the proposed tolled bridge or if the travel time saved on the tolled bridge relative to the untolled bridge decreases.

Further, the table shows a positive sign on the constant for tolled bridge. All else being equal, we expect that the respondents are more likely to use the tolled bridge relative to the Wright Memorial Bridge. This might be because respondents see the toll bridge as more reliable, with less potential for unexpected delay. As expected, the respondents are more likely to choose the tolled bridge as their household income increases.

[9] The effect of the base category becomes represented in the base toll cost coefficient, and the additional variable is the estimate of the difference in toll cost utility for each household income band. If the additional variables are not significant, it means that the effect for that household income band is not significantly different than for the base group.

The results show that the respondents who make commute trips are less likely to choose the tolled bridge, relative to those that make vacation trips. However, respondents who make commute trips and face congestion on the existing bridge are more likely to choose the tolled bridge.

TABLE 13: MODEL ESTIMATION RESULTS

Observations		8823
Final log-likelihood		-3828.7084
Rho-squared (total)[10]		0.3739
Rho-squared (adjusted)		0.3419
	COEFFICIENT	**T-STAT.**[11]
Toll cost ($)	-0.2299	-26.8
Time savings (hrs)	2.2551	28.7
Constant for tolled bridge	0.3652	4.7
Constant for business trips	0.0299	0.1
Constant for commute trips	-0.1807	-0.6
Constant for other trips	0.1007	0.5
Constant for residents that make non-vacation trips	-0.4780	-3.1
Toll cost – Income $50K–<$100K ($)	0.0412	5.1
Toll cost – Income $100K–<150K ($)	0.0567	6.8
Toll cost – Income >=$150K ($)	0.1019	13.1
Time savings – Business trips (hrs)	-0.5086	-2.4
Time savings – Commute trips (hrs)	-0.6174	-2.2
Time savings – Other trips (hrs)	-0.3607	-2.0
Congestion dummy – Commute trips	0.4918	1.6

Table 14 presents the estimates of VOT, toll bridge constant for residents, toll bridge constant for visitors, and congestion dummy. The VOT of $9.81 applies to the base group of vacation trips made by respondents with a household income of less than $50,000. The table shows the VOT estimates for all other trip purpose and income band combinations that were computed by adding relevant variables from Table 13 to the base value of $9.81. Similar computations were made to estimate the toll bridge constant and congestion dummy.

As shown in the table, the VOT estimates increase as household income increases. Overall, non-vacation trips have lower VOT than vacation trips. With regards to the estimate of toll bridge constant, there are significant differences between visitors and residents for non-vacation trips. In particular, the toll constants for all residents, except for those who make vacation trips (i.e., seasonal residents), are negative. This implies that all residents who make non-vacation trips are less favorable to the new bridge, as expected. The values for congestion dummies on the commute trips are intuitive. Specifically, for commuters who are most likely to be aware of congestion on the existing bridge, there is an extra positive benefit for the toll bridge in congested conditions.

[10] Rho-squared values describe the overall goodness of fit of the model. According to Koppelman and Bhat (2006), there are no guidelines for 'good' rho-squared values. Consequently, the measures are of limited value in assessing the quality of an estimated model.

[11] The variables that are statistically significant at the 95% confidence level were included in this model.

The VOT estimates are close to what we would expect. As compared to previous SP studies conducted to measure the respondents' VOT or willingness to pay toll for using a High Occupancy Toll (HOT) lane, the VOT estimates are a little higher (as expected). This is because the bottleneck effect at the bridge translates to lower reliability for the non-tolled option than is typically the case. Overall, the toll estimates are in line with the estimates from the 2006 preliminary traffic and revenue study for the proposed Mid-Currituck Bridge.

TABLE 14: ESTIMATES OF VOT, TOLL BRIDGE CONSTANT, AND CONGESTION DUMMY

TRIP PURPOSE	HOUSEHOLD INCOME BAND	VALUE OF TIME ($/HR)	TOLL BRIDGE CONSTANT ($) - RESIDENTS	TOLL BRIDGE CONSTANT ($) - VISITORS	CONGESTION DUMMY ($)
Vacation	<$50K	$9.81	$1.59	$1.59	-
Vacation	$50K–<$100K	$11.95	$1.94	$1.94	-
Vacation	$100K–<$150K	$13.02	$2.11	$2.11	-
Vacation	>=$150K	$17.63	$2.86	$2.86	-
Business	<$50K	$7.60	-$0.36	$1.72	-
Business	$50K–<$100K	$9.26	-$0.44	$2.09	-
Business	$100K–<$150K	$10.08	-$0.48	$2.28	-
Business	>=$150K	$13.65	-$0.65	$3.09	-
Commute	<$50K	$7.12	-$1.28	$0.80	$2.14
Commute	$50K–<$100K	$8.68	-$1.56	$0.98	$2.61
Commute	$100K–<$150K	$9.46	-$1.69	$1.07	$2.84
Commute	>=$150K	$12.80	-$2.29	$1.44	$3.84
Other	<$50K	$8.24	-$0.05	$2.03	-
Other	$50K–<$100K	$10.04	-$0.06	$2.47	-
Other	$100K–<$150K	$10.94	-$0.07	$2.69	-
Other	>=$150K	$14.81	-$0.09	$3.64	-

References

Koppelman and Bhat (2006). A Self Instructing Course in Mode Choice Modeling: Multinomial and Nested Logit Models Prepared For U.S. Department of Transportation Federal Transit Administration, <http://www.ce.utexas.edu/prof/bhat/COURSES/LM_Draft_060131Final-060630.pdf>, accessed on November 16, 2009.

APPENDIX A: SUMMARY OF VISITOR SURVEY DATA

The following is a summary of the survey data collected from visitors to the region. The following tables are based on processed and unweighted data.

TABLE A1: METHOD OF DATA COLLECTION

CHOICE	CODE	FREQUENCY	PERCENT
PDA	1	1,125	81.3%
Web Survey	2	258	18.7%
Total	**-**	**1,383**	**100.0%**

TABLE A2: LOCATION OF COLLECTION [METHOD=PDA]

CHOICE	CODE	FREQUENCY	PERCENT
Aycock-Brown Visitor Center – Kitty Hawk	1	252	22.4%
Currituck Beach Lighthouse – Corolla	2	8	0.7%
Currituck County Rest Area – Barco	3	64	5.7%
Currituck County Visitor Center – Corolla	4	1	0.1%
Currituck County Welcome Center – Moyock	5	22	2.0%
Currituck to Knotts Island Ferry – Barco	6	1	0.1%
Duck's Cottage – Duck	7	4	0.4%
Hampton Inn and Suites – Corolla	9	3	0.3%
Hilton Garden Inn – Kitty Hawk	10	61	5.4%
Holiday Inn Express – Kitty Hawk	11	4	0.4%
Public Beaches – Kill Devil Hills	15	1	0.1%
Tanger Outlet – Nags Head	22	230	20.4%
Tim-Buk-Tu – Corolla	24	385	34.2%
Other	99	89	7.9%
Total	**-**	***1,125***	**100.0%**

TABLE A3: PURPOSE OF TRIP

CHOICE	CODE	FREQUENCY	PERCENT
Business (Non-commute-related, such as delivery or attend meeting)	1	29	2.1%
Commuting to/from regular workplace	2	4	0.3%
Vacation start/end (i.e., to/from home residence to/from residence on Outer Banks)	3	1,299	93.9%
Other (All other places that do not fit into the above categories)	4	51	3.7%
Total	-	**1,383**	**100.0%**

TABLE A4: HOUSEHOLD INCOME

CHOICE	CODE	FREQUENCY	PERCENT
Less than $15,000	1	20	1.4%
$15,000 to $24,999	2	31	2.2%
$25,000 to $34,999	3	53	3.8%
$35,000 to $49,999	4	120	8.7%
$50,000 to $74,999	5	198	14.3%
$75,000 to $99,999	6	223	16.1%
$100,000 to $149,999	7	288	20.8%
$150,000 to $199,999	8	231	16.7%
$200,000 to $249,999	9	98	7.1%
$250,000 and above	10	121	8.7%
Total	**-**	**1,383**	**100.0%**

TABLE A5: PEOPLE IN VEHICLE (INCLUDING RESPONDENT)

CHOICE	CODE	FREQUENCY	PERCENT
One	1	95	6.9%
Two	2	461	33.3%
Three	3	242	17.5%
Four	4	344	24.9%
Five or More	5	239	17.3%
Don't Know/Refused	9	2	0.1%
Total	**-**	**1,383**	**100.0%**

TABLE A6: TYPE OF VEHICLE USED

CHOICE	CODE	FREQUENCY	PERCENT
Passenger Car, SUV, or Pick-Up Truck	1	1,351	97.7%
2-Axle, 6-Tire Truck or Bus	2	8	0.6%
3-Axle Truck or Bus	3	4	0.3%
4-Axle Truck	4	1	0.1%
Truck with 6 or more Axles	5	0	0.0%
Motorcycle	6	15	1.1%
Don't Know/Refused	9	4	0.3%
Total	**-**	**1,383**	**100.0%**

TABLE A7: DAY OF WEEK OF TRAVEL

CHOICE	CODE	FREQUENCY	PERCENT
Monday	1	85	6.1%
Tuesday	2	81	5.9%
Wednesday	3	72	5.2%
Thursday	4	51	3.7%
Friday	5	186	13.4%
Saturday	6	532	38.5%
Sunday	7	364	26.3%
Don't Know/Refused	9	12	0.9%
Total	**-**	**1,383**	**100.0%**

TABLE A8: TRAVEL TIME (COMPUTED)

CHOICE	FREQUENCY	PERCENT
Less than Three Hours	257	18.6%
Between Three and Six Hours	423	30.6%
Six or More Hours	703	50.8%
Total	**1,383**	**100.0%**

TABLE A9: DELAYED BY CONGESTION APPROACHING WRIGHT MEMORIAL BRIDGE

CHOICE	CODE	FREQUENCY	PERCENT
Yes	1	438	31.7%
No	2	939	67.9%
Don't Know/Refused	9	6	0.4%
Total	**-**	**1,383**	**100.0%**

TABLE A10: EXTRA TIME ADDED TO TRIP FROM CONGESTION

CHOICE	FREQUENCY	PERCENT
Less than 15 Minutes	87	19.9%
Between 15 and 30 Minutes	60	13.7%
30 Minutes or More	291	66.4%
Total	**438**	**100.0%**

TABLE A11: PREFERRED METHOD OF TOLL COLLECTION

CHOICE	CODE	FREQUENCY	PERCENT
Cash Pay (Stopping to pay at booth)	1	524	37.9%
Electronic Toll Collection (Toll Tag)	2	830	60.0%
Mail in Payment Upon Receiving Bill in Mail	3	21	1.5%
Refused	9	8	0.6%
Total	**-**	**1,383**	**100.0%**

TABLE A12: OWN ELECTRONIC TAG

CHOICE	CODE	FREQUENCY	PERCENT
Yes	1	729	52.7%
No	2	651	47.1%
Don't Know/Refused	9	3	0.2%
Total	**-**	**1,383**	**100.0%**

TABLE A13: TIMES, PER WEEK, CROSS WRIGHT MEMORIAL BRIDGE DURING STAY ON OUTER BANKS

CHOICE	FREQUENCY	PERCENT
None	92	6.7%
1	252	18.2%
2	862	62.3%
3	16	1.2%
4	73	5.3%
5	10	0.7%
6	10	0.7%
8	7	0.5%
10	2	0.1%
12	4	0.3%
14	1	0.1%
Don't Know/Refused	54	3.9%
Total	**1,383**	**100.0%**

TABLE A14: WOULD STOP AND PAY AT TOLL BOOTH AFFECT DECISION TO TAKE BRIDGE

CHOICE	CODE	FREQUENCY	PERCENT
Yes	1	261	18.9%
No	2	1,071	77.4%
Don't Know/Refused	9	51	3.7%
Total	**-**	**1,383**	**100.0%**

TABLE A15: LIKELINESS OF USING MID-CURRITUCK BRIDGE IF STOP AND PAY TOLL[12]

CHOICE	CODE	FREQUENCY	PERCENT
Very Unlikely	1	85	32.6%
Unlikely	2	29	11.1%
Neither Likely or Unlikely	3	26	10.0%
Likely	4	74	28.4%
Very Likely	5	46	17.6%
Don't Know/Refused	9	1	0.4%
Total	**-**	**1,122**	**100.0%**

TABLE A16: AGE

CHOICE	CODE	FREQUENCY	PERCENT
18–24	1	88	6.4%
25–34	2	200	14.5%
35–44	3	385	27.8%
45–54	4	369	26.7%
55–64	5	219	15.8%
65 or Older	6	119	8.6%
Don't Know/Refused	9	3	0.2%
Total	**-**	**1,383**	**100.0%**

TABLE A17: HOUSEHOLD SIZE

CHOICE	CODE	FREQUENCY	PERCENT
One	1	101	7.9%
Two	2	488	35.3%
Three	3	284	20.5%
Four or More	4	507	36.7%
Don't Know/Refused	9	3	0.2%
Total	**-**	**1,383**	**100.0%**

TABLE A18: GENDER

CHOICE	CODE	FREQUENCY	PERCENT
Male	1	861	62.3%
Female	2	522	37.7%
Total	**-**	**1,383**	**100.0%**

[12] Only respondents that answered "No" or "Don't Know/Refuse" to previous question were asked this question.

APPENDIX B: SUMMARY OF RESIDENT SURVEY DATA

The following is a summary of the survey data collected from residents of the region. The following tables are based on processed and unweighted data.

TABLE B1: METHOD OF DATA COLLECTION

CHOICE	CODE	FREQUENCY	PERCENT
PDA	1	130	17.3%
Web Survey	2	620	82.7%
Total	**-**	**750**	**100.0%**

TABLE B2: LOCATION OF COLLECTION [METHOD=PDA]

CHOICE	CODE	FREQUENCY	PERCENT
Aycock-Brown Visitor Center – Kitty Hawk	1	27	20.8%
Currituck Beach Lighthouse – Corolla	2	4	3.1%
Currituck County Rest Area – Barco	3	14	10.8%
Currituck County Welcome Center – Moyock	5	5	3.8%
Hilton Garden Inn – Kitty Hawk	10	11	8.5%
R/C Movie Theater – Kill Devil Hills	18	1	0.8%
Tanger Outlet – Nags Head	22	37	28.5%
Tim-Buk-Tu – Corolla	24	29	22.3%
Other	99	2	1.5%
Total	**-**	***130***	**100.0%**

TABLE B3: PURPOSE OF TRIP

CHOICE	CODE	FREQUENCY	PERCENT
Business (Non-commute-related, such as delivery or attend meeting)	1	198	26.4%
Commuting to/from regular workplace	2	112	14.9%
Vacation start/end (i.e., to/from home residence to/from residence on Outer Banks)	3	140	18.7%
Other (All other places that don't fit into the above categories)	4	300	40.0%
Total	-	**750**	**100.0%**

TABLE B4: HOUSEHOLD INCOME

CHOICE	CODE	FREQUENCY	PERCENT
Less than $15,000	1	13	1.7%
$15,000 to $24,999	2	17	2.3%
$25,000 to $34,999	3	53	7.1%
$35,000 to $49,999	4	75	10.0%
$50,000 to $74,999	5	148	19.7%
$75,000 to $99,999	6	164	21.9%
$100,000 to $149,999	7	148	19.7%
$150,000 to $199,999	8	52	6.9%
$200,000 to $249,999	9	34	4.5%
$250,000 and Above	10	46	6.1%
Total	**-**	**750**	**100.0%**

TABLE B5: PEOPLE IN VEHICLE (INCLUDING RESPONDENT)

CHOICE	CODE	FREQUENCY	PERCENT
One	1	242	32.3%
Two	2	326	43.5%
Three	3	78	10.4%
Four	4	71	9.5%
Five or More	5	32	4.3%
Don't Know/Refused	9	1	0.1%
Total	**-**	**750**	**100.0%**

TABLE B6: TYPE OF VEHICLE USED

CHOICE	CODE	FREQUENCY	PERCENT
Passenger Car, SUV, or Pick-Up Truck	1	736	98.1%
2-Axle, 6-Tire Truck or Bus	2	9	1.2%
3-Axle Truck or Bus	3	0	0.0%
4-Axle Truck	4	2	0.3%
Truck with 6 or more Axles	5	1	0.1%
Motorcycle	6	1	0.1%
Don't Know/Refused	9	1	0.1%
Total	**-**	**750**	**100.0%**

TABLE B7: DAY OF WEEK OF TRAVEL

CHOICE	CODE	FREQUENCY	PERCENT
Monday	1	78	10.4%
Tuesday	2	93	12.4%
Wednesday	3	93	12.4%
Thursday	4	116	15.5%
Friday	5	93	12.4%
Saturday	6	154	20.5%
Sunday	7	79	10.5%
Don't Know/Refused	9	44	5.9%
Total	**-**	**750**	**100.0%**

TABLE B8: TRAVEL TIME (COMPUTED)

CHOICE	FREQUENCY	PERCENT
Less than Three Hours	507	67.2%
Between Three and Six Hours	122	16.3%
Six or More Hours	124	16.5%
Total	**750**	**100.0%**

TABLE B9: DELAYED BY CONGESTION APPROACHING WRIGHT MEMORIAL BRIDGE

CHOICE	CODE	FREQUENCY	PERCENT
Yes	1	166	22.1%
No	2	574	76.5%
Don't Know/Refused	9	10	1.3%
Total	**-**	**750**	**100.0%**

TABLE B10: EXTRA TIME ADDED TO TRIP FROM CONGESTION

CHOICE	FREQUENCY	PERCENT
Less than 15 Minutes	35	21.1%
Between 15 and 30 Minutes	51	30.7%
30 Minutes or More	80	48.2%
Total	**166**	**100.0%**

TABLE B11: PREFERRED METHOD OF TOLL COLLECTION

CHOICE	CODE	FREQUENCY	PERCENT
Cash Pay (Stopping to pay at booth)	1	198	26.4%
Electronic Toll Collection (Toll Tag)	2	482	64.3%
Mail in Payment upon Receiving Bill in Mail	3	21	2.8%
Refused	9	49	6.5%
Total	**-**	**750**	**100.0%**

TABLE B12: OWN ELECTRONIC TAG

CHOICE	CODE	FREQUENCY	PERCENT
Yes	1	352	46.9%
No	2	398	53.1%
Total	**-**	**750**	**100.0%**

TABLE B13: TIMES, PER WEEK, CROSS WRIGHT MEMORIAL BRIDGE DURING STAY ON OUTER BANKS

CHOICE	FREQUENCY	PERCENT
None	126	16.8%
1	100	13.3%
2	152	20.3%
3	38	5.1%
4	65	8.7%
5	37	4.9%
6	29	3.9%
7	7	0.9%
8	8	1.1%
9	2	0.3%
10	42	5.6%
11	1	0.1%
12	14	1.9%
14	10	1.3%
15 or More	8	1.1%
Don't Know/Refused	109	14.5%
Total	**750**	**100.0%**

TABLE B14: WOULD STOP AND PAY AT TOLL BOOTH AFFECT DECISION TO TAKE BRIDGE

CHOICE	CODE	FREQUENCY	PERCENT
Yes	1	151	20.2%
No	2	532	70.9%
Don't Know/Refused	9	67	8.9%
Total	**-**	**750**	**100.0%**

TABLE B15: LIKELINESS OF USING MID-CURRITUCK BRIDGE IF STOP AND PAY TOLL

CHOICE	CODE	FREQUENCY	PERCENT
Very Unlikely	1	47	31.1%
Unlikely	2	45	29.8%
Neither Likely or Unlikely	3	25	16.6%
Likely	4	13	8.6%
Very Likely	5	16	10.6%
Don't Know/Refused	9	5	3.3%
Total	**-**	**151**	**100.0%**

TABLE B16: AGE

CHOICE	CODE	FREQUENCY	PERCENT
18–24	1	26	3.5%
25–34	2	73	9.7%
35–44	3	118	15.7%
45–54	4	220	29.3%
55–64	5	208	27.7%
65 or Older	6	103	13.7%
Don't Know/Refused	9	2	0.3%
Total	**-**	**750**	**100.0%**

TABLE B17: HOUSEHOLD SIZE

CHOICE	CODE	FREQUENCY	PERCENT
One	1	86	11.5%
Two	2	352	46.9%
Three	3	139	18.5%
Four or More	4	172	22.9%
Don't Know/Refused	9	1	0.1%
Total	**-**	**750**	**100.0%**

TABLE B18: GENDER

CHOICE	CODE	FREQUENCY	PERCENT
Male	1	418	55.7%
Female	2	332	44.3%
Total	**-**	**750**	**100.0%**

APPENDIX C: VISITOR INTERCEPT SITES

TYPE	SITE	CITY	PERMISSION	SITE VISIT	ACTUAL SURVEY SITE	SURVEY HOURS	SURVEY DAYS
Visitor	Hilton Garden Inn	Southern Shores	Yes	Yes	Yes	7am-5pm	7 days/week
Visitor	Aycock Brown Visitor Center	Kitty Hawk	Yes	Yes	Yes	9am-5pm	7 days/week
Visitor	Currituck Beach Lighthouse	Corolla	Yes	Yes	No	9am-5pm	7 days/week
Visitor	Holiday Inn Express	Kitty Hawk	Yes	Yes	No	11am-5pm	Monday - Friday
Visitor	Currituck County Rest Area	Barco	Yes	Yes	Yes	7am-7pm	7 days/week
Visitor	Tanger Outlet	Nags Head	Yes	Yes	Yes	*TBD	7 days/week
Visitor	Visitor Center	Manteo	No	Yes	No	N/A	N/A
Visitor	Duck Research Pier	Duck	No	No	No	N/A	N/A
Visitor	Sea Kove Motel	Kitty Hawk	No	No	No	N/A	N/A
Visitor	Currituck County Visitor Center	Corolla	No	Yes	No	TBD	TBD
Visitor	Currituck County Welcome Center	Moyock	No	No	No	TBD	TBD
Visitor	Monument to a Century of Flight	Kitty Hawk	No	Yes	No	TBD	TBD
Visitor	Wright Brothers National Memorial	Kill Devil Hills	No	Yes	No	TBD	TBD
Visitor	Hampton Inn & Suites	Corolla	No	Yes	No	TBD	TBD
Visitor	The Sanderling	Duck	No	Yes	No	TBD	TBD
Visitor	Realtor – Krista Templeton	Corolla	No	No	No	TBD	TBD
Visitor	Brindley Beach Vacations (Corolla) (Realtor – Doug Brindley	Corolla	No	No	Yes	TBD	TBD
Visitor	Twiddy & Co. (Duck office & Corolla office) Realtor – Jon Summerton	Corolla & Duck	Yes	No	Yes X2	TBD	TBD
Visitor	Realtor – Tim Cafferty	Kitty Hawk	No	No	No	TBD	TBD
Visitor	Realtor – Norman Bibeau	Kitty Hawk	No	No	No	TBD	TBD
Visitor	Realtor – Janice Farr	Kill Devil Hills	No	No	No	TBD	TBD
Resident	Food Lion (all sites)	Corolla, Kitty Hawk	No	Yes	No	N/A	N/A
Resident	Wal-Mart (all sites)	Kitty Hawk, Elizabeth City	No	Yes	No	N/A	N/A
Resident	Harris Teeter (all sites)	Corolla	No	Yes	No	N/A	N/A
Resident	Sea Mark Foods	Kitty Hawk	No	Yes	No	TBD	TBD

Type	Site	City	Permission	Site Visit	Actual Survey Site	Survey Hours	Survey Days
Resident	Food-A-Rama	Manteo	No	Yes	No	TBD	TBD
Both	Public Beaches	Kill Devil Hills	Yes	No	No	7am-7pm	7 days/week
Both	R/C Movie Theater	Kill Devil Hills	No	No	No	TBD	TBD
Both	R/C Movie Theater	Corolla	No	No	No	TBD	TBD
Both	Tim-Buk-Tu	Corolla	Yes	No	Yes	7am-7pm	7 days/week
Both	Duck's Cottage	Duck	No	Yes	No	TBD	TBD
Both	Scarborough Faire	Duck	No	No	No	TBD	TBD
Both	Public Beaches	Corolla	No	Yes	No	TBD	TBD
Both	I Scream Ice Cream	Duck	No	No	No	TBD	TBD
Both	Tommy's Market	Duck	No	Yes	No	TBD	TBD
Both	Starbuck's	Kitty Hawk	No	No	No	TBD	TBD

APPENDIX D: FIELD ASSESSMENT LETTER

STATE OF NORTH CAROLINA
TURNPIKE AUTHORITY

BEVERLY E. PERDUE
GOVERNOR

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

DAVID W. JOYNER
EXECUTIVE DIRECTOR

July 16, 2009

The North Carolina Turnpike Authority (NCTA) needs your help!

The NCTA is studying the Mid-Currituck Bridge project, which includes consideration of a new 7-mile toll bridge that will connect US 158 on the Currituck County mainland across Currituck Sound to NC 12 on the Currituck County Outer Banks. This facility would provide users another option to cross Currituck Sound and would significantly reduce travel times to the northernmost Outer Banks. The project would also reduce traffic congestion on the Wright Memorial Bridge and portions of NC 12 and US 158. Also, the project would reduce hurricane evacuation clearance times.

An important part of the planning effort is to collect information from both area residents and visitors regarding their thoughts on local traffic congestion and the value they put on potential time savings that will be realized by taking the Mid-Currituck Bridge. This data will be used to determine potential user benefits (including reduced travel time and improved travel time reliability to and from your facility) and help NCTA determine how both local residents and visitors value their time. NCTA is requesting your participation and cooperation in this effort.

Consultants from NuStats, a transportation research firm based in Austin, Texas, would like to survey visitors and residents at your facility some time during the week of August 3 and/or August 10, 2009. Your participation in the survey would involve allowing a team of two to four trained interviewers to intercept residents and visitors at mutually agreed-upon locations at your facility and ask them if they would be willing to participate in a short 7-10 minute survey that will be administered on a small, hand-held PDA-type device. Participation is voluntary, and the information collected will only be used for research purposes. If the respondent chooses not to participate, they will be thanked for their time, and the next patron will be approached. If the respondent chooses to participate, the survey will begin.

During Nustats' initial site visit, they would like to identify a site contact and obtain permission to survey at your site. Furthermore, they would like to identify the best locations to intercept the greatest number of respondents (high traffic areas are preferred), the best days of week and times of day for surveying, and answer any questions you may have about the study. Prior to returning to your facility the week of August 3 and/or August 10, 2009 for data collection, Nustats will provide you with a schedule for review and approval.

If you should have any general questions about the Mid-Currituck Project, please contact me at 919-571-3000. If you should have any questions about the data collection, contact Chris Simek, NuStats project manager, at 512-279-4144 or csimek@nustats.com.

Thank you in advance for your cooperation in expanding transportation options in the Outer Banks.

Sincerely,

Jennifer Harris

Jennifer Harris

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

APPENDIX E: WEB SURVEY LETTER

NuStats
A PTV Group Company

206 Wild Basin Road
Building A, Suite 300
Austin, Texas 78746
512.306.9065 Fax: 512.306.9077
www.nustats.com

NuStats, a transportation research firm, is working on the Mid-Currituck Bridge Project, which includes construction of a new 7-mile toll bridge that will connect US 158 on the Currituck County mainland across Currituck Sound to NC 12 on the Currituck County Outer Banks. This facility would provide users another option to cross Currituck Sound and would significantly reduce travel times to the Northernmost Outer Banks. The project would also reduce traffic congestion on the Wright Memorial Bridge and portions of NC 12 and US 158. Also, the project would reduce hurricane evacuation times.

An important part of the planning effort is the collection of data from area residents and visitors regarding their thoughts on local traffic congestion, and the value they put on potential time savings that will be realized by taking the Mid-Currituck Bridge. This data will be used to determine potential user benefit (including reduced travel time and increased travel time reliability) and help determine how both local residents and visitors value their time.

At this time, we are requesting your cooperation in this effort.

Participation is easy. Just click on the web link below and answer a few questions regarding the demographics of your household and your travel in the region.

www.nustats.com/midcurrituck.com

It will only take a few minutes of your time. We assure you that the information you provide will be kept strictly confidential, and will not be sold or given away for marketing purposes.

We ask that you only complete the survey one time, and one time only. We also ask that you complete the survey in the next few days.

If you should have any questions, comments or concerns please contact Chris Simek, NuStats, at 512-279-4144.

NuStats appreciates your participation!

Regards,

Chris Simek
NuStats

APPENDIX F: SURVEY INSTRUMENT

MID CURRITUCK BRIDGE SP SURVEY INSTRUMENT

Note: This questionnaire has been constructed using the following convention – text presented in upper and lower case is read by the interviewer; text in ALL CAPS is not.

Hello, my name is _____. I'm here today on behalf of the North Carolina Turnpike Authority. We're conducting a short survey with residents and visitors regarding a yet to be constructed toll bridge that will span Currituck Sound, connecting the mainland to the Outer Banks. We would very much like to include your opinions in the survey. It will take only a few minutes of your time.

SUGGESTED: The Mid Currituck Bridge will be approximately seven miles in length and will connect US 158 with NC 12 south of Corolla. It will be built as a tolled facility, but the toll has not yet been determined. The bridge should be open to traffic by mid 2013. The Wright Memorial Bridge will remain open as a free alternative. The amount of travel time saved by paying the toll will depend mainly on the levels of traffic congestion on the two bridges.

P0. May we begin the survey?

YES	1
NO (TERMINATE)	2
DK/RF (TERMINATE)	9

SCREENING QUESTIONS

S0. Are you a resident of the region (defined as Dare, Currituck, Camden and Pasquotank counties) or a visitor to the region?

RESIDENT	1
VISITOR	2
DK/RF (TERMINATE)	9

NOTE: CREATE VARIABLE CALLED RTYPE

RTYPE1 = RESIDENTS

RTYPE2 = VISITORS

S00. IF RTYPE1 ASK Have you taken a trip across the Wright Memorial Bridge in the last 3 months?

YES (S1)	1
NO (TERMINATE)	2
DK/RF (TERMINATE)	9

S000. IF RTYPE2 ASK Have you used the Wright Memorial Bridge to travel to the Outer Banks? IF NEEDED The Wright Memorial Bridge is the bridge that connects mainland North Carolina (at Point Harbor, NC) to the Outer Banks (at Kitty Hawk, NC and Southern Shores, NC) via US 158 (also known as North Croatan Highway).

YES (S1)	1
NO (TERMINATE)	2
DK/RF (TERMINATE)	9

S1. Think about the most recent trip you took using the Wright Memorial Bridge across Currituck Sound. What was the purpose of that trip? Was it for: . . .

Business (non commute related such as delivery or attend meeting)	1
Commuting to/from regular workplace	2
Vacation Start/End (i.e. to/from their home residence to/from residence on Outer Banks)	3
Other (all other purposes which don't fit into the above categories)	4
DK/RF (TERMINATE)	9

S2. And to ensure that our survey responses are representative of the wide variety of RTYPE that are found in the region, could you please tell me into which of the following categories your household income falls.

Less than $14,999	1
$15,000 to $24,999	2
$25,000 to $34,999	3
$35,000 to $49,999	4
$50,000 to $74,999	5
$75,000 to $99,999	6
$100,000 to $149,999	7
$150,000 to $199,999	8
$200,000 to $249,999	9
$250,000 and above	10
DK/RF (TERMINATE)	99

REFERENCE TRIP DETAILS

R1. Including yourself, how many persons were in the vehicle?

ONE	1
TWO	2
THREE	3
FOUR	4
FIVE OR MORE	5
DK/RF	9

R2. What type of vehicle were you driving when you made this trip?

PASSENGER CAR, SUV OR PICKUP TRUCK	1
2-AXLE, 6 TYRE TRUCK OR BUS	2
3-AXLE TRUCK OR BUS	3
4-AXLE TRUCK	4
TRUCK WITH 6 OR MORE AXLES	5
MOTORCYCLE	6
DK/RF	9

R3. What day of the week was it?

MONDAY	1
TUESDAY	2
WEDNESDAY	3
THURSDAY	4
FRIDAY	5
SATURDAY	6
SUNDAY	7
DK/RF	9

R4. What time did you start this trip?

RECORD IN MILITARY TIME	1
DK/RF	9

R5. Where did you start this trip?

COLLECT TOWN/CITY, STATE AND ZIP CODE.	1
DK/RF	9

NOTE: AT A MINIMUM, YOU MUST COLLECT CITY/TOWN, IF NOT, TERMINATE.

R6. Where did you end this trip?

Corolla	1
Sanderling	2
Duck	3
Southern Shores	4
Kitty Hawk	5
Kill Devil Hills	6
Collington	7
Nags Head	8
Whale Bone	9
Other (TERMINATE)	99

R7. What time did you arrive at this end location?

RECORD IN MILITARY TIME	1
DK/RF	9

COMPUTE NEW VARIABLE, TRAVEL TIME = R7– R4 [# minutes]

R8. This means that your trip took about [TRAVEL TIME] minutes from start to end. Is this about right?

YES	1
IF NECESSARY COLLECT NEW START/END TIMES<-----NO	2
DK/RF	9

R9: Were you delayed by congestion on this trip when approaching or crossing the Wright Memorial Bridge?

YES	1
NO (SP EXPERIMENT)	2
DK/RF	9

R11. How much extra travel time do you think the congestion at the Wright Memorial Bridge added to your trip? A guess is OK.

ENTER TIME	1
DK/RF	9

MAKE SURE THE ANSWER TO R11 IS LESS THAN TRAVEL TIME

SP TRADE-OFF QUESTIONS

SP TRADE-OFF QUESTIONS: There are four SP questions, with two versions of the wording and response order – Half of the sample will get Version A and half of the sample gets Version B. The difference is the order of the response categories. For each respondent regardless of whether they are given SP Set A or B, there are three random draws- RANDZ = 1 through 3, RANDX = 1 through 4, and RANDY = 1 through 5 for each of the four questions in the set (see the tables below).

Values to use in SP scenarios

Scenario	SP1	SP 2	SP 3	SP 4	SP 5
Toll cost	(TOLL) from Table C	(TOLL) from Table C	(TOLL) from Table C	(TOLL) from Table C	(TOLL) from Table C
Distance saved	(DSAVED) from Table A	(DSAVED) from Table A	(DSAVED) from Table A	(DSAVED) from Table A	(DSAVED) from Table A
Time via existing bridge	Actual (R7 – R4)	Free flow (R7 – R4 – R11)	Random extra (R7 – R4 – R11 + TEXTRA from Table B)	Random extra (R7 – R4 – R11 + TEXTRA from Table B)	Random extra (R7 – R4 – R11 + TEXTRA from Table B)
Time via new bridge	Free flow (R7 – R4 – R11 - TSAVED) from Table A	Free flow (R7 – R4 – R11 - TSAVED) from Table A	Free flow (R7 – R4 – R11 - TSAVED) from Table A	Free flow (R7 – R4 – R11 - TSAVED) from Table A	Free flow (R7 – R4 – R11 - TSAVED) from Table A
Total time saved	TSAVED + R11	TSAVED	TSAVED + TEXTRA	TSAVED + TEXTRA	TSAVED + TEXTRA

Table A1: Derivation for base levels of DSAVED and TSAVED as a function of R6

Destination	**Corolla**	**Sander-ling**	**Duck**	**Souther n Shores**	**South of 158**
Coinjock-Point Harbor on 158	21 miles, 26 min.	21 miles, 26 min.	21 miles, 26 min.	21 miles, 26 min.	21 miles, 26 min.
Wright Memorial Bridge	5 miles, 6 min	5 miles, 6 min	5 miles, 6 min	5 miles, 6 min	5 miles, 6 min
North on Rte. 12	17 miles, 30 min	9 miles, 18 min	4 miles, 7 min	1 mile, 2 min	0
Total via Wright Bridge	**43 miles, 62 min**	**35 miles, 50 min**	**30 miles, 39 min**	**27 miles, 34 min**	**26 miles, 32 min**
Mid-Cuttrick Bridge	8 miles, 9 min	8 miles, 9 min	8 miles, 9 min	8 miles, 9 min	8 miles, 9 min
South on Rte 12	0	8 miles, 12 min	13 miles, 23 min	16 miles, 28 min	17 miles, 30 min
Total via New Bridge	**8 miles, 9 min**	**16 miles, 21 min**	**21 miles, 32 min**	**24 miles, 37 min**	**25 miles, 39 min**
Distance Savings	**35 miles**	**19 miles**	**9 miles**	**3 miles**	**1 mile**
Time Savings	**53 min**	**29 min**	**7 min**	**(3 min)**	**(7 min)**

Table A2: Values for DSAVED and TSAVED as a function of R6 and RANDZ:

Destination	Distance Saved	Time Saved, RANDZ = 1	Time Saved, RANDZ = 2	Time Saved, RANDZ = 3
Corolla	35 miles	50 min	55 min	60 min
Sanderling	20 miles	25 min	30 min	35 min
Duck	10 miles	5 min	10 min	15 min
Southern Shores	3 miles	0 min	5 min	5 min
Kitty Hawk	1 mile	0 min	0 min	5 min
Kill Devil Hills	1 mile	0 min	0 min	5 min
Collington	1 mile	0 min	0 min	5 min
Nags Head	1 mile	0 min	0 min	5 min
Whale Bone	1 mile	0 min	0 min	5 min

Table B: Values for TEXTRA as a function of RANDX

RANDX	SP 1	SP 2	SP 3	SP 4	SP 5
1	0	0	20	10	40
2	0	0	30	40	10
3	0	0	10	20	30
4	0	0	40	30	20

Table C: Values of TOLL as a function of RANDY

RANDY	SP 1	SP 2	SP 3	SP 4	SP 5
1	5	20	15	10	30
2	16	8	4	24	12
3	9	21	15	3	6
4	12	18	30	24	6
5	25	5	10	15	20

Example

Now assume you're making a future trip just like the one that you just told me about. It's a trip on the same day, at the same time of day, for the same purpose, and you're under the same time pressures. When traveling over Currituck Sound, you have the option of using the new Mid Currituck Toll Bridge if you want to. Compared to the existing Wright Memorial Bridge, the new toll bridge would save you a certain amount of driving distance and travel time, depending on your destination on the Outer Banks. In some of the scenarios that follow, you can imagine that there will be additional traffic congestion on the current bridge, in which case the new toll bridge would save you even more time. Let's start with the first choice scenario….

SP1 Trade-off Version A: If you were to use the Wright Memorial Bridge, your trip would take ..... minutes and be free. If you used the new Mid Currituck Bridge you would pay $Y and your trip would take ..... minutes, saving ..... minutes. The journey via the new bridge would be ..... miles shorter avoiding Route 158 through the Currituck peninsula.
Now under these conditions, would you choose to:

Use the new Mid Currituck Bridge, pay [**$Y**] and save [X] minutes	1
Use the Wright Memorial Bridge for free	2
DK	9

SP 1Trade-off Version B: If you were to use the new Mid Currituck Bridge you would pay $Y and your trip would take ..... minutes. If you used the Wright Memorial Bridge, your trip would take ..... minutes, ... minutes longer than the toll bridge, but it would be free. The journey via the Wright Memorial Bridge would be ..... miles longer using Route 158 through the Currituck peninsula.

Now, under these conditions, would you choose to:

Use the Wright Memorial Bridge for free	2
Use the new Mid Currituck Bridge, pay [**$Y**] and save [X] minutes	1
DK	9

[Repeat 4 times values changing]

DEMOGRAPHICS MODULE

Just a few more questions, and we will be done . . . .

T1. What is your preferred method of toll collection?

Cash Pay (Stopping to pay at booth)	1
Electronic Toll Collection (Toll Tag)	2
Mail in Payment Upon Receiving Bill in Mail	3
RF	9

T2. Do you own an electronic toll tag?

YES	1
NO	2
DK/RF	9

T4. –IF RTYPE1 ASK How many times per week do you usually cross the Wright Memorial Bridge?

NONE	1
RECORD INTEGER	2
DK/RF	9

–T5. IF RTYPE2 ASK How many times per week do you think you will cross the Wright Memorial Bridge during your stay on the Outer Banks?

NONE	1
RECORD INTEGER	2
DK/RF	9

T6. The new Mid Currituck Bridge will most likely have a toll payment system that requires you to stop and pay at a toll booth. Would this alter your decision to use the bridge?

YES	1
NO	2
DK/RF	9

T7. IF YES Using a scale of 1 to 5 where 1 is Very Unlikely and 5 is Very Likely, how likely would you be to use the new Mid Currituck Bridge, knowing that you would have to stop and pay at a toll booth?

VERY UNLIKELY	1
UNLIKELY	2
NEITHER LIKELY OR UNLIKELY	3
LIKELY	4
VERY LIKELY	5
DK/RF	9

D1. What is your age?

18 - 24	1
25 - 34	2
35 - 44	3
45 -54	4
55 - 64	5
65 OR OLDER	6
RF	9

D2. How many people, including yourself, currently live in your household?

ONE	1
TWO	2
THREE	3
FOUR OR MORE	4
DK/RF	9

D3. What is your home zip code?

ZIP CODE	1
RF	9

D4. RECORD GENDER (BY OBSERVATION).

MALE	1
FEMALE	2

Thank you very much for your time.

APPENDIX H: SUPPLEMENTARY DATA TABLES – PERCENT WILLINGNESS TO PAY FOR TIME SAVINGS – RESIDENTS AND VISITORS

TABLE H1: PERCENT OF RESIDENTS WILLING TO PAY FOR TIME SAVINGS

PRICE/TIME SAVINGS	0 MIN	5 MIN	10 MIN	15 MIN	20 MIN	25 MIN	30 MIN	35 MIN	40 MIN	45 MIN	50 MIN	55 MIN	60 MIN
$3			51.9%	100.0%	58.3%	50.0%	66.7%	66.7%	65.5%	0.0%	0.0%	0.0%	87.5%
$4			32.6%	50.0%	53.7%	60.0%	52.4%	100.0%	60.0%	0.0%	0.0%	50.0%	75.0%
$5	22.7%	36.4%	66.7%	100.0%	33.3%	50.0%	75.0%	75.0%	75.0%	100.0%	85.7%	92.3%	75.0%
$6			28.0%	33.3%	60.0%	0.0%	47.8%	66.7%	57.6%	40.0%	100.0%	100.0%	86.7%
$8	15.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	62.5%	61.1%	
$9	13.3%	0.0%	0.0%	50.0%	25.0%	33.3%	33.3%	0.0%	0.0%	0.0%	66.7%	89.5%	100.0%
$10			13.2%	0.0%	23.5%	0.0%	16.7%	66.7%	36.8%	66.7%	66.7%	0.0%	57.1%
$12	10.5%	60.0%	9.3%	12.5%	0.0%	25.0%	29.8%	0.0%	34.9%	50.0%	43.8%	57.1%	55.6%
$15			11.6%	0.0%	10.4%	25.0%	18.1%	0.0%	28.6%	28.6%	28.6%	0.0%	50.0%
$16	7.9%	16.7%	0.0%	0.0%	40.0%	40.0%	0.0%	0.0%	0.0%	33.3%	27.3%	42.9%	50.0%
$18	8.7%	0.0%	0.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	22.2%	55.0%	0.0%
$20	7.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	11.8%	17.6%	0.0%
$21	4.2%	9.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	44.0%	21.7%	
$24			1.3%	0.0%	5.2%	0.0%	0.0%	20.0%	6.4%	16.7%	16.7%	16.7%	0.0%
$25	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
$30			2.7%	0.0%	2.6%	0.0%	3.5%	20.0%	10.5%	20.0%	20.0%	0.0%	0.0%

** Note that the range of time savings has been limited to 60 minutes and certain time savings categories have been excluded due to the small number of SP responses pertaining to those combinations.*

TABLE H2: PERCENT OF VISITORS WILLING TO PAY FOR TIME SAVINGS

PRICE/TIME SAVINGS	0 MIN	5 MIN	10 MIN	15 MIN	20 MIN	25 MIN	30 MIN	35 MIN	40 MIN	45 MIN	50 MIN	55 MIN	60 MIN
$3			76.9%	77.8%	86.4%	87.5%	64.7%	100.0%	71.4%	80.0%	100.0%	100.0%	94.7%
$4			35.3%	18.2%	71.4%	54.5%	50.0%	80.0%	62.5%	92.9%	100.0%	100.0%	100.0%
$5	27.9%	34.4%	47.1%	100.0%	0.0%	100.0%	88.9%	80.0%	75.0%	100.0%	95.9%	91.5%	91.3%
$6			43.3%	40.0%	55.6%	60.0%	58.8%	76.2%	72.2%	66.7%	100.0%	100.0%	97.1%
$8	10.4%	9.8%	33.3%	33.3%	33.3%	0.0%	100.0%	100.0%	100.0%	100.0%	87.2%	88.6%	86.4%
$9	14.9%	0.0%	0.0%	0.0%	0.0%	57.1%	57.1%	40.0%	66.7%	100.0%	72.4%	88.2%	76.9%
$10			20.0%	24.0%	29.0%	29.6%	33.3%	47.1%	44.8%	61.5%	83.3%	100.0%	86.4%
$12	15.0%	3.7%	13.8%	12.5%	31.3%	14.3%	20.0%	13.3%	42.3%	30.0%	69.8%	47.4%	72.7%
$15			13.3%	2.9%	20.5%	26.5%	18.0%	13.6%	28.6%	32.0%	66.7%	33.3%	60.6%
$16	7.4%	0.0%	0.0%	0.0%	100.0%	20.0%	0.0%	20.0%	100.0%	100.0%	42.9%	51.9%	62.5%
$18	6.5%	4.9%	0.0%	0.0%	0.0%	33.3%	0.0%	0.0%	0.0%	0.0%	34.0%	41.9%	36.0%
$20	8.5%	4.2%	4.0%	0.0%	0.0%	7.1%	6.3%	0.0%	10.0%	11.1%	33.3%	62.2%	33.3%
$21	6.3%	3.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	30.0%	38.0%	18.8%
$24			3.0%	4.5%	5.1%	0.0%	3.6%	3.7%	6.7%	11.1%	22.2%	22.2%	17.9%
$25	7.7%	5.9%	14.3%	0.0%	50.0%	100.0%	0.0%	0.0%	50.0%	33.3%	25.0%	25.0%	20.0%
$30			3.6%	0.0%	0.0%	4.0%	10.8%	0.0%	5.7%	7.4%	16.7%	0.0%	16.7%

** Note that the range of time savings has been limited to 60 minutes and certain time savings categories have been excluded due to the small number of SP responses pertaining to those combinations.*

APPENDIX I: "TRADERS" AND "NON-TRADERS"

The experimental design of the instrument always provided the respondent the following options from which they were asked to select one:

Use the new Mid-Currituck Bridge, pay [$Y] and save [X] minutes *1*

Use the Wright Memorial Bridge for free *2*

Regardless of the potential time savings of the offered by the new Mid Currituck Bridge, there were respondents who always chose to use the Wright Memorial Bridge. Likewise, regardless of the toll cost, there were respondents who always chose to use the Mid-Currituck Bridge. So, despite variability in time savings and toll cost, these "traders" and "non-traders" have specific preferences and chose their preferred method of crossing Currituck Sound accordingly. Table I1 below provides a summary of the total number of traders and non traders, as well as the corresponding number of usable scenarios collected from these respondents.

As the data suggests, 38-percent (668 out of 1777 respondents (incl. visitors and residents) are non-traders.

This includes 339 visitors and 329 residents. Overall, 38.3 percent (i.e., 3382 out of 8823) scenarios pertain to non-traders.

It should be noted that both the responses from traders and non traders were included in the model, as excluding them would result in biased estimates.

TABLE I1: DECISION TO ALWAYS USE THE NEW BRIDGE VS. DECISION TO ALWAYS USE THE EXISTING BRIDGE – NUMBER OR RESPONDENTS AND NUMBER OF SCENARIOS BY RESPONDENT TYPE

RESPONDENT TYPE	RESPONDENT CHOICE (NUMBER OF RESPONDENTS/ NUMBER OF SCENARIOS)		TOTAL
	ALWAYS CHOOSE NEW BRIDGE	ALWAYS CHOOSE EXISTING BRIDGE	
Residents	50/250	279/1,395	329/1,645
Visitors	156/769	194/968	350/1,737
Total	206/1,019	473/2,363	679/3,382

APPENDIX J: CONFIDENCE INTERVAL ANALYSIS

Tables J1 and J2 provide pre- and post-processing confidence intervals for the survey data using both survey respondent and SP scenario as the unit of analysis.

TABLE J1: CONFIDENCE INTERVAL ANALYSIS WITH SURVEY RESPONDENT AS UNIT OF ANALYSIS

TRIP PURPOSE	TOTAL RESPONDENTS (BEFORE PROCESSING)				TOTAL RESPONDENTS (AFTER PROCESSING)			
	WEB	PDA	TOTAL	CONFIDENCE INTERVAL (AT 95% CI)	WEB	PDA	TOTAL	CONFIDENCE INTERVAL (AT 95% CI)
Business	154	44	198	6.96	150	33	183	7.24
Commuting	85	27	112	9.26	78	22	100	9.80
Vacation	119	21	140	8.28	118	14	132	8.53
Other	262	38	300	5.66	260	28	288	5.77
Total	620	130	750	3.58	606	97	703	3.70

TABLE J2: CONFIDENCE INTERVAL ANALYSIS WITH SP SCENARIO AS UNIT OF ANALYSIS

TRIP PURPOSE	TOTAL SCENARIOS (BEFORE PROCESSING)				TOTAL SCENARIOS (AFTER PROCESSING)			
	WEB	PDA	TOTAL	CONFIDENCE INTERVAL (AT 95% CI)	WEB	PDA	TOTAL	CONFIDENCE INTERVAL (AT 95% CI)
Business	770	220	990	3.11	750	164	914	3.24
Commuting	425	135	560	4.14	390	108	498	4.39
Vacation	595	105	700	3.70	590	70	660	3.81
Other	1310	190	1500	2.53	1300	139	1439	2.58
Total	3100	650	3750	1.60	3030	481	3511	1.65

Appendix H

Willingness to Pay Survey
Independent Review

RSG INC.
TRANSPORTATION

Mid-Currituck Bridge Willingness to Pay Survey Interpretation

Final Report

Prepared for Arup

August
2010

DATA ■ ANALYSIS ■ SOLUTIONS

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1.0 INTRODUCTION

In the summer of 2009, Arup conducted the Mid-Currituck Bridge Stated Preference Travel survey for automobile travelers in the Outer Banks region of North Carolina. The stated preference (SP) travel survey was conducted as part of Arup's work for the Currituck Development Group (CDG) and the North Carolina Turnpike Authority (NCTA).

The NCTA is authorized to study, plan, develop, and undertake preliminary design work on the Mid-Currituck Bridge, a proposed toll facility that would connect US 158 on the Currituck County mainland to NC 12 on the Currituck County Outer Banks. The proposed bridge could reduce congestion on the existing Wright Memorial Bridge and offer faster travel times for many travelers.

The purpose of the SP survey was to estimate values of the toll sensitivity, or "values of time (VOT)," of travelers who currently use the existing Wright Memorial Bridge to travel to the Outer Banks. Estimates of travelers' toll price sensitivities will be used to support Arup's estimates of traffic and toll revenue.

Resource Systems Group (RSG) reviewed the SP survey questionnaire, the experimental design, the choice data, and the sample characteristics and estimated statistical choice models to evaluate the values of time of potential users of the Mid-Currituck Bridge.

This report discusses the SP survey, presents an overview of the data that was collected and the sample characteristics, and describes the choice model estimation that RSG conducted.

2.0 SURVEY QUESTIONNAIRE

The Mid-Currituck Bridge stated preference survey questionnaire employed a commonly-used approach for stated preference surveys where qualifying respondents are asked a series of revealed preference questions about a recent trip they made in the study corridor. These revealed preference questions are followed by a set of stated preference scenarios where respondents are asked to choose from a set of hypothetical travel alternatives under varying travel time and toll cost combinations. The stated preference questions are followed by a final set of household demographic questions for classification purposes.

The survey questionnaire screened for resident respondents who had taken a trip across the Wright Memorial Bridge within the past three months and for visitor respondents who had used the bridge at least once to travel to the Outer Banks. Qualifying respondents were asked to think about their most recent trip across the Wright Memorial bridge as they answered a set of background questions regarding the trip, including trip purpose, vehicle occupancy, vehicle type, day of week, time of day, start and end times, start and end locations, and amount of delay experienced due to congestion (if any).

After the trip background questions, respondents were presented with a set of five stated preference tradeoff scenarios. In these questions, respondents were asked to choose between two travel alternatives for their trip:

1. The existing Wright Memorial Bridge
2. The new Mid-Currituck Bridge

The alternatives were described by attributes of travel time, toll cost, and distance saved. The values of the travel time and toll cost attributes in each scenario varied around a base value according to an experimental design, where the base values were customized using the information from each respondent's reference trip. The values presented for distance saved varied by respondent but were fixed within each set of experiments and were based on the respondent's destination.

In each scenario, respondents were asked to choose the alternative they would most prefer for making their trip in the future based on the values presented. In this way, respondents traded-off the various attributes, expressing their sensitivity to the attributes across a range of values.

Because RSG was not involved in the creation of experimental design, it is difficult to ascertain the exact type of experimental design that was used without further clarification from the survey designers. The design was successful in producing uncorrelated variations in travel time savings and toll costs, which is necessary for estimating statistically significant travel time and toll cost sensitivities independent of each other.

The final set of questions asked about household demographics, trip frequency, ETC transponder ownership, and payment methods.

One final point of note is that the survey questionnaire did not include debrief or opinion questions after the stated preference section. These questions are often included to understand the choices respondents made in the stated preference questions and to identify potential strategic bias.

3.0 SURVEY ADMINISTRATION

The SP survey was fielded in the summer of 2009. Two distinct groups of respondents were targeted: residents (defined as those residing in Dare, Currituck, Camden, or Pasquotank counties) and visitors. The survey was administered using two primary methods:

1. Intercept administration at activity sites in Currituck and Dare counties using PDAs
2. Online administration through local chambers of commerce and advertisements in local newspapers

A total of 2,133 complete surveys were collected, with 1,383 visitors and 750 residents in the final dataset.

4.0 SURVEY DATA

RSG performed a thorough review of the survey data and conducted data cleaning before proceeding with model estimation. This included evaluating the sample characteristics, the stated preference data, and the key variables that were included in the model estimation. The following section presents a brief overview of the data cleaning that was conducted, the characteristics of the remaining survey sample used to estimate the choice models, and the characteristics of the attributes that were tested in the stated preference questions.

4.1 Data Cleaning and Identification of Outliers

The data were screened and filtered to ensure that all observations included in the model estimation represented realistic trips and reasonable trade-offs in the stated preference exercises. RSG identified several types of outliers based on the survey data, including:

- Respondents demonstrating inconsistent choice behavior. These respondents established a certain dollar amount for willingness to pay for travel time savings and then rejected paying less money for equal or more travel time savings in a separate experiment – 74 respondents (370 observations).
- Respondents whose reported travel time was greater than 5 times a calculated travel time or less than 1/5 their calculated travel time – 65 respondents (325 observations).
- Respondents who answered don't know or unsure in the stated preference experiments – 33 respondents (165 observations).

- Respondents with a zero or negative travel time value for an alternative in the SP scenarios – 33 respondents (165 observations).
- Respondents who indicated they experienced a delay on their trip, but reported zero minutes of delay – 12 respondents (60 observations).
- Respondents classified as visitors who reported a work commute trip – 4 respondents (20 observations).

The methods used to identify outliers are not mutually exclusive such that any given respondent could be identified as an outlier in multiple categories. Based on this outlier analysis, a total of 1,928 respondents (9,640) observations were included in the dataset used in model estimation. The initial dataset before removing outliers is shown in Figure 1, while Figure 2 presents the dataset after removing outliers.

Figure 1: Sample Prior to Removing Outliers

	Business		Commute		Vacation		Other		
Income	Res.	Visitor	Res.	Visitor	Res.	Visitor	Res.	Visitor	Total
Less than $14,999	2	0	2	0	2	15	7	5	33
$15,000 - $24,999	5	2	3	0	2	27	7	2	48
$25,000 - $34,999	21	5	9	1	4	45	19	2	106
$35,000 - $49,999	22	2	18	1	7	112	28	5	195
$50,000 - $74,999	38	4	30	0	12	189	68	5	346
$75,000 - $99,999	40	5	18	0	33	213	73	5	387
$100,000 - $149,999	37	4	17	2	29	267	65	15	436
$150,000 - $199,999	11	2	9	0	14	223	18	6	283
$200,000 - $249,999	13	2	5	0	12	92	4	4	132
$250,000 and above	9	3	1	0	25	116	11	2	167
Total	198	29	112	4	140	1299	300	51	2133

Figure 2: Sample after Removing Outliers

	Business		Commute		Vacation		Other		
Income	Res.	Visitor	Res.	Visitor	Res.	Visitor	Res.	Visitor	Total
Less than $14,999	2	0	2	0	0	14	2	5	25
$15,000 - $24,999	5	1	0	0	1	23	7	1	38
$25,000 - $34,999	16	4	7	0	3	41	16	2	89
$35,000 - $49,999	17	2	12	0	7	107	24	4	173
$50,000 - $74,999	28	4	28	0	9	171	61	3	304
$75,000 - $99,999	32	5	17	0	27	193	65	4	343
$100,000 - $149,999	33	3	17	0	27	248	64	15	407
$150,000 - $199,999	9	2	7	0	14	212	16	4	264
$200,000 - $249,999	12	1	4	0	12	88	4	4	125
$250,000 and above	9	2	1	0	24	111	11	2	160
Total	163	24	95	0	124	1208	270	44	1928

4.2 Sample Characteristics

After data cleaning and outlier analysis, the final survey sample consisted of 652 resident respondents and 1,276 visitor respondents. Most visitor trips across the Wright Memorial Bridge (95%) were for the purpose of beginning or ending a vacation stay, while resident trips were more evenly distributed among work and non-work purposes. About two-thirds of visitor trips in the sample were made on a weekend, while only one-third of resident trips were made on a weekend.

Figure 3 presents the distribution of trip purpose by respondent type for both weekday and weekend trips.

Figure 3: Total Responses by Trip Purpose, Day of Week, and Respondent Type*

Day of Week	Trip purpose	Resident	Visitor	Total
Weekday	Business (non commute)	126	17	143
	Commuting to regular workplace	72	0	72
	Vacation start/end	58	377	435
	Other	149	34	183
	Total	405	428	833
Weekend	Business (non commute)	28	5	33
	Commuting to regular workplace	21	0	21
	Vacation start/end	61	826	887
	Other	98	7	105
	Total	208	838	1046
Day of week not available	Business (non commute)	9	2	11
	Commuting to regular workplace	2	0	2
	Vacation start/end	5	5	10
	Other	23	3	26
	Total	39	10	49
	Grand Total	652	1276	1928

* Responses after data cleaning

The survey questionnaire collected information about the origin and destination for each trip. Respondents whose trips began or ended in the Outer Banks provided the name of the town in which their trip began or ended. The city, state, and ZIP code were collected for origins and destinations outside of the Outer Banks. RSG used this information to geocode the origin and destination locations to a city centroid level of accuracy. Given the length of trips in the sample, this level of accuracy is sufficient for macro-level analyses. Once geocoded to the city level, travel time and trip distances were estimated using software employing Google Maps technology. RSG was able to geocode both the origin and destination 87% of the sample. The remaining 13% of the sample did not contain sufficient location information to obtain an accurate geocode. These respondents were assigned the median travel time and trip distance according to their specific market segment. Figure 4 shows a subset of the origins and destinations located near the study area, and Figure 5 shows the density of trip origins at a county level for origins located near the study area.

Figure 4: Trip Origins and Destinations

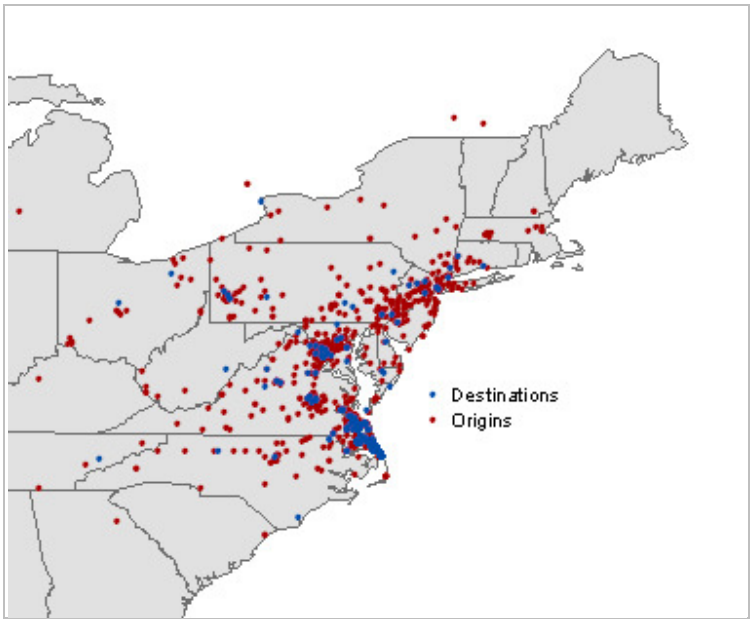
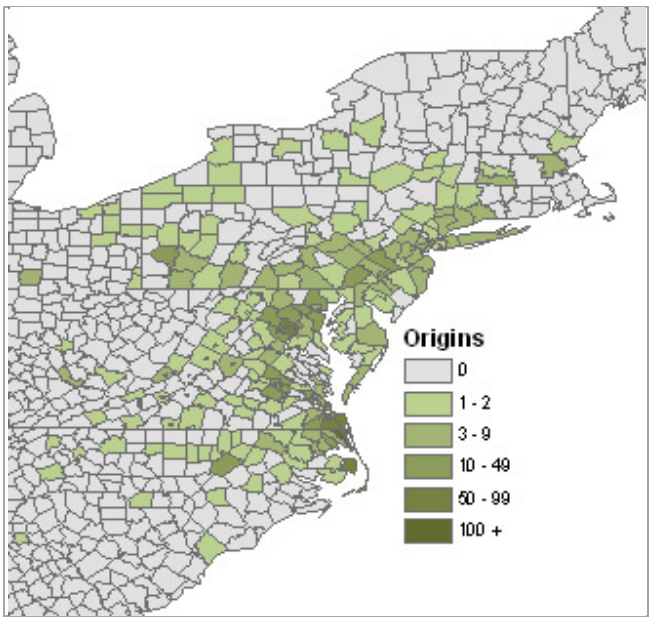


Figure 5: Origin Density



Trips made by visitors were generally longer than resident trips in both distance and travel time. In particular, the median distance of visitor vacation trips, the largest visitor trip purpose segment, was nearly 300 miles, with a corresponding median travel time of nearly five and one-quarter hours. Figure 6 shows the mean and median trip distances for residents and visitors by trip purpose, while Figure 7 presents the distribution of trip distances for residents and visitors.

Figure 6: Estimated Trip Distance by Segment (miles)

	Resident		Visitor	
	Mean	Median	Mean	Median
Business	89	54	189	87
Commute	47	41	--	--
Vacation	260	291	292	275
Other	87	55	213	185
All Purposes	115	55	290	275

Figure 7: Estimated Trip Distance by Respondent Type

Estimated Trip Distance	Resident	Visitor	Total
Less than 25 miles	12%	0%	4%
25 to 49.99 miles	22%	1%	8%
50 to 74.99 miles	28%	4%	12%
75 to 99.99 miles	13%	11%	12%
100 to 199.99 miles	6%	15%	12%
200 to 299.99 miles	6%	36%	26%
300 miles or more	12%	33%	26%
Total	100%	100%	100%

The travel times reported by respondents were consistent with the calculated trip distances, with 53% of visitor trips taking six hours or longer (Figure 8).

Figure 8: Reported Travel Time by Respondent Type

Travel time	Resident	Visitor	Total
Less than 1 hour	20%	1%	7%
1 hour to less than 2 hours	33%	5%	14%
2 hours to less than 4 hours	22%	21%	21%
4 hours to less than 6 hours	10%	21%	17%
6 hours or more	16%	53%	40%
Total	100%	100%	100%

Respondents were classified as northern or southern Outer Banks trips depending on where their trip began or ended. Northern Outer Banks trips are classified as trips beginning or ending in Duck, Sanderling, Corolla, or the Outer Banks 4WD (or 4x4) area. Trips to these areas would realize the most travel time and distance savings from the Mid-Currituck Bridge compared to the existing Wright Memorial Bridge. Overall, 62% of the sample was classified as northern Outer Banks (Figure 9).

Figure 9: Northern/Southern Classification by Respondent Type

Northern/Southern Classification	Resident	Visitor	Total
Southern	48%	33%	38%
Northern	52%	66%	62%
Total	100%	66%	100%

Visitors reported higher vehicle occupancy than residents. This is consistent with the higher occupancies expected for vacation trip purposes (Figure 10).

Figure 10: Vehicle Occupancy by Respondent Type

Vehicle occupancy	Resident	Visitor	Total
1	33%	7%	16%
2	44%	34%	37%
3	10%	17%	15%
4	9%	25%	20%
5 or more	4%	17%	13%
Total	100%	100%	100%

Forty-nine percent of residents and 54% of visitors in the sample reported having an ETC transponder in their vehicle. Residents that took the web survey reported transponder ownership at a much higher proportion than did those who participated via the PDA intercept survey (53 percent versus 21 percent, respectively).

Upon examination of several other data sources, 49 percent does not seem to be an accurate estimate for the residential population. The project team believes that the actual percentage of residents that own toll tags is much closer to 21 percent than 49 percent. This figure is in-line with a study conducted in 2007 on US 158 in Currituck, NC that observed 29.4% of average annual daily traffic with an ETC transponder.

Figure 11: ETC Ownership by Respondent Type

ETC Ownership	Resident	Visitor	Total
Own ETC Transponder	49%	54%	52%
Do Not Own ETC Transponder	51%	46%	48%
Total	100%	100%	100%

Visitors had a higher median annual household income than residents in the sample, with the median resident household income falling in the range of $75,000 to $99,999 per year and the median visitor household income in the $100,000 to $150,000 per year. One-third of visitors reported a household income of $150,000 per year or more (Figure 12).

Figure 12: Household Income by Respondent Type

Income	Resident	Visitor	Total
Less than $25,000	3%	3%	3%
$25,000 - $49,999	16%	13%	14%
$50,000 - $74,999	19%	14%	16%
$75,000 - $99,999	22%	16%	18%
$100,000 - $149,999	22%	21%	21%
$150,000 - $199,999	7%	17%	14%
$200,000 or more	12%	16%	15%
Total	100%	100%	100%

4.3 Choice Data Characteristics

RSG evaluated the choice data to determine the travel time savings, distance savings, and toll costs that were presented to respondents in the stated preference scenarios. Understanding the ranges of each attribute presented in the SP scenarios is important when evaluating respondent behavior and the results of the choice model estimation.

4.3.1 Evaluation of Attribute Values

The travel time savings presented to respondents for the proposed Mid-Currituck Bridge varied significantly within the sample, from zero minutes of travel time savings in many scenarios to more than 200 minutes. In particular, the values of travel time savings for southern Outer Banks trips were much smaller than the values for northern Outer Banks trips (Figure 13). This is because the time savings were tailored to the specific trip each respondent made based on their destination on the Outer Banks. Respondents making trips to southern destinations would experience less time savings than those making trips to northern destinations, and this was reflected in the tradeoff scenarios.

Figure 13: Mid-Currituck Bridge Travel Time Savings Shown by Northern vs. Southern Outer Banks

Travel Time Savings	Southern	Northern	Total
No travel time savings	27%	6%	14%
1 to 15 minutes	21%	8%	13%
15 to 29 minutes	19%	8%	12%
30 to 44 minutes	28%	10%	17%
45 to 59 minutes	3%	20%	14%
60 minutes or more	2%	48%	30%
Total	100%	100%	100%

More than one-quarter (27%) of southern Outer Banks scenarios presented respondents with no travel time savings on the Mid-Currituck Bridge. As stated above, this is a realistic scenario for many trips to the southern Outer Banks trips where the proposed Mid-Currituck Bridge would provide no travel time savings compared to, or even take longer than, the Wright Memorial Bridge. However, this is somewhat inefficient from a survey design perspective, as little useful information about travel time sensitivity can be obtained when respondents are asked to choose between two options with equal travel times.

In contrast to the southern Outer Banks respondents, northern Outer Banks respondents were presented with significant time savings on the Mid-Currituck Bridge. Nearly 50% of the scenarios presented a time savings of 1 hour or more.

While the time savings differed greatly between northern and southern Outer Banks trips, the toll costs presented remained the same, resulting in a large difference in the value of time tradeoffs presented in each stated preference scenario. Forty-six percent of southern Outer Banks scenarios presented VOT tradeoffs of $30/hr or more, while only 19% of northern Outer Banks scenarios presented VOT tradeoffs of $30/hr or more (Figure 14). Note that this does not imply that southern Outer Banks respondents have a higher value of time than northern Outer Banks respondents, only that they were presented with more high-value tradeoffs in the SP scenarios as a result of the survey design. However, a significantly higher proportion of northern respondents chose the tolled route compared with southern respondents (as shown in Figure 15).

Figure 14: Value of Time Tradeoffs Presented in Stated Preference Scenarios by Northern and Southern Outer Banks

Boundary VOT Tradeoff	Southern	Northern	Total
Less than 15 $/hr	15%	46%	34%
15 to 29 $/hr	13%	29%	23%
30 to 44 $/hr	14%	7%	9%
45 to 59 $/hr	7%	2%	4%
60 $/hr or more	25%	10%	15%
No travel time difference	27%	6%	14%
Total	100%	100%	100%

4.3.2 Evaluation of Choices

Overall, 39% of choices in all tradeoff scenarios were for the Mid-Currituck Bridge. Northern Outer Banks respondents chose the Mid-Currituck Bridge alternative much more often than southern Outer Banks respondents as shown in Figure 15.

Figure 15: Alternative Choice by Northern vs. Southern Outer Banks

% Choice	Southern	Northern	Total
Wright Memorial Bridge	81%	49%	61%
Mid-Currituck Bridge	19%	51%	39%
Total	100%	100%	100%

The difference in choice is likely a result of the greater travel time savings for northern Outer Banks respondents. However, even when presented with similar amounts of time savings, northern Outer Banks respondents were more likely to choose the Mid-Currituck Bridge than southern Outer Banks respondents (Figure 16). This indicates a difference in preference for the Mid-Currituck Bridge that cannot be explained by travel time savings alone.

Figure 16: Percent of Choice for the Mid-Currituck Bridge by Time Savings Shown

Travel Time Savings for Mid-Currituck Bridge	% Chose Mid-Currituck	
	Southern	Northern
No time savings	6%	29%
Less than 15 minutes	12%	22%
15 to 29 minutes	22%	29%
30 to 44 minutes	31%	42%
45 to 59 minutes	42%	55%
60 minutes or more	58%	62%

Southern Outer Banks respondents were significantly more likely to choose the Wright Memorial Bridge alternative in all five SP scenarios, and northern Outer Banks respondents were more likely to choose the Mid-Currituck alternative in all five SP scenarios (Figure 17).

Figure 17: Invariance by Northern vs. Southern Outer Banks

Invariance	Southern	Northern	Total
Variant	49%	70%	62%
Always chose Mid-Currituck Bridge	4%	18%	13%
Always chose Wright Memorial Bridge	47%	12%	25%
Total	100%	100%	100%

The level of invariance for southern Outer Banks trips is not surprising given the low travel time savings and high tolls that were presented to them in the choice experiments. As the survey questionnaire did not include follow-up questions after the stated preference experiments, it is not possible to determine the precise reasons for their choice behavior.

5.0 MODEL ESTIMATION

Statistical analysis and discrete choice model estimation were carried out using the stated preference survey data. Responses from the stated preference experiments were expanded into a dataset containing five observations for each respondent. The statistical estimation and specification testing were completed using a conventional maximum likelihood procedure that estimated a set of coefficients for a multinomial logit (MNL) [1] model for each market segment. The model coefficients provide information about the relative importance of travel time and toll cost that can be used to infer travelers' VOT.

5.1 Segmentation

RSG estimated models for the specific market segments requested by the project team. The base-line models requested by the project team were segmented by trip purpose and included:

1. Business trips (residents and visitors)

[1] The multinomial logit model has the general form $p(i) = \frac{e^{U_i}}{\sum_{AllModes} e^{Uj}}$, where *p(i)* is the probability that mode i will be chosen and U_i is the "utility" of mode i, a function of service and other variables. See, for example, M. E. Ben-Akiva and S. R. Lerman, *Discrete Choice Analysis*, MIT Press, 1985, for details on the model structure and statistical estimations procedures.

2. Commute trips (residents only)
3. Vacation trips (visitors only[1])
4. Other trips (residents and visitors)

In addition to the four trip purpose segments, the project team was interested in conducting several other sensitivity tests to evaluate behavioral differences among different traveler segments, including:

- Northern and southern Outer Banks trips
- Congested and uncongested trips
- Household income
- Non-traders

Many of these sensitivity tests were conducted by further segmenting the models to evaluate the differences. These tests are described in more detail in the sections below.

5.2 Baseline Model Specification

Several utility equation structures were tested using the variables included in the stated preference scenarios, as well as trip characteristic and demographic variables. Specification testing included evaluation of various alternative-specific constants, transformations of the auto travel time and toll cost variables by household income, vehicle occupancy, and travel distance.

All baseline models include coefficients for travel time and toll cost. The toll cost coefficient was initially segmented by household income to identify how cost sensitivity varied with household income. In the final model specification, the toll cost coefficients for the commute, other, and business model segments were divided by the natural log of household income. A separate toll cost elasticity coefficient was estimated for the vacation trip purpose, which resulted in a better model fit for this segment (Figure 18). The business and other model segments include separate toll route constants for residents and visitors while the commute and vacation model segments include a single toll constant for residents and visitors, respectively.

Figure 18: Income Elasticity Estimate for Vacation Trips

$$V_i = \cdots + \beta_c * C_i * \left(\frac{inc}{\overline{inc}} \right)^{\lambda_{c,inc}} + \ldots$$

Where:

- C_i gives the toll cost of alternative i
- inc gives the household income for the current respondent, with $\overline{inc}$ giving the base value, the mean household income for the sample

The remaining terms are estimated in the model:

- The term β_c is the cost sensitivity (in 1/$)
- The interaction term $\lambda_{c,inc}$ gives the cost elasticity in relation to income

[1] For the purposes of model estimation, respondents who classified themselves as residents making vacation trips were assumed to be visitors.

5.3 Baseline Model Results

The coefficient values and t-statistics are presented below for each model segment. The statistics for each model include the number of observations, log-likelihood values, the number of estimated parameters, rho-squared (a model-fit measure) and adjusted rho-squared (another model fit measure that incorporates the number of estimated parameters). Finally, the value of time for each model segment is shown at $25,000 household income intervals.

5.3.1 Vacation Trip Purpose Model Results

Figure 19: Vacation Trip Purpose Model Coefficients

			Alternatives		Coefficients	
Coefficient	**Description**	**Units**	**Current**	**New**	**Value**	**T-Test(0)**
ϐTime	Travel Time	Minutes	X	X	-0.0361	-29.59
*ϐCost**	Toll Cost	Dollars		X	-0.171	-34.48
ϐTollConstant	Toll Route Constant for Visitors	(0,1)		X	0.535	7.01
λIncome	Toll Cost - Income Elasticity	(0,1)		X	-0.301	-16.57

Fit Statistic	**Value**	**Income**	**VOT**
# estimated parameters:	4	$25,000	$7.74
# observations:	6660	$50,000	$9.54
# individuals:	1332	$75,000	$10.78
Null log-likelihood:	-4616.36	$100,000	$11.75
Cte log-likelihood:	-4577.148	$125,000	$12.57
Final log-likelihood:	-3008.573	$150,000	$13.28
Rho-square:	0.348	$175,000	$13.91
Adjusted rho-square:	0.347	$200,000	$14.48

**Toll cost is multiplied by [(household income/average household income)^λIncome]*

5.3.2 Other Trip Purpose Model Results

Figure 20: Other Trip Purpose Model Coefficients

			Alternatives		Coefficients	
Coefficient	**Description**	**Units**	**Current**	**New**	**Value**	**T-Test(0)**
βTime	Travel Time	Minutes	X	X	-0.0318	-11.26
βCost*	Toll Cost	Dollars		X	-1.83	-13.98
βTollConstantRes	Toll Route Constant for Residents	(0,1)		X	-0.173	-1.19
βTollConstantVis	Toll Route Constant for Visitors	(0,1)		X	0.228	0.96

Fit Statistic	**Value**	**Income**	**VOT**
# estimated parameters:	4	$25,000	$10.56
# observations:	1570	$50,000	$11.28
# individuals:	314	$75,000	$11.70
Null log-likelihood:	-1088.241	$100,000	$12.00
Cte log-likelihood:	-863.115	$125,000	$12.24
Final log-likelihood:	-640.398	$150,000	$12.43
Rho-square:	0.412	$175,000	$12.59
Adjusted rho-square:	0.408	$200,000	$12.73

**Toll cost is divided by the natural log of household income*

5.3.3 Business Trip Purpose Model Results

Figure 21: Business Trip Purpose Model Coefficients

Coefficient	Description	Units	Alternatives		Coefficients	
			Current	New	Value	T-Test(0)
βTime	Travel Time	Minutes	X	X	-0.0221	-7.21
βCost*	Toll Cost	Dollars		X	-1.23	-9.53
βTollConstantRes	Toll Route Constant for Residents	(0,1)		X	-0.139	-0.80
βTollConstantVis	Toll Route Constant for Visitors	(0,1)		X	-0.179	-0.62
Fit Statistic		**Value**		**Income**		**VOT**
# estimated parameters:		4		$25,000		$10.92
# observations:		935		$50,000		$11.66
# individuals:		187		$75,000		$12.10
Null log-likelihood:		-648.093		$100,000		$12.41
Cte log-likelihood:		-560.166		$125,000		$12.65
Final log-likelihood:		-475.239		$150,000		$12.85
Rho-square:		0.267		$175,000		$13.01
Adjusted rho-square:		0.261		$200,000		$13.16

**Toll cost is divided by the natural log of household income*

5.3.4 Commute Trip Purpose Model Results

Figure 22: Commute Trip Purpose Model Coefficients

Coefficient	Description	Units	Alternatives		Coefficients	
			Current	New	Value	T-Test(0)
βTime	Travel Time	Minutes	X	X	-0.0145	-4.00
βCost*	Toll Cost	Dollars		X	-1.01	-5.90
βTollConstant	Toll Route Constant for Residents	(0,1)		X	-0.173	-0.760
Fit Statistic		**Value**		**Income**		**VOT**
# estimated parameters:		3		$25,000		$8.72
# observations:		475		$50,000		$9.32
# individuals:		95		$75,000		$9.67
Null log-likelihood:		-329.245		$100,000		$9.92
Cte log-likelihood:		-283.521		$125,000		$10.11
Final log-likelihood:		-256.52		$150,000		$10.27
Rho-square:		0.221		$175,000		$10.40
Adjusted rho-square:		0.212		$200,000		$10.51

**Toll cost is divided by the natural log of household income*

5.4 Value of Time

The marginal rate of substitution of the travel time coefficient and toll cost coefficient provides an estimate of the monetary value that travelers place on travel time, commonly referred to as the value of time. Similarly, the marginal rate of substitution of the toll constant and toll cost coefficient can provide an estimate of the monetary value of the uncalibrated toll constant. The formulas for calculating the value of time and value of the toll constant are presented below in Figure 23 through Figure 26. Because the vacation segment incorporated a different transformation of toll cost by household income than the other trip purpose segments (described in more detail in section 5.2), the formulas for calculating the marginal rate of substitution are slightly different.

Figure 23: Value of Time Calculation for the Vacation Segment

$$VOT = \frac{60 * \beta Time}{\beta Cost * \left(\frac{income}{128{,}277}\right)^{\lambda Income}}$$

Figure 24: Value of Constant Calculation for the Vacation Segment

$$VOC = \frac{\beta TollConstant}{\beta Cost * \left(\frac{income}{128{,}277}\right)^{\lambda Income}}$$

Figure 25: Value of Time Calculation for the Other, Commute, and Business Segments

$$VOT = \frac{60 * \beta Time}{\beta Cost} * LN(income)$$

Figure 26: Value of Constant Calculation for the Other, Commute and Business Segments

$$VOC = \frac{\beta TollConstant}{\beta Cost} * LN(income)$$

Figure 27 presents a summary of the value of time (labeled VOT) and value of toll constant (labeled VOC) estimates by trip purpose. Negative values are shown in parentheses. Because sensitivity to cost varies with income in the models, the values are presented across a range of household income levels.

Figure 27: Value of Time and Value of Toll Constant Summary

		Annual Household Income			
Trip Purpose	Calculation	$50,000	$100,000	$150,000	$200,000
Vacation	VOT ($/hr)	$ 9.54	$ 11.75	$ 13.28	$ 14.48
	VOC Resident ($)	--	--	--	--
	VOC Visitor ($)	$ 2.36	$ 2.90	$ 3.28	$ 3.58
Other	VOT ($/hr)	$ 11.28	$ 12.00	$ 12.43	$ 12.73
	VOC Resident ($)	$ (1.02)	$ (1.09)	$ (1.13)	$ (1.15)
	VOC Visitor ($)	$ 1.35	$ 1.43	$ 1.48	$ 1.52
Business	VOT ($/hr)	$ 11.66	$ 12.41	$ 12.85	$ 13.16
	VOC Resident ($)	$ (1.22)	$ (1.30)	$(1.35)	$ (1.38)
	VOC Visitor ($)	$ (1.57)	$ (1.68)	$(1.73)	$ (1.78)
Commute	VOT ($/hr)	$ 9.32	$ 9.92	$ 10.27	$ 10.51
	VOC Resident ($)	$ (1.85)	$ (1.97)	$(2.04)	$(2.09)
	VOC Visitor ($)	--	--	--	--

5.5 Additional Sensitivity Tests

Additional sensitivity tests were conducted to evaluate behavioral differences between northern and southern Outer Banks trips, the impact of traffic congestion on choice behavior, and the impact of non-traders on the coefficient estimates. RSG estimated these models and coefficients where the sample sizes were large enough to support the specifications.

5.5.1 Northern and Southern Outer Banks Trips

Using the above models as a baseline for further segmentation, RSG estimated separate models for northern and southern Outer Banks trips. The sample size of the business and commute segments did not support further segmentation by northern and southern trips.

Northern Outer Banks respondents are less time-sensitive than southern Outer Banks respondents, resulting in a lower value of time for northern trips. However, northern respondents are much more likely to choose the new toll bridge, resulting in a much more positive estimate of the toll constant. This result makes intuitive sense; the southern respondents who choose the new bridge are very time-sensitive as the new bridge offers very little travel time savings over the existing Wright Memorial Bridge for a high toll. However, fewer southern respondents choose the toll bridge overall, resulting in a large negative toll constant. The result of this difference in the value of the toll constant is that despite the higher value of time for southern trips in the sample, the overall market share for the new bridge is lower for southern trips than for northern trips.

5.5.2 Congested and Uncongested Travel Time

The project team was also interested in evaluating the impact of traffic congestion and delay on behavioral response. This was achieved by segmenting the travel time coefficient by those respondents who experienced delay due to traffic congestion on their reported trip and those who did not experience delay. The commute segment did not support further segmentation by delay.

In general, respondents who experienced congestion and delay on their trip were more time-sensitive than those respondents who did not experience delay, as exhibited by the larger negative magnitude of the delay travel time coefficient. The result is a higher aggregate value of time for congested travel time. This value is approximately 11% higher for the aggregate sample, although it varies considerably among the market segments.

5.5.3 Non-trading Respondents

Stated Preference datasets commonly contain non-traders. That is, respondents who choose the same alternative in each stated preference scenario regardless of the travel time or toll cost values presented to them. This is not unexpected behavior; in actuality there are some travelers who will choose to always travel on a toll facility and others who will choose to never travel on a toll facility. There are a number of reasons why travelers behave this way. They could choose to always use the toll facility because they have a very high value of time, or they feel the toll facility is faster, better maintained, or safer. They could choose to never use the toll facility because they have a very low value of time, they don't like paying tolls, they have some inertia to changing their route, or they are opposed to the project in general. In the absence of follow-up questions to the SP scenarios, it is impossible to know why a respondent always chose the Mid-Currituck Bridge or always chose the Wright Memorial Bridge in this survey. Removing the invariants from model estimation will have some impact on the coefficient estimates. For example, removing the respondents who always chose the toll-free alternative will result in a somewhat larger (more positive) toll constant, while removing the respondents who always chose the toll alternative will result in a somewhat smaller (more negative) toll constant. However, removing some or all invariants from the SP dataset is an arbitrary process that is difficult to defend and is not recommended.

5.6 Sensitivity Test Results

RSG estimated models and coefficients with segmentation by reported delay and destination on the Outer Banks where the sample sizes were large enough to support the specifications. Figure 28 details the models that supported these specification tests.

Figure 28: Sensitivity Tests Conducted

Trip purpose	Baseline Model	Delay/No Delay Segmentation	North/South Segmentation
Vacation Trips	X	X	X
Other Trips	X	X	X
Business Trips	X	X	
Commute Trips	X		

The results of these sensitivity tests are presented below in Figure 29 through Figure 34. As with the baseline model specification, the toll cost was interacted with household income for each segment, and a toll route constant was estimated to capture the average effect of all unspecified parameters on choice.

5.6.1 Vacation Trip Purpose Sensitivity Test Results

The vacation and other trip purpose segments were large enough to support segmentation by both delay and northern vs. southern Outer Banks trips. Two travel time coefficients were estimated, one for delayed trips and one for trips with no delay. The vacation trip segment includes an income elasticity coefficient to capture the sensitivity of toll cost in relation to income. The toll cost coefficient was divided by the natural logarithm of household income for the other trip segment.

Figure 29: Northern Vacation Trips with Delay and No Delay Travel Time Coefficients

			Alternatives		Coefficients	
Coefficient	**Description**	**Units**	**Current**	**New**	**Value**	**T-Test(0)**
βTTDelay	Delay Travel time	Minutes	X	X	-0.0288	-17.67
βTTNoDelay	No Delay Travel time	Minutes	X	X	-0.025	-15.97
βCost*	Toll Cost	Dollars		X	-0.167	-30.11
βTollConstant	Toll Route Constant	(0,1)		X	1.28	11.93
λIncome	Toll Cost - Income Elasticity	(0,1)		X	-0.301	-15.15

			VOT	
Fit Statistic	**Value**	**Income**	**Delay**	**No Delay**
# estimated parameters:	5	$25,000	$ 6.17	$5.36
# observations:	4550	$50,000	$ 7.61	$6.60
# individuals:	910	$75,000	$ 8.59	$7.46
Null log-likelihood:	-3153.82	$100,000	$ 9.37	$8.13
Cte log-likelihood:	-3128.242	$125,000	$10.02	$8.70
Final log-likelihood:	-2174.424	$150,000	$10.59	$9.19
Rho-square:	0.311	$175,000	$11.09	$9.63
Adjusted rho-square:	0.309	$200,000	$11.54	$10.02

**Toll cost is multiplied by [(household income/average household income)^λIncome]*

Figure 30: Southern Vacation Trips with Delay and No Delay Travel Time Coefficients

Coefficient	Description	Units	Alternatives		Coefficients	
			Current	New	Value	T-Test(0)
βTTDelay	Delay Travel time	Minutes	X	X	-0.049	-9.61
βTTNoDelay	No Delay Travel time	Minutes	X	X	-0.0412	-10.01
βCost*	Toll Cost	Dollars		X	-0.205	-16.43
βTollConstant	Toll Route Constant	(0,1)		X	0.0914	0.61
λIncome	Toll Cost - Income Elasticity	(0,1)		X	-0.159	-3.48

Fit Statistic	Value	Income	VOT	
			Delay	No Delay
# estimated parameters:	5	$25,000	$10.92	$9.18
# observations:	2110	$50,000	$12.19	$10.25
# individuals:	422	$75,000	$13.00	$10.93
Null log-likelihood:	-1462.541	$100,000	$13.61	$11.44
Cte log-likelihood:	-1097.426	$125,000	$14.10	$11.86
Final log-likelihood:	-764.642	$150,000	$14.52	$12.21
Rho-square:	0.477	$175,000	$14.88	$12.51
Adjusted rho-square:	0.474	$200,000	$ 15.20	$12.78

**Toll cost is multiplied by [(household income/average household income)^λIncome]*

5.6.2 Other Trip Purpose Sensitivity Test Results

Figure 31: Northern Other Trips with Delay and No Delay Travel Time Coefficients

Coefficient	Description	Units	Alternatives		Coefficients	
			Current	New	Value	T-Test(0)
βTTDelay	Delay Travel time	Minutes	X	X	-0.0302	-5.96
βTTNoDelay	No Delay Travel time	Minutes	X	X	-0.0171	-5.24
βCost*	Toll Cost	Dollars		X	-1.98	-11.76
βTollConstant	Toll Route Constant	(0,1)		X	0.914	4.38

Fit Statistic	Value	Income	VOT	
			Delay	No Delay
# estimated parameters:	4	$25,000	$9.27	$5.25
# observations:	755	$50,000	$9.90	$5.61
# individuals:	151	$75,000	$10.27	$5.82
Null log-likelihood:	-523.326	$100,000	$10.54	$5.97
Cte log-likelihood:	-492.286	$125,000	$10.74	$6.08
Final log-likelihood:	-364.738	$150,000	$10.91	$6.18
Rho-square:	0.303	$175,000	$11.05	$6.26
Adjusted rho-square:	0.295	$200,000	$11.17	$6.32

**Toll cost is divided by the natural log of household income*

Figure 32: Southern Other Trips with Delay and No Delay Travel Time Coefficients

Coefficient	Description	Units	Alternatives		Coefficients	
			Current	New	Value	T-Test(0)
βTTDelay	Delay Travel time	Minutes	X	X	-0.0543	-4.91
βTTNoDelay	No Delay Travel time	Minutes	X	X	-0.0571	-6.84
βCost*	Toll Cost	Dollars		X	-1.79	-7.71
βTollConstant	Toll Route Constant	(0,1)		X	-1.18	-4.43

Fit Statistic	Value	Income	VOT	
			Delay	No Delay
# estimated parameters:	4	$25,000	$18.43	$19.38
# observations:	815	$50,000	$19.69	$20.71
# individuals:	163	$75,000	$20.43	$21.48
Null log-likelihood:	-564.915	$100,000	$20.95	$22.04
Cte log-likelihood:	-313.094	$125,000	$21.36	$22.46
Final log-likelihood:	-238.457	$150,000	$21.69	$22.81
Rho-square:	0.578	$175,000	$21.97	$23.11
Adjusted rho-square:	0.571	$200,000	$22.22	$23.36

**Toll cost is divided by the natural log of household income*

5.6.3 Business Trip Purpose Sensitivity Test Results

Figure 33: Business Trips with Delay and No Delay Travel Time Coefficients

Coefficient	Description	Units	Alternatives		Coefficients	
			Current	New	Value	T-Test(0)
βTTDelay	Delayed Travel time	Minutes	X	X	-0.0343	-6.18
βTTNoDelay	No Delay Travel time	Minutes	X	X	-0.0198	-6.42
*βCost**	Toll Cost	Dollars		X	-1.24	-9.56
βTollConstant	Toll Route Constant	(0,1)		X	-0.148	-0.84

Fit Statistic	Value	Income	VOT	
			Delay	No Delay
# estimated parameters:	4	$25,000	$16.81	$9.70
# observations:	935	$50,000	$17.96	$10.37
# individuals:	187	$75,000	$18.63	$10.75
Null log-likelihood:	-648.093	$100,000	$19.11	$11.03
Cte log-likelihood:	-560.166	$125,000	$19.48	$11.24
Final log-likelihood:	-471.359	$150,000	$19.78	$11.42
Rho-square:	0.273	$175,000	$20.04	$11.57
Adjusted rho-square:	0.267	$200,000	$20.26	$11.69

**Toll cost is divided by the natural log of household income*

Respondents making business trips, particularly those who experienced delay due to traffic congestion, have a relatively high value of time. This result is not uncommon in willingness-to-pay studies. Travelers on business are generally more time-sensitive than other travelers as they need to be somewhere at a particular time (meeting, sales call, site visit, etc.). They are also more likely to be reimbursed for their travel, and therefore less cost-sensitive. The result is a higher value of time, particularly when delayed by traffic congestion.

5.6.4 Commute Trip Purpose Sensitivity Test Results

The commute trip segment did not support segmentation of the travel time coefficient by delay vs. no delay or separate models for northern vs. southern Outer Banks trips. However, separate toll constants were estimated for northern and southern trips. The toll cost coefficient was divided by the natural logarithm of household income as was done in the baseline model.

Figure 34: Commute Trips with Separate Toll Constants for Northern vs. Southern Trips

Coefficient	Description	Units	Alternatives		Coefficients	
			Current	New	Value	T-Test(0)
βTime	Travel Time	Minutes	X	X	-0.0107	-2.64
*βCost**	Toll Cost	Dollars		X	-1.02	-5.92
βTollConstantN	Toll Route Constant Northern	(0,1)		X	0.194	0.65
βTollConstantS	Toll Route Constant Southern	(0,1)		X	-0.274	-1.17

Fit Statistic	Value	Income	VOT
# estimated parameters:	4	$25,000	$ 6.37
# observations:	475	$50,000	$ 6.81
# individuals:	95	$75,000	$ 7.07
Null log-likelihood:	-329.245	$100,000	$ 7.25
Cte log-likelihood:	-283.521	$125,000	$ 7.39
Final log-likelihood:	-254.722	$150,000	$ 7.50
Rho-square:	0.216	$175,000	$ 7.60
Adjusted rho-square:	0.214	$200,000	$ 7.68

**Toll cost is divided by the natural log of household income*

6.0 MODEL APPLICATION

The coefficients of the multinomial logit models presented above can be applied in a travel demand model to forecast toll diversion for the applicable market segments between each origin-destination pair.

Ideally, when stated preference data is used to forecast market shares, the scale of the model coefficients and the value of the alternative specific constant are calibrated using existing market shares. For a facility such as the Mid-Currituck Bridge, relevant data for calibration is not readily available or simply does not exist. In cases such as this, the scale of the coefficients may be adjusted to bring toll shares into line with what would be expected based on past experience and the professional judgment of the forecaster.

It should be noted that adjusting the scale of an MNL model has no impact on the relative values of the coefficients and therefore does not alter the marginal rates of substitution or values of time. Adjusting the scale only affects the sensitivity of the model to changes in the model inputs, such as travel time and toll cost.

7.0 CONCLUSION

RSG conducted an extensive and thorough review of the stated preference questionnaire, experimental design, administration methods, and the survey data, and estimated several sets of multinomial logit models to produce estimates of values of time.

The resulting values of time range from $5.00 to more than $20.00 per hour depending on the market segment, household income, and the presence of congested conditions or delay. These values are within the range of studies conducted for similar corridors across the country. The relationships between values of time for income, delay, and northern and southern respondents are reasonable and intuitively correct when taking the magnitude and signs of the model coefficients into account.

Appendix I

Demographic and Land Use Survey Report

Land Use and Socioeconomic Forecasts

Mid-Currituck Bridge

Currituck County, North Carolina

DELTA
ASSOCIATES
A TRANSWESTERN COMPANY

LAND USE AND SOCIOECONOMIC FORECASTS
MID-CURRITUCK BRIDGE
CURRITUCK COUNTY, NORTH CAROLINA

Prepared On:

February 16, 2010

Prepared For:

ARUP
13 Fitzroy Street
London W1T 4BQ

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DELTA
ASSOCIATES
A TRANSWESTERN COMPANY

February 16, 2010

Arup
13 Fitzroy Street
London W1T 4BQ
United Kingdom

Re: Land Use and Socioeconomic Forecasts
Mid-Currituck Bridge
Currituck County, NC
Delta's Project #29251

Dear Sirs:

This letter and the attached appendices present the results of our land use and socioeconomic forecast analysis undertaken in connection with the project referenced above. Pursuant to our contract dated August 24, 2009, the primary purpose of this study is to assist you with the traffic and revenue forecasts for the proposed Mid-Currituck Bridge in Currituck County, North Carolina.

By way of background, the North Carolina Turnpike Authority (NCTA) is authorized to study, plan, develop, and undertake preliminary design work on the Mid-Currituck Bridge, a proposed toll facility that will connect the Currituck County mainland to the Outer Banks. NCTA selected the Currituck Development Group to develop the project. Arup was appointed by the Currituck Development Group as traffic and revenue advisors for the project. The purpose of our work is to provide a detailed, investment grade demographic and land use analysis for the project. The results of this analysis will be included in materials to be presented to underwriters, investors, and lenders.

The primary tasks involved in our work are as follows:

- Define the Study Area in cooperation with Arup.
- Collect existing relevant data, reports, studies, regulations, and planning documents from government, public, and industry organizations.
- Identify and conduct interviews with realtors, developers and land owners to establish the location, type, scale, and timing of potential developments in the Study Area.
- Identify and conduct interviews with key public officials in local, state, and federal government agencies and other constituents of long-term growth, planning, and land use regulation in the Study Area.
- Identify and conduct interviews with major employers to scale current and future markets that will generate demand for the bridge through year-round and seasonal employment in the Study Area and vicinity.
- Develop land use forecasts through 2040 of the general development potential of the Outer Banks and mainland Currituck and Dare counties, focusing on the Study Area and including a base case and two variations around the base depending on the likelihood of future development.
- Develop socioeconomic forecasts through 2040, including population, households, household income, and vehicle ownership in the Study Area, as well as forecasts of selected characteristics of seasonal visitors from locations identified as principal sources of demand.
- Develop forecasts through 2040 of Gross Domestic Product (GDP) for the United States and Gross Regional Product (GRP) for an area that includes the Study Area.

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The work program to develop the data outlined above was carried out by Delta Associates, along with Dr. James Kleckley, Director of the Bureau of Business Research at East Carolina University. Dr. Kleckley was the primary contributor to the socioeconomic forecasts, as well as the GDP and GRP forecasts.

Our methodology, research and data collection activities, survey results, and findings are discussed below. The data on which these findings are based are found in the attached appendices.

SUMMARY FINDINGS

In reviewing the findings for the 2009-2040 base case forecast, we are focusing first on ARUP traffic analysis zones 4-9, which are the core markets for the Mid-Currituck Bridge. Going from south to north, these six zones are Sanderling North, Corolla South, Corolla South Central, Corolla North Central, Corolla North, and Carova/4WD Area.

The forecast adds 2,787 residential units in Zones 4-9, including permanent homes, second homes that are never available for rent, and rental units. The last represent 2,226 new rental units -- a 66% increase over the current rental inventory.

Importantly, rental bedrooms increase from 16,301 in 2009 to 32,243 in 2040, just short of 100%. This results from both new construction and redevelopment with larger units so that the average bedroom count per rental unit rises from 4.8 today to 5.7 in 2040. Stated differently, every newly built or redeveloped unit will average 7 bedrooms. [1]

The increased bedroom count will drive up the number of automobiles in direct proportion. At 0.75 cars per bedroom (from the Catevo survey of Realtors), there is a gross potential of 11,957 more cars if every bedroom in Zones 4-9 is occupied. This number will be adjusted downward by appropriate seasonal occupancy rates (again, derived from the Realtors' survey).

Peak season and peak of peak season average daily population will also rise proportionately. After adjustment by appropriate seasonal occupancy rates, the number of people in Zones 4-9 will rise from an average of 19,886 today to 33,371 in 2040. The average daily peak of peak population will go from 29,934 to 40,164. (This does not include the permanent population.)

Retail space and employment increase in response to new demand for retail trade, services, eating and drinking establishments, etc. We estimate that Zones 4-9 will support an additional 265,000 square feet of retail space and 2,310 more jobs during peak season in 2040.

Present impediments to large-scale development in Zone 9 (Carova/4WD Area) are formidable and will be very difficult and costly to change within the forecast period. Impediments include public opinion, county land use policies, and a lack of public utilities and road access, which would require extending Highway 12 through wildlife preserves and undisturbed natural lands. As a result, rental units increase from 528 today to 999 in 2040. Again, assuming larger new and redeveloped units,

[1] There is no direct relationship between rental bedrooms and plots (or lots). The basic unit of measurement for future residential development capacity was the number of acres of vacant, developable land, which we estimated using the real property tax parcel records from Dare and Currituck counties. The tax parcel records were geo-coded, allowing us to distribute vacant land among the TAZs. Based on zoning requirements (i.e., number of units per acre), we could project when during the forecast period a TAZ will reach full capacity. After a TAZ reached full capacity, no new rental units were added, but the number of rental bedrooms could still increase until 2040 and beyond due to redevelopment activity that produces larger units with more bedrooms than before.

the rental bedroom count rises from 2,194 to 4,796. This is not inconsequential given that the current housing stock ranges from basic beach cottages, which predominate today, to newer "McMansions".

Permanent population for Zones 4-9, which is now 1,162 persons, increases to 2,154 persons. This is consistent with the low number of year round residents there now and an expectation that the permanent settlement pattern will not change materially over the forecast period.

Looking at the entire Study Area, which has 24 zones encompassing all of the Outer Banks north of Hatteras Island, plus Roanoke Island and mainland Currituck County, here are the highlights in the 2009-2040 base case forecast:

- ***Permanent Population*** increases by 32,222 persons from 51,822 currently.
- ***Average Daily Peak Visitor Population*** increases by 36,065 from 70,998 currently.
- ***Average Daily Peak of Peak Visitor Population*** increases by 43,407 from 85,451 now. (Note: The Peak and Peak of Peak figures rise by 51% in the Study Area, compared to 68% in zones 4-9, indicating that the Mid-Currituck Bridge will serve the area of the fastest relative growth.)
- ***Average Employment*** increases by 23,819 jobs from 29,975 currently. (Note: The largest share of new jobs will be in Mainland Currituck in the northern end of the county where it adjoins the City of Chesapeake, which could translate into business for the bridge.)
- ***Permanent Households*** increase from 21,659 to 37,088, a gain of 15,428. Again, the growth is primarily in Mainland Currituck.
- ***Average Household Income*** of permanent residents shows substantial growth in local affluence, rising from $84,003 to $330,761 (4.7% compound annual growth) in current dollars.
- ***Vehicle Ownership*** by permanent residents increases from 49,801 to 85,255 (2.3 vehicles per household), a 71% increase, due in part to relatively greater affluence.
- ***Retail Space*** grows by 50%, from 3.8 to 5.7 million square feet.
- ***Seasonal Rental Units*** increase by 5,701, from 16,417 today to 22,118 in 2040, with virtually all of the new development taking place on the Outer Banks.
- ***Rental Unit Bedrooms*** grow by 40,499 to 103,732. At 0.75 vehicles per bedroom (from the Catevo Realtors' survey), this indicates a gross potential of 30,374 additional cars before downward adjustment for appropriate seasonal occupancy rates.
- ***Hotel Rooms*** will grow by 1,300 rooms from an existing stock of 3,108 rooms. No major hotels are anticipated due to zoning and utility constraints, along with severe seasonality of demand.

The 46 external zones were defined through analysis of a database of more than 160,000 rental contracts, which allowed us to focus in on the most prolific "sending zones". These external zones represent more than 90% of the current seasonal renters. Following are a few external zone highlights from the 2009-2040 base case forecast.

- ***Households*** grow from 45.1 to 57.7 million, an increase of 12.6 million households, or an increase of about 28%.
- ***Weighted Average Household Income*** rises from $110,994 to $502,745 in current dollars.
- ***Vehicle Ownership*** increases by some 20.5 million vehicles.

STUDY AREA DEFINITION

During the early stages of our work, Arup and Delta Associates defined 70 traffic analysis zones, which are classified as either external ("sending") or internal ("receiving") zones. We first defined a Study

Area with 24 internal zones in Currituck and Dare counties. The internal zones are based in part on the traffic analysis zones used in previous studies by Wilbur Smith Associates. Zone boundaries are based on municipal boundaries or recognizable landmarks such as roads and water courses.

To define the external zones, Delta analyzed a database assembled by Catevo of about 160,000 rental contracts for vacation homes in Currituck and Dare Counties. This allowed us to determine the clusters of ZIP codes in metropolitan areas that generated the most contracts -- the most prolific "sending zones". We defined as external zones the 23 Metropolitan Statistical Areas (MSA) that account for 75% of the contracts in the Catevo database. After these 23 top MSAs, no single MSA accounts for more than 0.5% of the contracts. In addition, we defined 12 external zones that represent the balances of the states (other than North Carolina) where the key zones are located; i.e., the portions of the states that are not in the MSA sending zones. Georgia and Michigan were also included due to the number of rental contracts they generated, even though none of the MSAs in those states accounted for more than 0.5% of the contracts. Three of the key MSAs are in North Carolina, and nine other external zones cover the balance of the state. These include Hatteras Island and the mainland portion of Dare County, Knotts Island in Currituck County, and Elizabeth City and Pasquotank and Camden counties, which lie immediately west of Currituck County.

The traffic analysis zone system was defined in an iterative effort between Arup and Delta Associates. Based on our discussions throughout the project, no revisions were required to the zone system over the forecast period as there were no major developments which would justify additional detail.

The internal and external zones are listed in Tables A-1 and A-2 in Appendix A, along with maps of the internal zones. Tables A-3 and A-4 show the distribution of rental contracts among the external zones.

INTERVIEW PROCESS

In order to understand key issues and to scale the current and future markets that will generate demand for the Mid-Currituck Bridge, we identified and conducted interviews with three groups:

- Key public officials in local, state, and federal government agencies.
- Realtors, developers and other constituents of long-term growth, planning, and land use regulation in the Study Area.
- Significant employers, including hotels and other lodging, which will generate permanent and seasonal employment.

Qualitative information gathered in the interview process was essential in developing assumptions that we relied upon in developing the demographic and land use projections. The information from the interviews is summarized below and is presented in greater detail in Appendix B, which includes a list of the interviewees.

Candidates for potential interviews were compiled from a variety of sources. These include recommendations of partners involved in this study, including CDG, Arup, and the NCTA. Organizations and agencies listed as references in prior bridge studies were also added to the potential interviewee catalogue. Potential lodging interviews were compiled from published lists of accommodations in the Study Area. As the interviews were conducted, additional interview candidates were identified by the interviewees themselves.

After compiling the lists of potential interviewees, Delta narrowed the list of callers to those determined to be the most useful. An interview log was created to track these contacts and progress on completion

of the interviews. Interviewees were contacted by phone, and interviews were requested, with a preference for face to face meetings. If face-to-face meetings were not logistically feasible, interviews were complete by phone. Delta team members travelled to the Study Area during the weeks of September 21 and September 28, 2009 to conduct interviews. Additional phone interviews and follow-up interviews were completed throughout October, concluding the week of November 9. An introduction was prepared by Delta to describe the nature of our interview requests to the candidates. Three questionnaires were developed for the three primary interviewee categories: Government, Real Estate, and Lodging. The interview log, interview introduction, and questionnaires are included in Appendix B.

The discussion below summarizes the responses under several broad topics. Selected interviewee comments are included in the discussion in Appendix B.

SUMMARY OF GOVERNMENT INTERVIEWS

Future Development Patterns

Many parts of the Outer Banks are perceived as near build-out, particularly areas in the central Outer Banks. Therefore, future development will largely consist of redevelopment of existing property, including residential and commercial properties. Some areas that currently function as commercial centers welcome additional density, while those with more of a residential character plan to preserve the status quo. Redevelopment will consist primarily of small-scale projects.

Large single-family homes make up the majority of the additional capacity for future residential growth. In most jurisdictions on the Outer Banks, there is limited desire on the part of government and citizens for multi-family development.

Jurisdictions are well aware of the environmental concerns raised by the potential for additional development due to the bridge.

Most jurisdictions in the central and southern Outer Banks do not believe that the new Mid-Currituck Bridge will have a measureable effect on their development patterns. This generally includes the area south of Southern Shores.

Jurisdictions in the northern Outer Banks and those familiar with the area believe that this section of the Outer Banks will have accelerated development and/or increased densities as existing parcels are redeveloped.

Traffic

Most jurisdictions commented on potential improvement in traffic conditions as a result of the bridge. Their specific views depend on their proximity to the bridge and the direction from which most of their visitor traffic arrives. Areas in the northern Outer Banks expect shorter travel times for their visitors, while jurisdictions just north of the Wright Memorial Bridge noted the potential for a reduction in cut-through traffic and congestion as beneficial effects of the Mid-Currituck Bridge. Jurisdictions further south were more ambivalent about the bridge, noting that will it have little benefit for their visitors due to travel patterns to the Outer Banks. Several noted the benefits of expedited hurricane evacuation.

Impact on Northern Beaches

Most interviewees believe that the new Mid-Currituck Bridge will increase development pressures on the northern beaches and the 4WD/Carova area. Some perceived this as inevitable due to current development patterns, while others believe that this is the primary purpose of the bridge, whether the sponsors state it explicitly or not. It was also noted that there are impediments to additional development in the area, including environmentalists, local residents, and land owners with parcels between the current terminus of Highway 12 and Carova who would have to grant access for the extension of Highway 12 through wildlife preserves and undisturbed natural lands.

Impact on Currituck Mainland

Many officials believe that the bridge will also have major impacts on the mainland portion of Currituck County. There is a perceived opportunity to offer services on the mainland that have land requirements that rule out an Outer Banks location, as well as the opportunity to compete with Dare County's "rainy day" attractions. It was noted that less traffic in the lower portion of the Currituck peninsula due to the siphoning off of traffic by the new bridge could negatively impact businesses in the area. At the same time, others commented that reduced congestion in the area could attract businesses that had otherwise passed it up.

Day Trippers

Most government interviewees said that day trippers to the Outer Banks may grow with the construction of a new bridge. Due to their limited stay, congestion is a major determinant for day trippers. Some noted that the one constraint on day trippers using the new bridge would be the fact that the areas in the north that will be made more convenient by the new bridge have limited public beach access. Jurisdictions in the south noted that they might benefit, because with congestion lessened on the Wright Memorial Bridge, ease of access to their multiple points of public access would be increased. Representatives of some of the northern areas noted, however, that if day trippers increased steps would likely be taken to add public beach access to accommodate these additional visitors.

Constraints on Growth

Several interviewees said there are no infrastructure constraints on development in their jurisdictions. Most noted, however, that there are indeed limits due to the need for on-site septic in most areas of the Outer Banks. The availability of potable water was not seen as a hindrance either, because the area currently has excess capacity and a new reverse osmosis plant was recently completed. Some of those interviewed noted the physical constraint of available land resulting from their jurisdiction's location on a barrier island. Some jurisdictions noted environmental concerns of citizens and other organizations as constraints on additional development in the area, while others said that there were no political constraints, as their jurisdictions are solidly behind additional development. [2]

[2] Flood zones, wetlands, poor soils, etc. were excluded from the vacant land acreage used in the development capacity calculations.

SUMMARY OF REALTOR/DEVELOPER INTERVIEWS

Impact on Northern Beaches

Most Realtor/developer interviewees believe that development of the northern beaches is occurring slowly. This is due in part to several issues including lack of easy access, lack of services, and difficulty in obtaining flood insurance. Several interviewees suggested a lower impact gravel road for access to the 4-wheel drive area to reduce impact on the beach and increase access to the area. Some stated that the new bridge itself will make additional and more intense development of the Carova area inevitable. Interviewees also believe that Corolla will experience additional development and redevelopment due to the increased access available from the new bridge.

Currituck Mainland Development

The Realtor/developer interviewees believe that the Mid-Currituck Bridge will spur additional development on the mainland. They suggested housing opportunities for the 55+ market, continuing care communities, as well as work-force housing for those priced out of the Outer Banks. Others suggested the development of rainy day attractions for those vacationing on the Outer Banks.

General Development Constraints

The interviewees stated that current development standards are likely to change after the bridge is built to somewhat contain development. Another constraint on development is the relatively small size of platted lots compared to the current market for large homes which require more land. They also stated that the new bridge is likely to help increase occupancy during the shoulder seasons. [3]

Access/Traffic

The Realtor/developer interviewees said the Mid-Currituck Bridge will be a great convenience for visitors to the northern Outer Banks, reducing some drive times by up to two hours in peak season. Evacuation benefits were seen as very secondary. Several interviewees noted that additional access will bring more traffic that current traffic management systems will not be able to handle. In particular, vehicular beach access should be managed through a permit process to limit congestion and increase safety for beach pedestrians. It was also noted that reduced congestion in Duck due to the bridge will greatly increase safety in the area. Interviewees stated that the bridge will likely increase commuters to and from Virginia and thereby increase the permanent population and employment pool.

Mid-Currituck Bridge Toll

The interviewees generally prefer that the bridge toll be wrapped into the weekly rental rate to make it more palatable to vacationers. They stated that workers that car pool would find the economics compelling to use the new bridge on turnover days. It was also noted that day trippers would likely not use the bridge due to cost and lack of public access in the northern beaches.

[3] We did not change development standards during the forecast period. The interviewees were not specific about what changes might occur, and it was not possible to anticipate the location, timing, or degree of changes, particularly given the number of jurisdictions.

Day Trippers

Interviewees believe that the new bridge will attract more day trippers to the Outer Banks, but they have differing opinions on how they will get there. Some noted that they will likely use the Wright Memorial Bridge to the south to save money and to reach the existing public beach access points. Others think the reduced drive time to the north will bring additional day trippers to the northern beaches and the 4-wheel drive area.

Political Considerations

At least one Realtor/developer interviewee believes that the bridge should move forward expeditiously while there is political support for its construction. They noted that the window of opportunity could close rapidly due to future political changes.

SUMMARY OF HOTEL/TRANSIENT LODGING INTERVIEWS

Based on the occupancies reported by the 16 lodging properties interviewed, there does not appear to be sufficient market demand to support development of new lodging in the short to medium term. Although these properties are full during the peak season and, in fact, turn away a significant amount of demand during this period, the reported average annual occupancies ranged from 55 to 60 percent. The tourism trend in recent years has been to rent condos and single family homes for a vacation rather than to rent a hotel room. In fact, several of the older lodging facilities have been or will be demolished and replaced with single and/or multifamily residences. A lack of available land in suitable locations was also cited as a hindrance to future development of lodging facilities in the area.

The primary market segment is tourists, with many of the facilities reporting an average of more than two guests to a room. Some properties report group meeting and/or group tour business and a few of the newer properties report some corporate demand, particularly during the off peak season.

Reaction to the bridge project from the persons interviewed was overwhelmingly positive. Although some felt that the bridge would not directly affect their property due to their location relative to the proposed bridge, most believe that it will have a very positive impact on the area overall.

SUMMARY OF OTHER INTERVIEWS

The Audubon Society plans to consolidate and retain ownership of their approximately 2,600 acres of land and marsh holdings as natural areas. The Audubon Society may open their land to public access, but in a low-impact way.

The North Carolina Division of Coastal Management pointed out hurdles that would inhibit road connections into the 4-wheel drive area, primarily in the form of land owners who would not be willing to grant access (i.e., the Audubon Society, the State of North Carolina, etc.) that have conservation lands in the area. They noted that there is the potential for future improvements, including paving the “streets” to the north, but connecting them to Hwy. 12 to the south is very unlikely. The Division noted that the new bridge should be a positive for the whole area, improving hurricane evacuation times, and providing the county with direct access to a major portion of its tax base.

LAND USE AND SOCIOECONOMIC FORECASTS

The main focus of our work was to develop the following data:

- Land use forecasts of the general development potential of the Outer Banks and mainland Currituck County, including permanent homes, vacation rental homes, and second homes, plus retail space and hotels.
- Socioeconomic forecasts including permanent and seasonal population, households, household income, employment, and vehicle ownership in the Study Area, as well as forecasts of selected characteristics of seasonal visitors from locations identified as principal sources of demand.

The forecasts include a base case and two variations around the base, which are presented in five-year intervals through the year 2040. Appendix C contains the tables for the base case and high and low variations around the base. The discussion that follows presents a summary of the variables and the data sources and methodology for the 2009 base year data and the forecasts.

Variables

For the 24 internal zones located in Currituck County and Dare County, we have forecast the following twelve variables:

- Population
- Resident Households
- At-Place Employment
- Average Household Income
- Vehicle Ownership
- Number of 2nd Homes
- Number of Rental Homes
- Number of Rental Bedrooms
- Number of Hotel Rooms
- Rental Housing Occupancy
- Hotel Occupancy
- Retail Square Feet

Seasonality patterns have been analyzed for four of the internal zone variables, including Population, At-Place Employment, Rental Housing Occupancy, and Hotel Occupancy. The seasons considered are as follows:

- Peak: June 1 – August 31
- Peak of peak: Last week of July and first two weeks of August
- Spring shoulder: May 1 – May 31
- Fall shoulder: September 1 – September 30
- Off-season: October 1 – April 30

The following five variables have been analyzed for the 46 external zones, with no consideration given *to seasonality:*

- Population
- Households
- Employment
- Average Household Income
- Vehicle Ownership

Principal Data Sources

Woods & Poole Economics is the principal source for certain demographic components of the 2009 base year socioeconomic data estimates and forecasts through 2040, which are presented in Appendix

C. The socioeconomic variables derived directly from Woods & Poole include the following: Population, Households, At-Place Employment, and Household Income.[4]

Woods & Poole is an independent firm that specializes in long-term economic and demographic projections. We consider their widely-used forecasts to be an appropriate base for our socioeconomic forecasts for the following reasons:

> The Woods & Poole Economics database contains more than 900 economic and demographic variables for every county in the United States for every year from 1970 to 2040. This comprehensive database includes detailed population data by age, sex, and race; employment and earnings by major industry; personal income by source of income; retail sales by kind of business; and data on the number of households, their size, and their income. All of these variables are projected for each year through 2040. In total, there are over 200 million statistics in the regional database. The regional model that produces the projection component of this database was developed by Woods & Poole. The regional projection methods are revised somewhat year to year to reflect new computational techniques and new sources of regional economic and demographic information. Each year, a new projection is produced based on an updated historical database and revised assumptions. The fact that the proprietary Woods & Poole economic and demographic projections rely on a very detailed database makes them one of the most comprehensive county-level projections available.
>
> The strength of Woods & Poole's economic and demographic projections also stems from the integrated nature of the projection model. The projection for each county in the United States is done simultaneously so that changes in one county will affect growth or decline in other counties. For example, growth in employment and population in Houston will affect growth in other metropolitan areas, such as Cleveland. This reflects the flow of economic activity around the country as new industries emerge or relocate in growing areas and as people migrate, in part because of job opportunities. The county projections are developed within the framework of the Woods & Poole projection for the United States, which is the control total for the 2010 regional projections.[5]

In order to account for the impact of future economic cycles, Dr. Kleckley projected cyclical trends in the GDP through 2040 — as opposed to a straight-line annual average. The cycled GDP data were then applied to the forecasting methodology for the socioeconomic and land use variables to show the potential impact of future economic cycles.

The land use estimates and forecasts are based on several sources, the most important of which is an electronic database of some 66,000 real property tax parcel records in Dare and Currituck counties. The individual parcel records were geocoded and assigned to zones in the project Study Area. Improved parcels were analyzed to identify the owner's name and mailing address, geographic location, structure type, age, floor area, number of bedrooms, number of hotel rooms, property value, and the like. Vacant parcels were analyzed for variables such as the owner's name, geographic location, size, zoning classification, and environmental factors such as flood zones, wetlands, etc. The vacant parcel data was used to estimate the amount of land that is potentially available for future development in each zone. Currituck County also provided a database of vested residential subdivision lots, which were geocoded and grouped by zone. We analyzed this database to determine the number of lots developed in each zone in each year since 1998 and the number of vacant lots remaining.

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[4] The definition of income used by Woods & Poole is based on Total Personal Income, which is the most comprehensive one available. Total Personal Income for the U.S. as a whole is about 25% greater than Total Money Income, which is the concept used by the Census Bureau. Personal Income includes all the components of Money Income, plus proprietors' income, the imputed rental value of owner-occupied housing, payments-in-kind (e.g., food stamps), and others.

[5] Woods & Poole Economics, "2010 Complete Economic and Demographic Data Source Technical Documentation", page 11.

The tax parcel and subdivision records were supplemented by lodging data from the Outer Banks Visitors Bureau and the Currituck County Travel & Tourism Department, as well as other previous studies. These data were used to develop a lodging inventory that includes the name, address, type, number of rooms, and traffic analysis zone location of each property. Based in part on this inventory, we were able to determine the number of hotel rooms in each zone.

In addition to the Woods & Poole socioeconomic data and vehicle ownership data from the U. S. Census, the principal data source for the external zone analysis was a database of about 160,000 rental contracts that was assembled by Catevo. As noted previously in the Study Area definition section, this database made it possible to determine which ZIP codes generate the most vacation visitors to the Outer Banks and then to identify the most prolific "sending zones".

Gross Domestic Product and Gross Regional Product

U. S. Gross Domestic Product (GDP) and Gross Regional Product (GRP) forecasts are derived from GDP and GRP data developed by Woods & Poole. The Woods & Poole forecast was considered the baseline for the analysis, as Dr. James Kleckley at East Carolina University determined that the rate of growth in their forecast was reasonable for long-term growth. It is rare that a forecast is exactly realized, however, even for the next quarter. Therefore, it is generally accepted to put lower and upper bounds on the baseline. The bounds that Dr. Kleckley provided as low and high case forecasts were selected to capture the majority of possible trends over the long-term time horizon, should the baseline forecast not be realized. The fact that the low case forecast is closer to the base case suggests that it is less likely for the average annual growth rate to approach zero. Rather, it is more likely that economic growth, as defined by GDP, would approach three percent.

In order to account for the impact of future economic cycles, Dr. Kleckley analyzed all U.S. economic cycles since 1945. His analysis showed, on average, a 5-year expansion period followed by a downturn in year 6. Based on this pattern, he then projected cyclical changes in the US GDP through 2040 for the low, base, and high case forecasts. Woods & Poole's GDP forecast is used for the base case, and it indicates that 2009-2040 GDP growth will be lower than past trends. The high case GDP forecast (2.92%) approximates the long-term GDP trend, which is shown in Figure 1 (and graphically in Appendix E in Table E-1). The forecast average GDP for the low case (1.5%) is about ½ of a standard deviation lower than the base case average GDP.

Figure 1
Average Annual GDP Growth Rate Trends

Period	Growth Rate
1945-2008	3.02%
1960-2008	3.28%
1970-2008	2.98%
1980-2008	2.89%
1990-2008	2.80%

The GDP forecasts with economic cycles are presented in the tables in Appendix E. When the cycled GDP forecasts are applied to the socioeconomic and land use variables, the economic cycles are evident on a year-by-year basis. (The forecasts in Appendix C are presented in five-year increments, which obscures the cyclicality of the data somewhat.)

The GRP data include all counties in North Carolina plus counties in other states where the external zones are located. Currituck and Dare counties are combined to produce the GRP estimate and forecast for the Study Area. The GDP and GRP data analysis is presented in Appendix E.

Figure 2 below shows average annual U.S. GDP and Study Area GRP growth for the base, high, and low cases from 2009 through 2040. As stated above, the GDP and GRP growth rates are based on the forecasts from Woods & Poole for the base case and from Dr. James Kleckley at East Carolina University for the low and high cases. See Appendix E.

Figure 2
Average Annual Growth in GDP and GRP
2009-2040

	Base	High	Low
GDP	1.95%	2.92%	1.46%
GRP	2.35%	3.36%	1.91%

Methodology - Internal Zones

The methodology used to produce the data inputs for the internal zones is discussed in this section, with an emphasis on the base case. The methodologies for the high and low variations are similar, but they are based on the high and low case GDP and GRP forecasts developed by Dr. Kleckley.

- ***Resident population, households, household income, and employment*** in 2009 were estimated for each county by Woods & Poole Economics, based in part on historical data from the U.S. Department of Commerce. The distribution of these variables among the Study Area zones is based on the geographic distribution of residential units, property values, and commercial property in the county property records database.
- ***Resident population and household forecasts through 2040*** were calculated using ratios of population to employment and of households to population, respectively. The county-level data are distributed among zones based on the distribution of primary residences in the county property records database. In some zones (e.g., Zone 4) projected household growth (i.e., new permanent residences) is limited by land availability at some point during the forecast period. In Zone 9, projected growth is based in part on past development activity – an average of only 23.5 units per year since 1998. In addition, we assumed that current barriers to growth in Zone 9, including county land use policies, the lack of road access, lack of public utilities, etc., will remain during the low case and base case forecast periods. Note that flood zones, wetlands, poor soils, etc. were excluded from the vacant land area used to determine the development capacity of each TAZ.
- ***Average annual employment*** at the county level in 2009 was estimated by Woods & Poole. Because employment and GDP are highly correlated, employment forecasts through 2040 are based on a productivity ratio that is calculated using Woods & Poole's US GDP and US Employment data. The ratio was applied to the US GDP forecast developed by the ECU Bureau of Business Research. Cyclicality in the GDP forecast is based on the economic cycles since 1945, which produced, on average, a 5-year expansion period followed by a downturn in year 6. Employment distribution by zone is based on the distribution of activity in the property tax files, plus the location of future retail development (at 600 square feet per employee) and hotel development (at 0.5 employees per room). See Appendix D for the retail and hotel development assumptions and forecasts.

- ***Seasonal employment***, which is based on the average annual employment data, is tied to the health of the national economy, providing a consistent change over time in the number of visitors and employees to service those visitors. The seasonal distribution of employment depends upon the seasonality of monthly workforce data from the N.C. Employment Security Commission, which reflect total employment by all employers that are subject to unemployment insurance laws. The data are by place of work and represent about 97% of actual employment in a county, giving an actual view of employment seasonality. Seasonality factors were developed from the workforce database and then applied to the total county employment**.**
- ***Average household income*** in 2009 has been estimated at the county level by Woods & Poole. The distribution among zones is based on the value of residential properties extracted from the county property tax files. Forecasts through 2040 are based on Woods & Poole's Household Income forecasts and the ratio of Total Income to Woods & Poole's total income. The current relationship between zonal income and county income has been held constant for the forecasted base case years.
- ***Seasonal (nonresident) population*** estimates are based on retail sales data, occupation data, and occupancy tax records. The estimates are updates from earlier studies by East Carolina University, including supporting data for a bond rating and work undertaken for an earlier study for NCTA. The distribution of nonresident population among zones is based on the geographic distribution of hotel rooms and bedrooms in residential units. The seasonal distribution of the nonresident population is based on the seasonal variation in inflation-adjusted occupancy tax data. The historical data was also adjusted for rate changes.
- ***Seasonal population growth*** is correlated with the health of the national economy, providing a consistent change in visitors over time. The better the economy, the more people take vacations, and vice versa. Therefore, seasonal population has been forecast through 2040 based on US GDP forecasts developed by the East Carolina University Bureau of Business Research. In zones where growth is limited by land availability at some point during the forecast period, seasonal population growth then becomes dependent upon new hotel rooms and bedrooms added through redevelopment of older homes. Redevelopment assumes that after a home reaches 50 years old, it may be redeveloped with 50% more bedrooms within 10 years. [6] Hotel development assumptions are illustrated in Appendix D.
- ***Seasonal residential units*** were estimated for 2009 using the U.S. Census estimate of the total housing stock minus permanent residences. The distribution among zones is based on the county property records. Seasonal units include seasonal rentals and second homes. Second homes are estimated at 7.5% of all seasonal units, based on an East Carolina University survey

[6] The base case forecast assumes that 90% of rental houses will be redeveloped within 10 years after they turn 50 years old, and that the rebuilt houses will have 50% more bedrooms. (The only difference in the low and high forecasts is that redevelopment will occur within 8 years in the high case and within 12 years in the low case.) Over the course of the 30-year forecast period, 5,679 rental dwellings will be redeveloped, adding 9,065 more bedrooms to the inventory. These assumptions were confirmed by a residential builder. The 50-year useful life assumption is just below the 55 to 60 year useful life estimate by Marshall Valuation Service for a typical single-family home built with wood frame construction and in average to excellent condition, on the assumption that homes in the Outer Banks experience more wear and tear due to the climate than the average U.S. home. Jason Summerton at Twiddy Real Estate has reviewed the assumptions and said that they are reasonable. He noted that he sometimes sees rehabs/tear-downs in the 30-40 year timeframe, and that homes in that environment may have a "shelf life" somewhat less than 50 years. He also noted that the number of bedrooms added will depend on several factors, such as the number of bedrooms in the existing home, lot size, and the jurisdiction in which it is located. He said that there will probably be a sliding scale of bedrooms added, such as a 3 BR home adding 100% more bedrooms, a 4 BR home adding 80% more, ...9 BR home adding 0 to 10%, etc. Mr. Summerton also noted that it is possible that the new bridge may shift the buyer demographic. If tolls are relatively affordable, or if there is a frequent user discount, a commuter community needing year-round homes may start to develop. Homes for that type of population will be smaller than typical rental homes.

of seasonal unit owners' use patterns. The original study was conducted in 1999 and then updated in 2008 and again in 2009 for this study. (Second homes are never available for rent and are used only by their owners, who maintain primary residences elsewhere. Seasonal rentals are available for rent by visitors, but their owners may also use them.)

- ***Seasonal unit growth forecasts*** are estimated in proportion to seasonal population forecasts and the development capacity of each TAZ. As noted earlier, flood zones, wetlands, poor soils, etc. were excluded from the vacant land area used to determine the development capacity of each TAZ. The ratio of second homes to rental homes is held constant during the forecast period. In zones with limited development capacity, permanent home growth is given priority over seasonal unit growth, and the number of units is capped when a zone's estimated capacity has been reached. In addition, no seasonal rental development is projected in Zone 17 (Wanchese) and Zones 19, 21, 25, 26, and 27 (Currituck mainland) because they are not considered to be feasible locations for seasonal rentals. See Appendix D for future development capacity estimates.
- ***Vehicle ownership*** is based on State of North Carolina vehicle registration data and data on Vehicles Available per Household from the U.S. Commerce Department. It is distributed between zones based on residential unit distribution in the county property files. Forecasts through 2040 are based on the household growth forecasts.
- ***Retail floor area*** in each zone has been derived from the county property records database, and future retail development assumptions are based on household growth forecasts, economic cycles, and zone capacity. We did not find any planned retail projects during our research, but several potential retail sites were identified. See Appendix C.
- ***The number of hotel rooms*** in each zone is derived from our 2009 hotel inventory, and assumptions about the number and location of new hotel rooms are based on currently planned projects (in Zone 5), seasonal population growth patterns, land availability, and sites that are zoned for hotel use. See Appendix C.[7]
- ***Seasonal rental occupancy rates*** are based on Realtor surveys conducted by Catevo and data contained in previous studies.
- ***Lodging occupancy*** patterns are based on lodging occupancy survey data collected by Smith Travel Research and Randall Travel Marketing in 2006 for the Currituck County Department of Travel and Tourism. Randall Travel Marketing presented the data in a 2007 report for the county titled "Tourism Research and Strategic Plan".

Methodology - External Zones

The methodology used to produce the data inputs for the external zones is summarized below, with an emphasis on the base case.

- ***Population*** forecast data were estimated by multiplying base case employment by the ratio of Woods & Poole's population to Woods & Poole's employment.

[7] The Catevo report identified a planned project called the North River Resort. It did not appear to be a viable project at the time of our research due to financing problems, and the site was for sale. The developer has sold the site to one of the partners, who is holding it for future development (5+ years), according to Currituck County Economic Development. The original plan included a marina, a 120-200 room hotel with a spa and event center, 111 multifamily units, 227 single-family homes, and a 17-acre retail site on US 158. Future plans are likely to be on a smaller scale, with a lower price point. The site is on the North River, which forms the boundary between Currituck and Camden counties. It is just north of Jarvisburg, midway between the western terminus of the MCB and the Wright Memorial Bridge, so it probably would not generate a significant amount of traffic for the MCB.

- ***Average Annual Employment*** forecast data were estimated by multiplying GDP by a productivity ratio that is calculated using Woods & Poole's US GDP and US Employment.
- ***Household*** forecasts were estimated by multiplying base case population by the ratio of Woods & Poole's households to Woods & Poole's population.
- ***Average Household Income*** forecast data were estimated by multiplying Woods & Poole's average household income by the ratio of base case total income to Woods & Poole's total income. The total is a weighted average weighted by the number of households. See the explanation in Table C-8 for additional details.
- ***Weighted Average Household Income*** was calculated for the MSAs in Zones 47 to 69 by weighting average household income by the number of rental contracts in the Catevo database that were generated in each zone. The total is a weighted average, weighted by the number of households.
- ***Vehicle Ownership*** is calculated based on the number of vehicles available per household reported in the 2000 U.S. Census. The forecasts are based on the household growth forecasts.

High and Low Cases

The principal factor in developing the high and low variations around the base case was to apply the high and low GDP/GRP forecasts that were developed by Dr. Kleckley to the 2009 base year data. This is because the forecasts for several data inputs are calculated directly or indirectly off of GDP/GRP. These data inputs include permanent and seasonal population, households, second homes, seasonal rentals, average annual and seasonal employment, household income, and vehicle ownership. In addition, adjustments were made to other data inputs, such as new bedrooms added through redevelopment and seasonal occupancy rates for hotels and rental units, based on industry standards and our professional judgment about the appropriate amounts.

Our interviews with Currituck County officials indicated that the county anticipates that the bridge will attract commercial development on the mainland, particularly land-intensive uses that cannot be accommodated on the Outer Banks. The Realtor interviews also showed strong support for that view. Therefore, we have assumed for the high case forecast that an amusement park or other type of large recreational amenity will be developed in Crawford Township (Zone 25) near the mainland terminus of the bridge, along with 100,000 square feet of retail and other commercial space and a 100-room hotel. The timing forecast for this activity is between 2021 and 2025.

In comparison, there will be no change in the Base and Low Cases in the relative balance of forecast development between the mainland and the Outer Banks. To put it another way, there will be no change in the attractiveness of the mainland compared to the Outer Banks according to our Base Case and Low Case forecasts.

The adjustments made to the data inputs for the high and low cases include the following:

- **Seasonal (or Non-Resident) Population** — In the high case, redevelopment assumes that within 8 years after a home reaches 50 years old, it will be redeveloped with 50% more bedrooms. In the low case, redevelopment assumes that within 12 years after a home reaches 50 years old, it will be redeveloped with 50% more bedrooms.
- **Number of Second Homes and Number of Rental Units** — In the high case, it is assumed that the 4-wheel drive area (Zone 9) will be opened up to development with a paved road and public utilities, resulting in the development of a major resort with a 300-room hotel, 100,000 SF of retail, and 1,900 residential units. The time period is 2030-2040.

- **Seasonal Employment** — In the high case, it is assumed that a recreational attraction plus retail and hotel rooms will be built in Zone 25 near the western terminus of the bridge in 2020-2025. Seasonal employment is assumed to be 1,080 jobs.
- **Rental Occupancy** — It is assumed that high and low case rental unit occupancy will vary by +/-2% to +/-5% from the base case, depending on the season.
- **Hotel Occupancy** — It is assumed that high and low case hotel occupancy will vary by +/-3% to +/-4% from the base case, depending on the season.
- **Retail Space** — the retail space added in the base case was adjusted up by roughly 100,000 to 150,000 SF for every 2,000 to 3,000 more households added in the high case. Similar negative adjustments were made in the low case.
- **Employment** — for new retail space and new hotels, we assumed that one employee will be added for every 600 SF of retail space and 0.5 employees will be added for each hotel room.

Key Assumptions for Carova/4-Wheel Drive Area (Zone 9)

The Carova/4-wheel drive area (Zone 9) represents the largest amount of potentially developable land on the Outer Banks portion of the Study Area. The most recent data from Currituck County indicates that Zone 9 has about 2,500 vacant, platted lots. In addition, our analysis of the county land records database indicates that there is about 1,200 acres of vacant land that is potentially developable. This represents another 390 lots, based on current county subdivision regulations.

The main impediments to development in the 4-wheel drive area include the lack of public utilities, lack of road access, and government agencies and nonprofits that own large parcels between the end of Highway 12 and Carova through which an extension of Highway 12 would have to run. In addition, Currituck County's current land use policies are intended to preserve the area and restrict development. Our interviews with public officials and others indicated that there is strong public sentiment to maintain the status quo. Based on these considerations, the base case and low case forecasts assume that current conditions in Zone 9 will continue through the forecast period.

For the high case forecast, we have assumed that the current situation will change enough over the next twenty years to make development possible in Zone 9. The most critical requirement is vehicular access, which will require the construction of a road to Carova from the current terminus of Highway 12. Though it is unlikely that a hard-paved road will be approved, a gravel road, with limited access and fencing to protect the wild horses, may eventually be possible. In addition, we have assumed an easing of the county's land use policies to allow development on a large enough scale to attract a major national developer that will undertake land assembly and master planning of a vacation and residential resort. In the high case forecast, we have assumed that this project will include 1,900 residential units, a 300-room hotel, and 100,000 square feet of retail/commercial space. The development period starts in 2030 and ends by 2040.

Socioeconomic Forecasts

The socioeconomic variables listed in Figures 2 and 3 on the following page were forecast for the base, high, and low cases over the period from 2009 to 2040 based on the methodology described above. Figure 3 presents the amount of growth for each variable in all zones in the Study Area. Figure 4 presents the growth of each variable in Zones 4 through 9, which is the Currituck County section of the Outer Banks. Detailed tables showing the forecasts for each zone are in Appendix C.

Figure 3
Forecast Growth of Socioeconomic Variables in the Study Area
2009-2040

Socioeconomic Variables	Base Case Growth		High Case Growth		Low Case Growth	
	#	%	#	%	#	%
Permanent Population	32,222	62%	62,129	120%	20,232	39%
Avg. Monthly Peak Season Population [1/]	1,009,807	51%	1,290,544	65%	888,787	45%
Avg. Monthly Peak of Peak Season Population [1/]	1,215,383	51%	1,552,791	65%	1,069,725	45%
Avg. Monthly Shoulder Season Population [1/]	302,499	51%	388,251	65%	266,246	45%
Employment	23,819	79%	45,118	151%	15,278	51%
Peak Season Employment [2/]	28,133	79%	54,079	153%	18,038	51%
Peak of Peak Season Employment [2/]	28,409	80%	54,587	153%	18,226	51%
Shoulder Season Employment [2/]	25,344	79%	48,066	151%	16,257	51%
Households	15,248	71%	28,955	134%	10,016	46%

1/ Based on a 28-day month. Does not include permanent population.
2/ Includes permanent and seasonal employees.

Figure 4
Forecast Growth of Socioeconomic Variables in Zones 4-9
2009-2040

Socioeconomic Variables	Base Case Growth		High Case Growth		Low Case Growth	
	#	%	#	%	#	%
Permanent Population	992	85%	1,759	151%	685	59%
Avg. Monthly Peak Season Population [1/]	377,572	68%	511,911	92%	310,800	56%
Avg. Monthly Peak of Peak Season Population [1/]	454,438	68%	615,645	92%	374,073	56%
Avg. Monthly Shoulder Season Population [1/]	113,106	68%	155,003	93%	93,104	56%
Employment	1,965	144%	3,582	263%	1,521	112%
Peak Season Employment [2/]	2,310	144%	4,210	263%	1,788	112%
Peak of Peak Season Employment [2/]	2,350	144%	4,282	263%	1,819	112%
Shoulder Season Employment [2/]	2,091	144%	3,811	263%	1,619	112%
Households	381	83%	974	213%	289	63%

1/ Based on a 28-day month. Does not include permanent population.
2/ Includes permanent and seasonal employees.

Land Use Forecasts

The land use forecasts for residential units, hotel rooms, and retail space are summarized in Figures 5 through 8 on the following pages. The forecasts include the base, high, and low cases. Figures 5 and 6 include the entire Study Area, and Figures 7 and 8 cover Zones 4-9 in Currituck County. Appendix C contains detailed tables showing the forecasts for each zone.

Figure 5
Residential Development Forecasts
New Units Added in the Study Area
2009-2040

Base Case	2009-2015	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040	Total Units
Permanent	3,078	3,395	2,559	2,332	2,145	1,919	15,428
2nd Homes	262	227	171	171	168	167	1,166
Rental	1,980	1,231	769	712	575	434	5,701
Total	**5,320**	**4,853**	**3,499**	**3,215**	**2,888**	**2,520**	**22,295**

High Case	2009-2015	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040	Total Units
Permanent	4,556	5,612	4,725	4,668	4,700	4,695	28,956
2nd Homes	361	326	261	266	342	352	1,908
Rental	2,538	1,487	935	786	1,409	1,157	8,312
Total	**7,455**	**7,425**	**5,921**	**5,723**	**6,451**	**6,204**	**39,176**

Low Case	2009-2015	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040	Total Units
Permanent	2,362	2,428	1,680	1,389	1,204	954	10,017
2nd Homes	169	175	107	99	101	106	757
Rental	1,311	1,188	554	464	459	481	4,457
Total	**3,842**	**3,791**	**2,341**	**1,952**	**1,764**	**1,541**	**15,231**

Figure 6
Hotel and Retail Development Forecasts
New Rooms and Floor Area Added in the Study Area
2009-2040

Base Case	2009-2015	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040	Total
Hotel Rms.	250	225	150	250	300	125	1,300
Retail SF	195,000	520,000	395,000	325,000	225,000	200,000	1,860,000

High Case	2009-2015	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040	Total
Hotel Rms.	250	225	600	350	600	125	2,150
Retail SF	420,000	715,000	700,000	465,000	325,000	200,000	2,825,000

Low Case	2009-2015	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040	Total
Hotel Rms.	250	100	150	125	150	125	900
Retail SF	145,000	365,000	350,000	225,000	150,000	100,000	1,335,000

Figure 7
Residential Development Forecasts
New Units Added in Zones 4-9
2009-2040

Base Case	2009-2015	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040	Total Units
Permanent	86	91	78	59	35	30	379
2nd Homes	35	43	28	28	24	23	181
Rental	429	536	346	342	292	281	2,226
Total	**550**	**670**	**452**	**429**	**351**	**334**	**2,786**

High Case	2009-2015	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040	Total Units
Permanent	119	162	112	109	198	275	975
2nd Homes	53	58	38	45	93	70	357
Rental	654	720	474	551	1,145	858	4,402
Total	**826**	**940**	**624**	**705**	**1,436**	**1,203**	**5,734**

Low Case	2009-2015	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040	Total Units
Permanent	70	69	52	42	30	25	288
2nd Homes	22	27	21	18	17	18	123
Rental	267	334	262	224	210	221	1,518
Total	**359**	**430**	**335**	**284**	**257**	**264**	**1,929**

Figure 8
Hotel and Retail Development Forecasts
New Rooms and Floor Area Added in Zones 4-9
2009-2040

Base Case	2009-2015	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040	Total
Hotel Rms.	100	0	0	0	0	0	100
Retail SF	70,000	125,000	70,000	0	0	0	265,000

High Case	2009-2015	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040	Total
Hotel Rms.	100	0	0	0	300	0	400
Retail SF	70,000	125,000	70,000	0	40,000	100,000	405,000

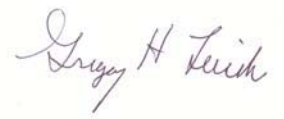
Low Case	2009-2015	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040	Total
Hotel Rms.	100	0	0	0	0	0	100
Retail SF	70,000	70,000	0	0	0	0	140,000

* * * * *

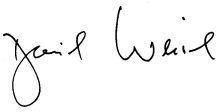
It has been a pleasure undertaking this assignment for you. Please do not hesitate to contact us if you wish to discuss these matters further or if you have any questions regarding our findings.

Respectfully submitted,

DELTA ASSOCIATES



Gregory H. Leisch, CRE
Chief Executive



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NOTICE

Delta Associates (DA) considers that it is essential to the reader's examination of this document, and projections contained herein, to understand the use of data, the methodology involved, the role of judgments as distinct from calculations in the methodology, factors which affect current projections, and the impact, if any, of change over time.

The purpose of market, economic and financial projections, together with the basis for the projections, is to make available a considered opinion on potential economic returns from the project so that those who utilize these results can evaluate them in terms of methodology employed, data applied as well as judgments made and identified. All prospective data are subject to uncertainties. As actual market and economic factors affecting the project materialize, they may differ somewhat from the basis projected herein. Unforeseen changes in laws may also affect real estate market performance and value. Accordingly, although the projections in this report are those one would reasonably expect to occur given the conditions existing at the time of this writing, actual market and financial results may differ from the projections.

Similarly, projections herein have been prepared utilizing the information, assumptions and calculations outlined in this report. Select information utilized in the projection process is on occasion from sources other than DA; where such information is from published sources, DA has identified the source and assumed such information to be accurate as presented. Where such information is from unpublished sources, DA has reviewed the information for reasonableness and consistency before including same herein. No representations are made by DA as regards property ownership, size, zoning conformance, occupancy and lease terms, availability of utilities, soil conditions, flood hazard, environmental problems, or any other matters. All such property specific data has been supplied to DA by the property owner and/or its agents and DA has assumed this data to be accurate as provided.

DA's principal business activity is the evaluation of real estate development economics, including the analysis of market potentials, evaluation of projected operating and financial results, and valuations. In the course of each year the firm typically performs more than a hundred assignments for building and development organizations, financial institutions, property owners and the like. The firm considers that it is "expert" in this field, and it is DA's belief that the methodology and other procedures employed by it constitute valid and accepted methods of evaluating and valuing real estate. However, it is pointed out that procedures used herein rely on judgments dependent on the accuracy of data and influenced by external circumstances which can change quickly with time and substantially affect the project and hence its value. DA recommends that its clients recognize these limitations inherent in using the projections of this report when making business decisions.

Finally, the reader is hereby advised that Delta Associates is the trade name of Transwestern Delta Associates L.L.C., a Delaware limited liability company. As such, DA is part of the Transwestern Commercial Services (TCS) family of real estate service companies that broker, finance, manage, and advise real estate throughout the United States. This disclosure is made so as to (1) avoid the appearance of a conflict and (2) to assure the client of confidentiality and impartiality. Delta Associates is independently operated by its principals and separately officed in Old Town Alexandria. In no way does Delta Associates' TCS affiliation affect the judgments expressed herein.

APPENDICES

Appendix A:

Study Area; Internal and External Traffic Analysis Zones

TABLE A-1

PRIMARY STUDY AREA (INTERNAL ZONES)
MID-CURRITUCK BRIDGE PROJECT
CURRITUCK AND DARE COUNTIES, NC

Zone	Zone Description	County	Zone Type
1	Southern Shores	Dare	Internal
2	Duck	Dare	Internal
3	Sanderling South	Dare	Internal
4	Sanderling North	Currituck	Internal
5	Corolla South	Currituck	Internal
6	Corolla South Central	Currituck	Internal
7	Corolla North Central	Currituck	Internal
8	Corolla North	Currituck	Internal
9	Carova, 4WD Area	Currituck	Internal
10	Kitty Hawk	Dare	Internal
11	Kill Devil Hills (N. of Wright Brothers Memorial)	Dare	Internal
12	Collington	Dare	Internal
13	Kill Devil Hills (S. of Wright Brothers Memorial)	Dare	Internal
14	Nags Head	Dare	Internal
15	Nags Head / Whalebone	Dare	Internal
16	Manteo	Dare	Internal
17	Wanchese	Dare	Internal
18	Bodie Island	Dare	Internal
19	Lower Currituck Peninsula - South	Currituck	Internal
21	Moyock Township	Currituck	Internal
25	Crawford Township	Currituck	Internal
26	Lower Currituck Peninsula - North	Currituck	Internal
27	Lower Currituck Peninsula - Central	Currituck	Internal
46	Marketplace @ Southern Shores / Walmart / Retail	Dare	Internal

Source: Delta Associates, February 2010.

DA29251
Appdx A-ZonesInternal

TABLE A-2

EXTERNAL ZONES
MID-CURRITUCK BRIDGE PROJECT

TAZ	Zone Description	State	Zone Type
20	Elizabeth City	NC	External
22	Dare County Mainland	NC	External
23	Hatteras Island	NC	External
24	Pasquotank County (Excl. Elizabeth City), NC	NC	External
28	Camden County, NC	NC	External
29	Balance of Massachusetts	MA	External
30	Balance of Connecticut	CT	External
31	Albemarle Peninsula, NC	NC	External
32	Knotts Island	NC	External
33	Balance of Maryland	MD	External
34	Balance of Delaware	DE	External
35	Balance of New Jersey	NJ	External
36	Balance of Virginia	VA	External
37	Balance of North Carolina	NC	External
38	Balance of South Carolina	SC	External
39	Georgia	GA	External
40	Balance of West Virginia	WV	External
41	Balance of Ohio	OH	External
42	Michigan	MI	External
43	Balance of Pennsylvania	PA	External
44	Balance of New York State	NY	External
45	Balance of New Hampshire	NH	External
47	Washington, DC-VA-MD-WV MSA	DC, VA, MD, WV	External
48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	PA, NJ, DE, MD	External
49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	NY, NJ, PA	External
50	Baltimore-Towson, MD MSA	MD	External
51	Richmond, VA MSA	VA	External
52	Virginia Beach-Norfolk-Newport News VA-NC MSA	VA, NC	External
53	Pittsburgh, PA MSA	PA	External
54	Raleigh-Cary, NC MSA	NC	External
55	Cleveland-Elyria-Mentor, OH MSA	OH	External
56	Harrisburg-Carlisle, PA MSA	PA	External
57	Allentown-Bethlehem-Easton, PA-NJ MSA	PA, NJ	External
58	Columbus, OH MSA	OH	External
59	Lancaster, PA MSA	PA	External
60	Charlottesville, VA MSA	VA	External
61	York-Hanover, PA MSA	PA	External
62	Bridgeport-Stamford-Norwalk, CT MSA	CT	External
63	Boston-Cambridge-Quincy, MA-NH MSA	MA, NH	External
64	Cincinnati-Middletown OH-KY-IN MSA	OH, KY, IN	External
65	Charlotte-Gastonia-Concord NC-SC MSA	NC, SC	External
66	Akron, OH MSA	OH	External
67	Rochester, NY MSA	NY	External
68	Reading, PA MSA	PA	External
69	Durham-Chapel Hill, NC MSA	NC	External
70	Bertie, Hertford, Gates, Chowan, Perquimans, & Northampton Counties, NC	NC	External

Source: Delta Associates, February 2010.

DA29251
Appdx A-ZonesExternal

TABLE A-3

EXTERNAL SENDING ZONE METRO AREAS
BY FREQUENCY OF RENTAL CONTRACTS
MID-CURRITUCK BRIDGE PROJECT

Rank	Zone	Metropolitan Statistical Areas	Frequency*	% of Total	Cum % of Total*	2009 Avg HH Inc
1	47	Washington-Arlington-Alexandria, DC-VA-MD-WV MSA	33,449	20.87%	20.87%	$159,621
2	48	Philadelphia-Camden-Wilimington, PA-NJ-DE-MD MSA	15,171	9.47%	30.34%	$135,928
3	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	14,648	9.14%	39.48%	$164,812
4	50	Baltimore-Towson, MD MSA	9,235	5.76%	45.24%	$131,244
5	51	Richmond, VA MSA	8,952	5.59%	50.83%	$105,094
6	52	Virginia Beach-Norfolk-Newport News, VA-NC MSA	7,769	4.85%	55.68%	$103,615
7	53	Pittsburgh, PA MSA	7,425	4.63%	60.31%	$105,021
8	54	Raleigh-Cary, NC MSA	2,558	1.60%	61.91%	$103,246
9	55	Cleveland-Elyria-Mentor, OH MSA	2,167	1.35%	63.26%	$98,860
10	56	Harrisburg-Carlisle, PA MSA	2,050	1.28%	64.54%	$95,385
11	57	Allentown-Bethlehem-Easton, PA-NJ MSA	2,011	1.25%	65.80%	$91,547
12	58	Columbus, OH MSA	1,911	1.19%	66.99%	$96,160
13	59	Lancaster, PA MSA	1,806	1.13%	68.12%	$93,078
14	60	Charlottesville, VA MSA	1,762	1.10%	68.09%	$102,857
15	61	York-Hanover, PA MSA	1,395	0.87%	68.96%	$87,024
16	62	Bridgeport-Stamford-Norwalk, CT MSA	1,321	0.82%	69.78%	$215,327
17	63	Boston-Cambridge-Quincy, MA-NH MSA	1,248	0.78%	70.56%	$139,690
18	64	Cincinnati-Middletown, OH-KY-IN MSA	1,148	0.72%	71.28%	$98,331
19	65	Charlotte-Gastonia-Concord, NC-SC MSA	1,052	0.66%	71.93%	$100,054
20	66	Akron, OH MSA	1,015	0.63%	72.57%	$91,050
21	67	Rochester, NY MSA	886	0.55%	73.12%	$98,957
22	68	Reading, PA MSA	879	0.55%	73.67%	$90,985
23	69	Durham-Chapel Hill, NC MSA	816	0.51%	74.18%	$102,532
		Average household income of the zones that make up 50% of all contracts				**$139,340**
		Average household income of the remaining sending zones.				**$106,318**
		Weighted average household income of the zones that make up 50% of all contracts.				**$146,932**
		Weighted average household income of the remaining sending zones.				**$104,997**

* Based on Catevo Realtor survey data, comprising 160,000+ records (contracts for rental homes) organized by ZIP code. Excludes blank records. Percentage as a total of all MSAs, including remote and non-metro ZIPs.

Source: Woods and Poole Economics,
Delta Associates, February 2010.

DA29251
Appdx A-ZonesExternal MSAs

TABLE A-4

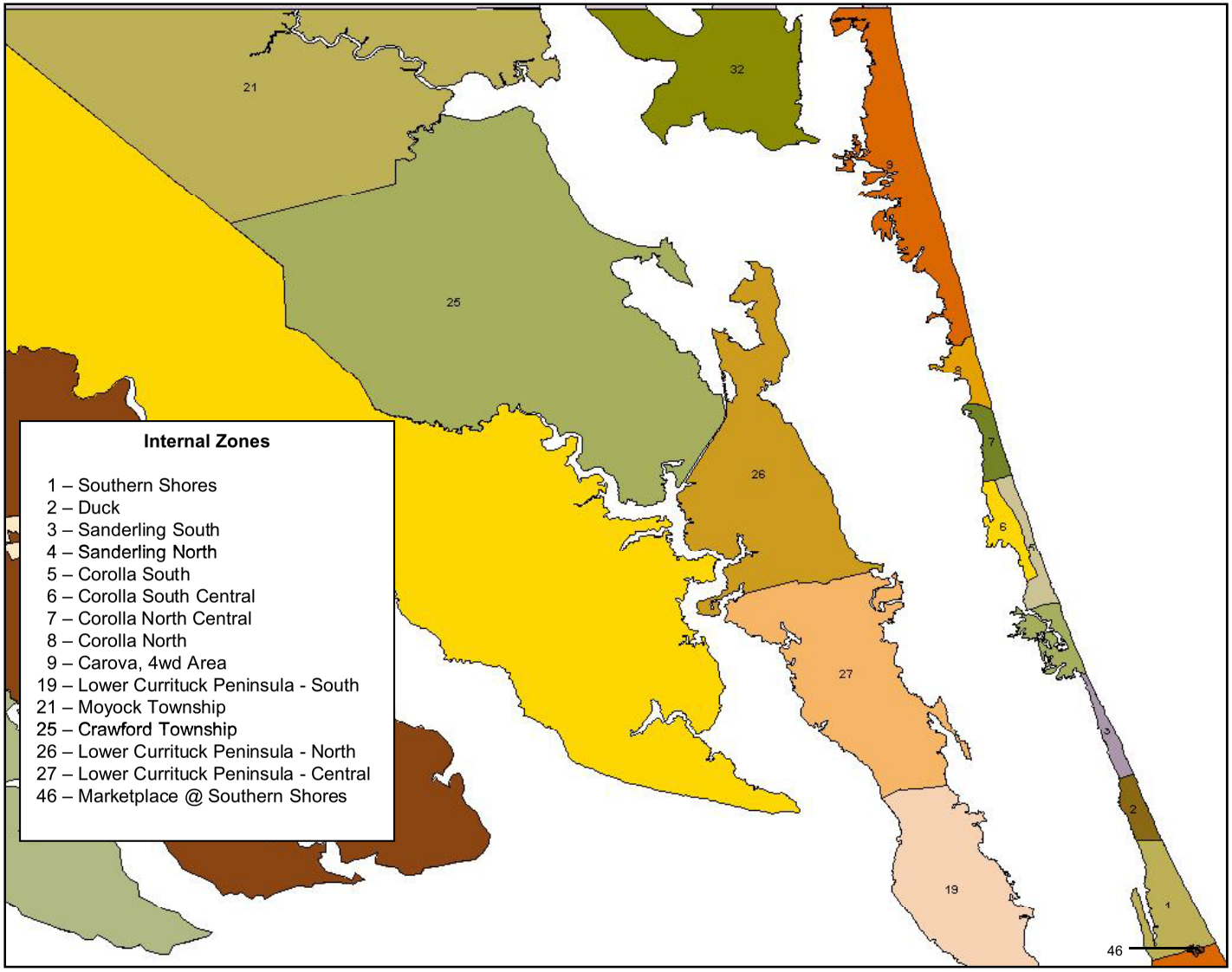
ALL EXTERNAL SENDING ZONES
BY FREQUENCY OF RENTAL CONTRACTS
MID-CURRITUCK BRIDGE PROJECT

Zone	Zone Description	Type of Zone	Frequency
47	Washington, DC-VA-MD-WV MSA	External	33,449
48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External	15,171
49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External	14,648
50	Baltimore-Towson, MD MSA	External	9,235
51	Richmond, VA MSA	External	8,952
52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External	7,769
53	Pittsburgh, PA MSA	External	7,425
43	Balance of Pennsylvania	External	6,239
36	Balance of Virginia	External	4,240
44	Balance of New York State	External	3,407
41	Balance of Ohio	External	3,261
37	Balance of North Carolina	External	3,032
54	Raleigh-Cary, NC MSA	External	2,558
55	Cleveland-Elyria-Mentor, OH MSA	External	2,167
56	Harrisburg-Carlisle, PA MSA	External	2,050
57	Allentown-Bethlehem-Easton, PA-NJ MSA	External	2,011
58	Columbus, OH MSA	External	1,911
59	Lancaster, PA MSA	External	1,806
60	Charlottesville, VA MSA	External	1,762
30	Balance of Connecticut	External	1,424
40	Balance of West Virginia	External	1,413
61	York-Hanover, PA MSA	External	1,395
62	Bridgeport-Stamford-Norwalk, CT MSA	External	1,321
63	Boston-Cambridge-Quincy, MA-NH MSA	External	1,248
33	Balance of Maryland	External	1,187
64	Cincinnati-Middletown OH-KY-IN MSA	External	1,148
65	Charlotte-Gastonia-Concord NC-SC MSA	External	1,052
66	Akron, OH MSA	External	1,015
42	Michigan	External	963
39	Georgia	External	924
67	Rochester, NY MSA	External	886
35	Balance of New Jersey	External	881
68	Reading, PA MSA	External	879
69	Durham-Chapel Hill, NC MSA	External	816
38	Balance of South Carolina	External	513
29	Balance of Massachusetts	External	459
34	Balance of Delaware	External	426
45	Balance of New Hampshire	External	270
20	Elizabeth City	External	96
28	Camden County, NC	External	22
31	Albemarle Peninsula, NC	External	13
24	Pasquotank County (Excl. Elizabeth City), NC	External	0
22	Dare County Mainland	External	N/A
23	Hatteras Island	External	N/A
32	Knotts Island	External	N/A
70	Bertie, Hertford, Gates, Chowan, Perquimans, & Northampton Counties, NC	External	N/A

DA29251
Appdx A-ZonesAll External
2/12/2010

Source: Woods and Poole Economics,
Delta Associates, February 2010.

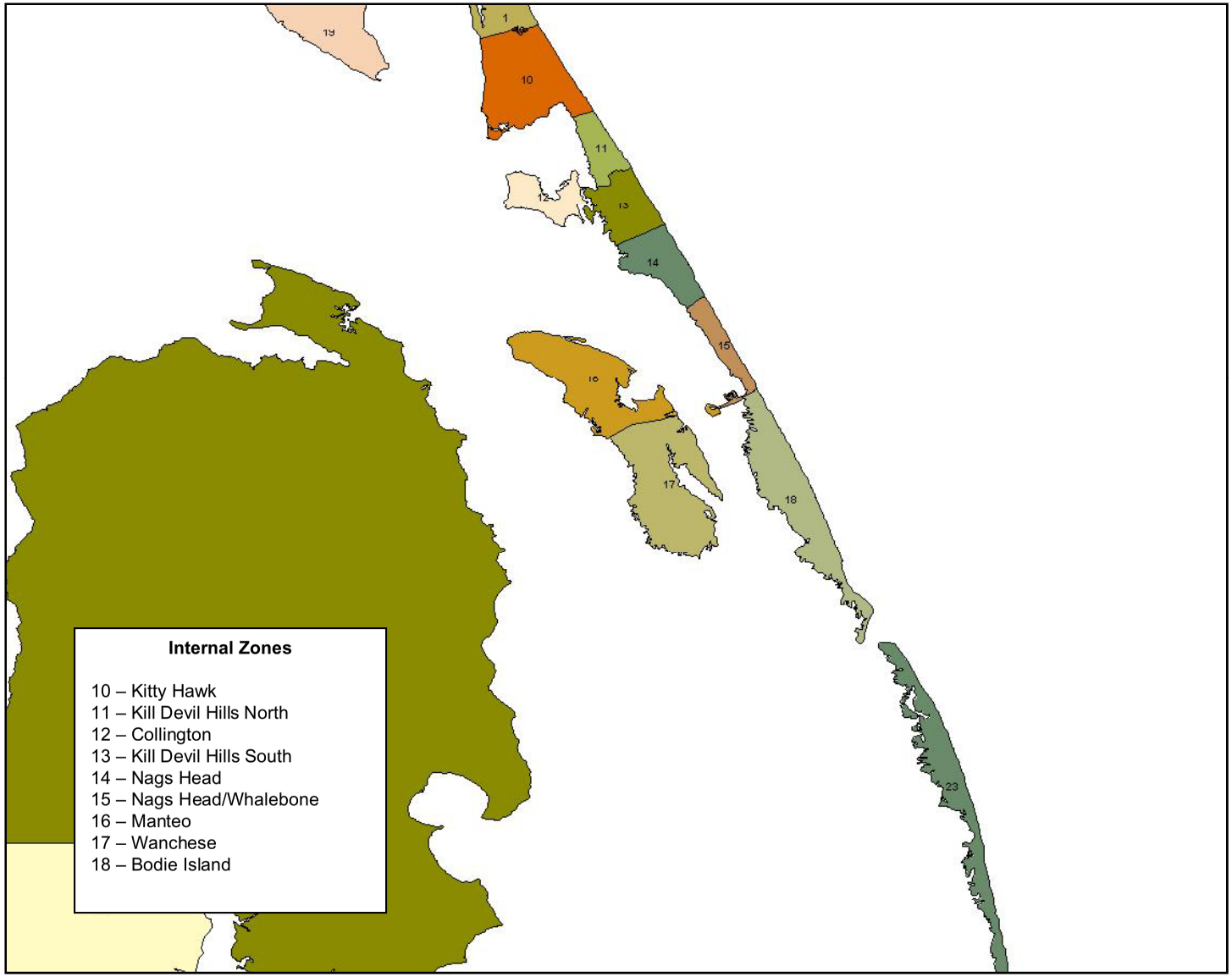
INTERNAL ZONES



Source: Arup, Delta Associates, February 2010.

DA29251

INTERNAL ZONES



Source: Arup, Delta Associates, February 2010.

DA29251

Appendix B:

Interviews Conducted by Delta Associates

TABLE B-1

INTERVIEW LOG
GOVERNMENT, NONPROFITS, REALTORS/DEVELOPERS
LAND USE AND DEMOGAPHIC ANALYSIS
MID CURRITUCK BRIDGE PROJECT

No.	Company/Organization	Type
1	Currituck County	Government
2	Currituck County	Government
3	Currituck County	Government
4	Currituck County	Government
5	Currituck County	Government
6	Currituck County	Government
7	Currituck County	Government
8	Currituck County	Government
9	Dare County	Government
10	Dare County	Government
11	Town of Duck	Government
12	Town of Kitty Hawk	Government
13	Town of Southern Shores	Government
14	Town of Nags Head	Government
15	Town of Nags Head	Government
16	Town of Nags Head	Government
17	Town of Kill Devil Hills	Government
18	Town of Manteo	Government
19	Currituck Co. Dept. of Travel & Tourism	Government
20	Brindley Beach Vacations & Sales	Realtor/Developer
21	Brindley Beach Vacations & Sales	Realtor/Developer
22	RV Owens Enterprises	Realtor/Developer
23	RV Owens Enterprises	Realtor/Developer
24	Carolina Designs Realty	Realtor/Developer
25	Twiddy & Company Realtors	Realtor/Developer
26	Twiddy & Company Realtors	Realtor/Developer
27	Twiddy & Company Realtors	Realtor/Developer
28	Coldwell Banker Outer Banks	Realtor/Developer
29	Buck Island Inc	Realtor/Developer
30	GEG, L.L.C.	Realtor/Developer
31	InterCoastal Realty - SAGA	Realtor/Developer
33	Newman Homes	Realtor/Developer
34	Ocean Builders	Realtor/Developer
35	Outer Banks Visitors Bureau	Nonprofit
36	Outer Banks Chamber of Commerce	Nonprofit
37	Atlantic Realty of the Outer Banks	Realtor/Developer
38	Atlantic Realty - Duck	Realtor/Developer
39	Resort Realty - Corolla	Realtor/Developer
40	Resort Realty - Duck	Realtor/Developer
41	Resort Realty - Kitty Hawk	Realtor/Developer
42	Resort Realty - Nags Head	Realtor/Developer
43	College of the Albemarle	Nonprofit
44	Outer Banks Hotel/Motel Association	Nonprofit
45	NC Division of Coastal Management	Government
46	NC Division of Coastal Management	Government
47	Audubon North Carolina	Nonprofit
48	BD&A Realty & Construction	Realtor/Developer

Source: Delta Associates, December 2009.

DA 29251
Appdx B-1 - Interview Logs,Interview Log

TABLE B-2

INTERVIEW LOG
HOTELS AND OTHER TRANSIENT ACCOMMODATIONS
LAND USE AND DEMOGAPHIC ANALYSIS
MID CURRITUCK BRIDGE PROJECT

Property Name/Location	Type	# of Rooms
Hilton Garden Inn, Kitty Hawk	Hotel	180
Ramada Plaza Nags Head Beach	Hotel	171
Hampton Inn & Suites, Corolla	Hotel	123
The Carolina Oceanfront, Kill Devil Hills	Hotel	119
John Yancy Quality Inn, Kill Devil Hills	Hotel	108
Comfort Inn on the Ocean, Kill Devil Hills	Hotel	105
Comfort Inn South, Nags Head	Hotel	105
Nags Head Inn, Nags Head	Hotel	100
Travelodge Outer Banks Kill Devil Hills	Hotel	96
Colony IV by the Sea, Kill Devil Hills	Hotel	95
The Sanderling Resort & Spa, Duck	Hotel	93
Surf Side Hotel, Nags Head	Hotel	82
Days Inn & Suites Mariner, Kill Devil Hills	Hotel	77
Best Western Ocean Reef Suites, Kill Devil Hills	Hotel	71
Days Inn Oceanfront Wright Brothers, Kill Devil Hills	Hotel	54
Sea Foam Motel, Nags Head	Hotel	53
Dolphin Oceanfront Hotel, Nags Head	Hotel	45
Cypress House Inn, Kill Devil Hills	B&B	10
Nags Head Beach Inn, Nags Head	B&B	8
The Sleeping Duck, Duck	B&B	3
The Duck Inn, Duck	B&B	
Saltaire Cottage Court, Kitty Hawk	CC	22
Wright Cottage Court and the Wright House, Kill Devil Hills	CC	19
Ocean Side Court, Nags Head	CC	11
Kitty Hawk RV Park, Inc., Kitty Hawk	RV/C	18

* Note: CC = Cottage Court; RV/C = RV Park/Campground.

Source: Delta Associates, December 2009.

DA 29251
Appdx B-1 - Interview LogsInterview Log-Hotel

OVERVIEW OF INTERVIEW PROCESS

Background and Purpose of Study

The North Carolina Turnpike Authority (NCTA) is authorized to study, plan, develop and undertake preliminary design work on the Mid-Currituck Bridge (MCB), a proposed toll facility in the Outer Banks. The Mid-Currituck Bridge is located in northeastern North Carolina and would connect the Currituck County mainland to the Outer Banks. NCTA selected the Currituck Development Group to develop the project. Arup was appointed by the Currituck Development Group as traffic and revenue advisors for the project. Arup conducted preliminary traffic and revenue forecasts in 2008. Arup engaged Delta Associates to prepare a detailed, investment grade demographic and land use analysis for the project.

Interview Objectives

As noted in the scope of work, the interview process involved the following:

1. Identify and conduct interviews with developers and land owners to establish the location, type, scale, and timing of potential developments in the study area.
2. Identify and conduct interviews with significant employers, including hotels and other transient accommodations, to scale current and future markets that would generate demand for the bridge through year-round and seasonal employment in the study area and vicinity.
3. Interview key public officials in local, state, and federal government agencies and other constituents of long-term growth, planning, and land use regulation in the study area.
4. We anticipated conducting roughly up to 50 interviews of this nature. Many of these interviews were conducted in face-to-face meetings. If face-to-face meetings were not logistically feasible, interviews were conducted by phone.

Delta Associates identified and conducted interviews with significant employers, including hotels and other transient accommodations, to scale current and future markets that would generate demand for the Mid-Currituck Bridge through year-round and seasonal employment in the study area and vicinity. Interviews were also conducted with key public officials in local, state, and federal government agencies and other constituents of long-term growth, planning and land use regulation in the study area. The qualitative information gathered from these interviews has been aggregated in the following summary. The interviews were not designed to collect quantitative data; rather the qualitative interview information was important in informing assumptions for the demographic and land use projections.

Interviewees

Candidates for potential interviews were compiled from a variety of sources. These sources include recommendations of partners involved in this study, including Arup and the NCTA. Organizations listed as references in prior bridge studies were also added to the list of potential interviewees. Potential lodging interviews were compiled from two published lists of accommodations in the study area: www.outerbanks.org and www.visitcurrituck.com, supplemented by searches of other online directories, and visual observations. As the interviews were conducted, additional interview candidates were identified by the interviewees themselves.

Methodology

After compiling the lists of potential interviewees, Delta narrowed the list to those considered to be the most useful. A table was created to track these contacts and progress on completion of the interviews. This interview log is attached as Exhibit X-1. Interviewees were contacted by telephone and interviews

were requested, with a preference for face-to-face meetings. If face-to-face meetings were not logistically feasible, interviews were complete by phone. Delta team members travelled to the study area the weeks of September 21 and September 28 to complete interviews. Additional telephone interviews and follow-up interviews were completed throughout October, concluding the week of November 9. An introduction was prepared to describe the nature of our interview request to the candidates. This text is attached as Exhibit X-2. Three questionnaires were developed for the three primary interviewee categories: Government, Real Estate, and Lodging. These questionnaires are included as Exhibit X-3.

SUMMARY OF FINDINGS

This section attempts to summarize key information from the interviews. We have separated out the three groups of interviewees:

- Government and planning organizations
- Real estate professional, land owners, developers
- Lodging and transient facility operators

For each group, we present a distillation of common or dominant comments of the interviewees, followed by selected comments. The selected comments are not intended to present all of the conversations, nor are they always direct quotes. Rather, a few comments were selected to give the reader a feel for key and recurring themes from the interviews. It is important to keep in mind that the summaries and the selected comments are the opinions of the interviewees and are not the opinions of Delta Associates. Detailed notes from most of the interviews are presented as Exhibit X-4. We have tried to faithfully represent the content of the interviews. Our scope of work did not involve verifying information collected during the interviews.

Government/Planning Organizations

Future Development Patterns/Build-Out

Many parts of the Outer Banks are perceived as near build-out, particularly areas in the central Outer Banks. Therefore, future development will largely consist of redevelopment of existing projects, including residential and commercial properties. Some areas which currently function as commercial centers welcome additional density, while those with more of a residential character plan to preserve the status quo. Redevelopment in these areas will consist primarily of small-scale projects.

Large single-family homes account for the majority of the additional capacity for future residential growth. In most jurisdictions on the Outer Banks, there is substantial opposition to multifamily development.

Jurisdictions are well aware of the environmental concerns raised by the potential for additional development due to the bridge.

Build-Out — Selected Comments

- *No major land holdings to be subdivided and developed in the town.*
- *Town is probably 85%-95% built out as of today.*

- *Redevelopment will be more prevalent in the future because the town is 85% developed already.*
- *In reality, the town is near build-out.*
- *80% of usable land has been developed. However much of it is under built. There is big potential for redevelopment.*
- *No increase in density in town will occur.*
- *Future development will be very small because most of land is built out.*
- *In the future, perhaps there will be additional pressures to develop additional areas of town.*

Single-Family — Selected Comments

- *Redevelopment will mainly entail single family structures.*
- *In the future, only single-family and commercial development will be allowed*
- *No interest in multifamily development for the town. Perhaps in the distant future this may change due to financial concerns, but not now.*

Redevelopment — Selected Comments

- *80% of usable land has been developed. However much of it is under built. There is big potential for redevelopment.*
- *Redevelopment will be small scale – all below four acres.*
- *The town's location "wants to be the center of commerce". The town has let the market drive development with no guiding hand.*

Limited Development Impacts of MCB

Jurisdictions in the central and southern Outer Banks do not believe that the new Mid-Currituck Bridge will have a measureable effect on their development patterns.

Limited Development Impacts — Selected Comments

- *The proposed bridge will cause less change on physical development in Nags Head. The biggest effect will be on evacuation of the town. Unlikely to accelerate development in Nags Head.*
- *Proposed bridge will not accelerate development in Duck or Southern Shores. It will be more about traffic alleviation for those two towns.*
- *Overall, not much change to development or town is expected.*
- *The bridge will have a negligible effect on Kill Devil Hills.*
- *The bridge will likely have no impact on Southern Shores but will impact Currituck. However, Currituck is already changing without the bridge.*
- *The bridge won't affect Nags Head employee commuter patterns.*
- *Proposed bridge will not accelerate development in Duck or Southern Shores.*
- *Bridge will not change the development character of Corolla because most of it is already built-out. However, the bridge could increase density in PUDs where additional space is available.*
- *The bridge could accelerate redevelopment primarily due to better travel times.*
- *Most of the bridge's effects will be felt in Currituck County.*
- *The bridge will likely have no impact on Southern Shores but will impact Currituck. However, Currituck is already changing without the bridge.*

Traffic

Most jurisdiction representatives commented on various types of improvement to traffic in their area as a result of the bridge. Their specific views depended on their relative proximity to the bridge and the direction from which most of their visitor traffic arrived. Areas in the northern Outer Banks commented on shorter travel times for their visitors, while jurisdictions just north the Wright Memorial Bridge (WMB) noted the reduction in cut-through traffic, non contributing traffic, and congestion would be beneficial effects of the new bridge. Jurisdictions farther south were more ambivalent about the bridge, noting that it have little benefit for their visitors due to access patterns to the Outer banks. Several jurisdictions noted the benefits of expedited hurricane evacuation.

Traffic, Evacuation, Etc. — Selected Comments

- *The bridge should help to limit cut-through traffic*
- *Main attraction of bridge is to reduce congestion at turnover of weekly rentals.*
- *Bridge is more about traffic alleviation for Duck and Southern Shores.*
- *The primary benefits to Southern Shores will be traffic volume control and hurricane evacuation.*
- *Dare County will not be affected as much by the bridge because most of its visitors come from the southern end on Route 64, not from the north and Route 158.*
- *The biggest effect will be on evacuation of the town.*
- *The bridge would not affect development in Kill Devil Hills – just make getting there more convenient – perhaps a very secondary effect.*
- *The primary benefits to Southern Shores will be traffic volume control and hurricane evacuation.*
- *The bridge will be helpful to cut down on non contributing traffic for the central Outer Banks.*

Impact on Northern Beaches

Most interviewees believe that the new Mid-Currituck Bridge will increase development pressures on the northern beaches/four-wheel-drive (4WD)/Corova area. Some perceived this as inevitable due to current development patterns while others noted that this was the primary purpose of the bridge whether sponsors stated it explicitly or not. It was also noted that there are major impediments to additional development in the area including environmentalists, local residents, the federal government (which controls critical land holdings), and land owners with parcels between the current terminus of Route 12 and Corova who would have to grant access for the extension of the highway through wildlife preserves and undisturbed natural lands.

Impact on Northern Beaches — Selected Comments

- *The new bridge will increase development pressure on Corova/4WD area.*
- *Feds would have to step in to extend Route 12.*
- *Public perception or northern beaches is "Don't touch it!" Developer's say give me a paved road to make another Corolla.*
- *Development in the northern beaches would benefit the county economy with additional revenue even if it did not create high paying jobs.*
- *Unlikely to accelerate development in Nags Head – more pressure on the Northern Beaches.*
- *Bridge will not have much of an effect on the 4WD area – it is already developing without additional access.*
- *The proposed bridge will definitely "accelerate development in the northern beaches for God's sake". Opening up Corova is the whole purpose of the bridge isn't it? Proponents may say it's*

other things but the real reason is to drive development and get more people in to get more money.

Impact on Currituck Mainland

Many officials believe that the bridge will have major impacts on the mainland portion of Currituck County as well. There is a perceived opportunity to offer services on the mainland that require space not available on the Outer Banks, as well as the opportunity to compete with Dare County "rainy day" activities. It was noted that less traffic in the lower portion of the county due to the siphoning off of traffic by the new bridge could negatively impact businesses in the area. At the same time, others commented that reduced congestion in the area could attract businesses that had otherwise passed the area up.

Impact on Currituck Mainland — Selected Comments

- *The proposed bridge may bring big development to mid-county on the mainland due to the new access.*
- *Construction of the bridge will encourage strip commercial development near the terminus intersection.*
- *Some potential development has been lost on southern Route 158 due to congestion concerns. If the bridge is built, the county might see that development due to better traffic flow.*
- *Bridge will have "huge impacts" on the mainland.*
- *The main benefit will be the opportunity for the mainland to provide services for the Outer Banks portion of the county.*
- *Currituck mainland needs to develop a day long attraction to lure people on rainy days, etc.*
- *The bridge would impact southern Currituck because traffic would be siphoned off. Fewer cars equal fewer shoppers.*

Day Trippers

Most of the interviewees felt that the number of day trippers to Outer Banks might increase with the construction of a new bridge. Due to their limited stay, congestion is a major byproduct from this type of visitor. Several noted that the one constraint on day trippers using the new bridge would be the fact that the areas in the north that would be made more convenient by the new bridge are the very areas with limited public beach access. Jurisdictions in the south noted that they might benefit because with congestion lessened on the WMB, ease of access to their multiple points of public access would be increased. Representatives of some of the northern areas noted however, that if day trippers increased, steps might be taken to add public beach access to accommodate these additional visitors.

Day Trippers — Selected Comments

- *Perhaps it would attract more day trippers. For vacationers coming for a week, congestion is less of an issue, however for day trippers it matters a lot.*
- *If the bridge is built, the county would increase beach access to accommodate day trippers.*
- *Bridge may help seasonal day trippers to Duck because traffic alleviation. However, Currituck will be affected less because there is no place to park at the beach.*
- *Day trippers are significant, but the bridge does have the capacity to service them. Kitty Hawk has eight or nine public access points, three of which have parking lots, and an additional three with on-street parking.*

- *There is not public beach access in the town, so any increase in day trippers would not impact the town.*
- *There is a potential for more day trippers.*

Constraints on Growth

Most interviewees noted that there are serious infrastructure-related development limits in their jurisdictions, primarily due to the necessity of on-site septic in most areas of the Outer Banks. Some interviewees stated that there were no infrastructure constraints on development within their jurisdictions. The availability of potable water was not seen as a hindrance, as the area currently has excess capacity and a new reverse osmosis plant was recently completed. Some of those interviewed noted the physical constraint of available land resulting from their jurisdiction's location on a barrier island. Some jurisdictions noted environmental concerns of citizens and other organizations as constraints on additional development in the area, while others noted that there were no political constraints, as their jurisdiction was solidly behind additional development.

Constraints on Growth Comments — Selected Comments

- *There are no infrastructure limits on development – water is ok and all sewage is handled on site, there is no central system.*
- *There are no infrastructural constraints on development.*
- *No infrastructure constraints – utilities are ok.*
- *No political constraints – county would like to have additional revenue*
- *Biggest constraint concern is environmentalists.*
- *Wastewater lawsuit was, until recently, holding up development in Corolla.*
- *Much of the land in the town is coastal preserve – a mix of federal and state.*
- *Infrastructure is limiting to some extent – on-site septic is the only option in Kitty Hawk. The town is not supportive of a sewer system. Water is not a constraint for the town.*
- *Land area to develop is limited.*
- *There is no central wastewater system. There are some package plants, but on site wastewater treatment limits size/amount of development. 0.5M gallon/day system serves some businesses.*
- *Water is fine; just expand reverse osmosis plant if needed.*
- *There are not utility constraints – almost all homes and development is on private septic.*
- *Access to drinking water is fine.*

Real Estate Professionals/Land Owners/Developers

Northern Beaches

Most interviewees believe that development of the northern beaches will continue to occur slowly. This is due in part to several issues including lack of easy access, lack of services, and difficulty in obtaining flood insurance. Several interviewees suggested a lower impact gravel road for access to 4WD area to reduce impact on the beach and increase access to the area. Others stated that the new bridge itself would make additional and more intense development of the Corova area inevitable. Interviewees also believe that Corolla will experience additional development and redevelopment due to the increased access available from the new bridge.

Northern Beaches — Selected Comments

- *Extend Route 12 into 4WD area? Not easy, not likely soon.*
- *Could do low-impact road, like a gravel road. This would have less environmental impact than current traffic on beach.*
- *Would encourage a gravel road to the 4WD area*
- *Development proceeding in 4WD area, albeit slowly.*
- *Bridge will be a positive for growth and development in Corova. Will make further development of the area "inevitable" and will "really open up "the area for development".*
- *Not many women want to live or rent in the 4WD area – is major constraint on future development in that area*
- *Flood insurance expensive and not readily available in 4WD area. Have to make special arrangements for it.*
- *Wouldn't be opposed to opening up the 4WD area.*
- *MCB will spur some development and redevelopment in Corolla, maybe bringing some needed commercial.*
- *Corolla will change with the bridge. There will be more commercial development but it will be upscale.*

Mainland Development

Interviewees believe that the new Mid-Currituck bridge will spur additional development on the mainland. They suggested housing opportunities for the 55+ community and continuing care communities, although the scarcity of medical facilities would hinder this type of development. Some mentioned opportunities for work-force housing. Others suggested the development of "rainy day attractions" and general family entertainment for those vacationing on the Outer Banks.

Mainland Development — Selected Comments

- *Development will explode with the bridge, especially on the mainland.*
- *Currituck mainland has lots of potential for development where bridge lands and north/south along Route 158. Maybe entertainment/recreation uses? Maybe workforce housing farther from landing.*
- *Need for more housing, retail, and entertainment with the bridge. Affordable housing needed and mainland would be good location.*
- *Opportunities for 55+ housing on the mainland.*
- *Can see development being spurred on mainland as well. More focused on year-round residents. More business growth there as well. In particular, opportunity for retirement communities.*
- *Mainland development – rainy day attractions near the bridge landing; workforce housing but farther from bridge.*

General Development

Interviewees stated that current development standards are likely to be changed after the bridge is built, somewhat containing development. Another constraint on the development area is the relative small size of platted lots vs. the current market for large homes which require more acreage. They also stated that the new bridge is likely to assist in filling rooms during the shoulder seasons.

General Development — Selected Comments

- *Density and height restrictions aren't likely to change*
- *Vacant land in OBX is all platted, but lots too small to hold houses at the size the rental market demands. Very difficult to change platting, especially in Currituck County.*
- *McMansions are the way the game is played these days.*
- *For rental houses, bigger is better. Swimming pool is a must.*
- *Excess rental capacity at the beginning and end of the season is likely to fill in due to the bridge.*

Access/Traffic

Interviewees stated that the Mid-Currituck Bridge would be a great convenience for visitors to the northern Outer Banks, reducing some drive times by up to two hours during peak season. Evacuation benefits were seen as very secondary. Several interviewees noted that with the additional access there will be additional traffic that current traffic management systems will not be able to handle. In particular, beach access for automobiles should be managed, perhaps through a permit process to limit congestion and increase safety for beach pedestrians. It was also noted that the reduced congestion in Duck due to bridge would greatly increase safety in the area. Interviewees stated that the new bridge would likely increase commuters to and from Virginia and thereby increase the permanent population and the employment pool.

Access/Traffic — Selected Comments

- *MCB will be a convenience, not a safety (evacuation) asset*
- *The Mid-Currituck Bridge should have a very positive effect on his business. It will cut travel times by 1½ to 2 hours in some locations.*
- *MCB will benefit the area if traffic management systems are in place.*
- *Poor traffic management on beach.*
- *Beach traffic vs. beachgoer conflict.*
- *Bridge would benefit 4WD area IF infrastructure (including extended Route 12) is in place BEFORE. Otherwise, day-trippers from Virginia will swarm beach and make conditions even worse.*
- *A few primary residents will commute (to Virginia) if there is a bridge.*
- *MCB might bring more permanent residents.*
- *MCB would open OBX to new labor pool from Virginia.*
- *MCB would encourage more year-round residents.*
- *MCB impacts on Duck: Will cut down on traffic jams in Duck, and will make it safer for pedestrians, bicyclists.*

Bridge Toll

Interviewees involved in rental homes noted a preference for the bridge toll to be wrapped into the weekly rental rate to make it more palatable to vacationers. They stated that work crews that car pool would find the economics compelling to use the new bridge on turnover days. It was also noted that day trippers would likely not use the bridge due to cost and lack of public access in the northern beaches.

Toll — Selected Comments

- *Week-long visitors would pay. Day-trippers would be pushed down to WMB, which is closer to more public access beaches anyway. Workers (weekend house cleaning crews) make $1,000/day -- $30 toll would be worth it.*
- *Would encourage an add-on fee for bridge pass for renters.*
- *Doesn't think there will be a lot of back-and-forth traffic on the MCB.*

Day Trippers

Interviewees believe that the new bridge will spur additional day trippers to the Outer Banks however they have differing opinions of how they will get there. Some noted that they will likely use the WMB to the south to save money and to reach the existing public beach access points. Others think the reduced drive time to the north will bring additional day trippers to the northern beaches and four wheel drive area.

Day Tripper — Selected Comments

- *Day-trippers would be pushed down to WMB.*
- *MCB will bring more day-trippers.*
- *MCB will bring more day-trippers, but more services for day-trippers will be needed.*
- *Bridge will likely spur more weekend visitors instead of largely week-long visitors coming currently.*

Political Considerations

At least one interviewee noted that the bridge should move forward expeditiously while there was political support for its construction. They noted that the window of opportunity could close rapidly.

Political Considerations — Selected Comments

- *Will be a new election in 14 months and Marc Basnight could lose. If that happens "they" will find a way to "steal" the money for the bridge.*
- *Tell NCTA and Currituck Development Group to "Operate in haste".*

Other Agencies/Organizations

Audubon will consolidate and retain ownership of their approximately 2,600 acres of land and marshes holdings as natural areas. Audubon will open the land to public access, but in a low-impact way.

The North Carolina Division of Coastal Management stated that there are hurdles that would inhibit continuation of road connections into the 4WD area, primarily in the form of land owners who would not be willing to grant access, e.g., Audubon, U.S. Government, and the State of North Carolina, etc. that have conservation lands in the area. They noted that there is potential for improvements in the future, including paving the "streets" to the north, however, connecting them to the south is very unlikely. The Division noted that the new bridge should be a positive for the whole area, improving hurricane evacuation times, and providing the county with direct access to a major portion of its tax base.

Lodging and Transient Facility Operators

For this portion of the engagement, we contacted 64 lodging facilities within the study area boundaries to request a telephone interview. This group of properties consisted of, for the most part, hotels and motels; however, we also included some bed and breakfast facilities and cottage colonies as well as a few campgrounds.

As it was past the end of the peak season, several of the owners and/or managers were not on property and therefore not available to interview. Further, a few of those contacted refused to divulge information regarding their property and some others didn't feel that the bridge project would impact them and therefore, would not grant an interview. We were able to complete interviews with 16 properties.

Of those properties interviewed who were willing to share occupancy statistics, the average annual occupancy averaged from 55 to 60 percent. Although these properties are full during the peak season and, in fact, turn away a significant amount of demand during this period, the overall annual occupancy does not appear to support the development of additional lodging facilities over the short to medium term. In fact, several of the older lodging facilities have been or will be demolished and replaced with single and/or multifamily residences. A lack of available land in suitable locations was also cited as a hindrance to future development of lodging facilities in the area. The tourism trend in recent years has been to rent condominiums and single family homes for a vacation visit rather than to rent a hotel room.

The primary market segment in the area is tourists, with many of the facilities reporting an average of more than two guests to a room. Some properties report group meeting and/or group tour business and a few of the newer properties report some corporate demand; particularly during the off peak season.

Reaction to the bridge project from the persons interviewed was overwhelmingly positive. Although some felt that the bridge would not directly affect their property due to their location relative to the proposed bridge, most people believe that it will have a very positive impact on the area overall.

EXHIBIT B-4

#29251 / NCTA-Outer Banks

Delta Associates
Introduction for interviews

I am with Delta Associates, a real estate analysis firm based in the Washington, DC area. We are working on the Mid-Currituck Bridge project for the Currituck Development Group, which was selected by the North Carolina Turnpike Authority to develop the bridge. The proposed bridge will cross Currituck Sound from Currituck County mainland to the Currituck County Outer Banks, and will be a toll bridge. We are speaking with a variety of organizations in the Outer Banks and vicinity to gain an understanding of current conditions and the outlook for growth in the area. As someone involved in the Outer Banks economy/government, we'd appreciate your insights and comments. We'd like to schedule time, at your convenience, for an interview of perhaps up to 20 minutes or so. We hope to do about 50 of these interviews with real estate firms, hotel operators, land owners, and government officials. These discussions can be confidential, if you prefer. In contrast to data collected by a government agency, the information Delta gathers as a private firm is not subject to public disclosure requirements. The interview information will be aggregated so that no individual responses or opinions are identified. The information you and others share will be essential in helping us develop assumptions for demographic and land use projections. These projections will in turn be inputs into a model estimating future bridge usage and revenues.

EXHIBIT B-5

#29251 / NCTA-Outer Banks DATE:_____

Delta Associates
Questions/Topics for interviews

CONTACT TYPE: **Real Estate**

CONTACT:_____

TITLE:_____

COMPANY/ORGANIZATION:_____

INTERVIEW TYPE:_____

INTERVIEWER:_____

Introduction

1. Is there a need for new development? If so, what type? Year-round, rental s.f., rental m.f., commercial, etc.

2. What are the key constraints on development?

3. Where is development most likely to be concentrated over the next 10-20 years? Existing areas more dense, expansion of developed area?

4. Are there specific planned projects that you are aware of that may impact the area? Who are the land owners/developers?

5. For your properties, what are your plans for expansion/renovation/development?

6. What impacts might the proposed Mid-Currituck bridge have on development location & type (both residential & commercial)?

7. What impacts might the proposed Mid-Currituck bridge have on demographics of full-time and part-time residents, as well as vacationers?

EXHIBIT B-5

#29251 / NCTA-Outer Banks DATE:_____

Delta Associates
Questions/Topics for interviews

CONTACT TYPE: **Government**

CONTACT:_____

TITLE:_____

COMPANY/ORGANIZATION:_____

INTERVIEW TYPE:_____

INTERVIEWER:_____

Introduction

1. What does the comprehensive plan have to say about development in the areas impacted by the new bridge? Vision of 2030?

2. Where will new development be located and of what type/character will it be?

3. Where will redevelopment be located and of what type/character will it be?

4. What is the land holding capacity at build out? # of acres, # of units, # of households, people, etc.

5. What is your long-term outlook on the development in the area if the proposed Mid-Currituck bridge in built? How might it affect the character of development (residential & commercial)?

6. What impacts might the proposed Mid-Currituck bridge have on demographics of full-time and part-time residents, as well as vacationers?

7. What are the geographical, political, & fiscal constraints on growth?

EXHIBIT B-5

HOTEL INTERVIEW FORM

Property Name: _____
Address: _____
_____
Telephone: _____
Contact Person: _____
Owner: _____
Relationship to property/management company: _____
Has management/name/franchise affiliation changed within the last five years? _____
_____

Rooms: _____
Year Opened: _____

MARKET CONDITIONS

	Occupancy %	Avg. Daily Rate
2009 Budget	_____	_____
2008	_____	_____
2007	_____	_____

Market Segmentation: (percent)

Corporate:	_____
Group Meeting:	_____
Group-Tour:	_____
Individual Tourist:	_____
Other:	_____

Which market segment do you expect to grow the most and why?_____
_____
_____

% Double occupancy:	_____
Average length of stay (# of days):	_____
% of business through reservation system:	_____
% of walk-in business:	_____
% of new business:	_____

Fill Patterns:

Weekly: _____
Seasonally: _____
Number of sold out nights in 2008/9: _____

New hotels rumored/proposed/under construction:

Property/Location	# of Rooms	Status	Opening Date
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

EXHIBIT B-5

Opportunities for growth and/or problems hindering growth?_____
_____
_____

FACILITIES AND AMENITITIES

Room Mix:

	# of Rooms	%Sold
King:	_____	_____
Queen:	_____	_____
Double/Double:	_____	_____
Suite:	_____	_____
Other:	_____	_____

Do you have plans for refurbishment or an addition to the property?_____

Scope: _____
Scheduled Date of Completion:_____
Budget: _____

Last refurbishment:

Date: _____
Scope: _____

Amenities

Indoor Pool
Outdoor Pool
Jacuzzi/Hot Tub
Fitness Center
Spa
Business Center
Restaurant
Cocktail Lounge
Meeting/banquet Space Square Feet_____
Snack Bar
Patio/balcony
Cable TV
In-room movies
Telephone
Guest laundry
WIFI access
Refrigerator
Coffee maker
Microwave oven
Fully equipped kitchen
Hair dryer
Iron and ironing board

EXHIBIT B-5

Employees

Number of employees by season

Number of FTE versus PT?

Where do the employees live?

How do the employes get to work (by season)

Do you provide/coordinate/encourage shuttles and/or carpools?

Appendix C:

Land Use and Demographic Forecasts

TABLE C-1

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - BASE CASE
BASE YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental							Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal									Annual Occ	Seasonal Occupancy					Annual Occ	Seasonal Occupancy									
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2009	Base	1	Southern Shores	Internal	3,994	4,913	5,913	1,472	445	527	529	473	1,748	$137,330	4,067	39,462	101	1,251	5,020	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2009	Base	2	Duck	Internal	544	4,949	5,957	1,483	1,043	1,235	1,241	1,109	238	$114,484	535	164,873	94	1,156	5,049	37%	84%	99%	59%	11%	10	58%	76%	79%	67%	46%						
2009	Base	3	Sanderling South	Internal	364	3,356	4,040	1,005	265	314	316	282	159	$175,216	371	49,065	63	777	3,344	37%	84%	99%	59%	11%	93	58%	76%	79%	67%	46%						
2009	Base	4	Sanderling North	Internal	0	578	696	173	21	24	25	22	0	$0	0	1,888	5	60	365	37%	84%	99%	59%	11%	123	58%	76%	79%	67%	46%						
2009	Base	5	Corolla South	Internal	262	6,229	7,497	1,866	77	90	92	82	103	$232,608	237	0	86	1,062	5,154	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2009	Base	6	Corolla South Central	Internal	132	1,643	1,978	492	202	237	241	215	52	$249,847	119	78,497	25	302	1,360	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2009	Base	7	Corolla North Central	Internal	251	4,359	5,247	1,306	615	723	735	655	99	$260,106	227	230,048	57	709	3,607	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2009	Base	8	Corolla North	Internal	244	4,425	5,326	1,326	309	363	369	329	96	$268,299	221	31,427	59	730	3,622	37%	84%	99%	59%	11%	43	58%	76%	79%	67%	46%						
2009	Base	9	Carova, 4wd area	Internal	274	2,652	3,191	794	139	164	166	148	108	$138,650	248	0	43	528	2,194	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2009	Base	10	Kitty Hawk	Internal	3,449	4,753	5,721	1,424	3,229	3,826	3,844	3,435	1,509	$81,572	3,447	330,488	110	1,352	4,467	37%	84%	99%	59%	11%	422	58%	76%	79%	67%	46%						
2009	Base	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	4,744	7,642	9,198	2,289	1,529	1,813	1,822	1,628	2,076	$65,213	4,795	369,479	195	2,400	7,244	37%	84%	99%	59%	11%	611	58%	76%	79%	67%	46%						
2009	Base	12	Collington	Internal	3,555	2,481	2,987	743	551	653	656	586	1,556	$68,225	3,624	17,188	65	804	2,532	37%	84%	99%	59%	11%	4	58%	76%	79%	67%	46%						
2009	Base	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,004	4,658	5,606	1,395	3,815	4,521	4,543	4,059	877	$72,312	1,989	403,273	103	1,275	4,154	37%	84%	99%	59%	11%	655	58%	76%	79%	67%	46%						
2009	Base	14	Nags Head	Internal	1,567	3,617	4,353	1,083	2,275	2,696	2,710	2,420	686	$94,826	1,574	319,765	78	966	3,594	37%	84%	99%	59%	11%	110	58%	76%	79%	67%	46%						
2009	Base	15	Nags Head / Whalebone	Internal	1,260	5,538	6,666	1,659	2,954	3,500	3,517	3,142	552	$95,723	1,247	480,425	104	1,287	5,162	37%	84%	99%	59%	11%	538	58%	76%	79%	67%	46%						
2009	Base	16	Manteo	Internal	5,083	3,101	3,732	929	3,726	4,414	4,435	3,963	2,224	$72,343	5,126	325,405	74	914	2,921	37%	84%	99%	59%	11%	268	58%	76%	79%	67%	46%						
2009	Base	17	Wanchese	Internal	1,376	343	413	103	962	1,140	1,146	1,024	602	$45,471	1,379	25,497	133	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2009	Base	18	Bodie Island	Internal	481	3,541	4,262	1,061	190	225	226	202	210	$106,408	470	3,200	68	845	3,445	37%	84%	99%	59%	11%	187	58%	76%	79%	67%	46%						
2009	Base	19	Lower Currituck Peninsula - South	Internal	2,781	477	574	143	1,997	2,347	2,388	2,125	1,096	$90,237	2,517	109,712	140	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2009	Base	20	Elizabeth City	External																											20,277	11,599	7,884	$65,419	$65,419	15,448
2009	Base	21	Moyock Township	Internal	7,201	356	428	107	1,232	1,449	1,473	1,312	2,838	$74,508	6,517	201,827	96	0	0	na	na	na	na	na	4	58%	76%	79%	67%	46%						
2009	Base	22	Dare County Mainland	External																											844	1,119	369	$43,510	$43,510	851
2009	Base	23	Hatteras Island	External																											4,758	4,787	2,082	$81,092	$81,092	4,748
2009	Base	24	Pasquotank County (Excl. Elizabeth City), NC	External																											21,373	12,225	8,310	$65,419	$65,419	16,277
2009	Base	25	Crawford Township	Internal	7,188	599	720	179	2,115	2,486	2,529	2,251	2,833	$77,731	6,505	81,230	173	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2009	Base	26	Lower Currituck Peninsula - North	Internal	1,478	236	284	71	542	637	648	577	582	$80,473	1,337	33,448	72	0	0	na	na	na	na	na	0	na	na	na	na	na						
2009	Base	27	Lower Currituck Peninsula - Central	Internal	3,590	552	665	165	1,294	1,521	1,547	1,377	1,415	$61,358	3,249	186,214	174	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2009	Base	28	Camden County, NC	External																											9,933	3,454	4,037	$74,159	$74,159	9,484
2009	Base	29	Balance of Massachusetts	External																											2,407,231	1,286,452	969,890	$101,449	$101,449	1,560,397
2009	Base	30	Balance of Connecticut	External																											2,616,307	1,618,007	1,044,574	$115,480	$115,480	1,758,295
2009	Base	31	Albemarle Peninsula, NC	External																											22,257	9,761	8,946	$69,164	$69,164	14,398
2009	Base	32	Knotts Island	External																											1,439	413	567	$64,612	$64,612	1,303
2009	Base	33	Balance of Maryland	External																											647,726	366,578	259,145	$84,774	$84,774	451,573
2009	Base	34	Balance of Delaware	External																											350,663	178,365	141,624	$77,334	$77,334	252,866
2009	Base	35	Balance of New Jersey	External																											894,079	586,296	336,527	$129,386	$129,386	523,359
2009	Base	36	Balance of Virginia	External																											2,242,764	1,235,300	923,008	$72,453	$72,453	1,695,153
2009	Base	37	Balance of North Carolina	External																											6,065,127	3,206,603	2,452,259	$78,315	$78,315	4,440,715
2009	Base	38	Balance of South Carolina	External																											4,311,829	2,365,876	1,714,621	$79,503	$79,503	2,957,051
2009	Base	39	Georgia	External																											9,822,815	5,375,426	3,698,353	$88,702	$88,702	6,601,274
2009	Base	40	Balance of West Virginia	External																											1,765,795	872,386	745,574	$75,474	$75,474	1,209,411
2009	Base	41	Balance of Ohio	External																											5,269,630	2,752,862	2,114,378	$76,540	$76,540	3,825,478
2009	Base	42	Michigan	External																											10,035,072	5,071,428	3,964,515	$88,826	$88,826	6,983,293
2009	Base	43	Balance of Pennsylvania	External																											3,594,865	1,922,969	1,441,525	$76,687	$76,687	2,403,851
2009	Base	44	Balance of New York State	External																											5,887,672	3,209,802	2,336,426	$86,077	$86,077	3,784,892
2009	Base	45	Balance of New Hampshire	External																											906,630	582,666	365,126	$102,255	$102,255	658,450
2009	Base	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	450	533	536	479	0	$0	0	364,834	na	na	na	na	na	na	na	na	na	na	na	na	na						
2009	Base	47	Washington, DC-VA-MD-WV MSA	External																											5,443,194	3,838,226	2,114,661	$146,754	$159,621	3,564,348
2009	Base	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											5,865,190	3,458,435	2,280,959	$121,503	$135,928	3,455,933
2009	Base	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											19,098,169	10,827,773	7,155,467	$144,547	$164,812	8,503,307
2009	Base	50	Baltimore-Towson, MD MSA	External																											2,697,617	1,645,813	1,074,633	$119,057	$131,244	1,717,602
2009	Base	51	Richmond, VA MSA	External																											1,247,375	760,143	500,228	$99,745	$105,094	906,034
2009	Base	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											1,677,344	1,039,248	643,354	$98,389	$103,615	1,117,931
2009	Base	53	Pittsburgh, PA MSA	External																											2,353,378	1,427,897	991,366	$102,934	$105,021	1,540,983
2009	Base	54	Raleigh-Cary, NC MSA	External																											1,112,618	656,500	440,056	$99,306	$103,246	809,040
2009	Base	55	Cleveland-Elyria-Mentor, OH MSA	External																											2,087,637	1,269,327	854,312	$98,156	$98,860	1,390,773
2009	Base	56	Harrisburg-Carlisle, PA MSA	External																											534,815	396,606	220,572	$94,455	$95,385	376,800
2009	Base	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											818,121	422,839	325,373	$95,086	$91,547	568,087
2009	Base	58	Columbus, OH MSA	External																											1,791,654	1,170,993	734,375	$93,386	$96,160	1,286,750
2009	Base	59	Lancaster, PA MSA	External																											507,385	302,854	193,371	$93,078	$93,078	336,704
2009	Base	60	Charlottesville, VA MSA	External																											196,719	134,934	80,247	$100,903	$102,857	149,217
2009	Base	61	York-Hanover, PA MSA	External																											429,522	225,013	172,601	$87,024	$87,024	321,150
2009	Base	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											897,717	601,179	338,005	$215,327	$215,327	597,575
2009	Base	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											4,543,803	3,071,881	1,802,378	$137,716	$139,690	2,791,018
2009	Base	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,171,185	1,266,738	872,478	$98,606	$98,331	1,532,234
2009	Base	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											1,733,739	1,048,744	686,456	$98,414	$100,054	1,224,150
2009	Base	66	Akron, OH MSA	External																											699,175	409,640	286,241	$91,341	$91,050	510,736
2009	Base	67	Rochester, NY MSA	External																											1,034,524	622,615	406,988	$96,756	$98,957	669,296
2009	Base	68	Reading, PA MSA	External																											405,808	222,402	157,825	$90,985	$90,985	274,449
2009	Base	69	Durham-Chapel Hill, NC MSA	External																											498,482	374,076	204,096	$98,665	$102,532	357,814
2009	Base	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											102,390	43,060	41,978	$71,789	$71,789	71,334
2009	**Base**		**Total/Average**		**51,822**	**70,998**	**85,451**	**21,268**	**29,975**	**35,440**	**35,734**	**31,894**	**21,659**	**$84,003**	**49,801**	**3,847,245**	**2,120**	**16,417**	**63,233**	**37%**	**84%**	**99%**	**59%**	**11%**	**3,108**	**58%**	**76%**	**79%**	**67%**	**46%**	**114,846,647**	**65,911,311**	**45,117,761**	**$105,764**	**$110,994**	**73,241,830**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-2

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - BASE CASE
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental							Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal								Annual Occ	Seasonal Occupancy						Annual Occ	Seasonal Occupancy									
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2015	Base	1	Southern Shores	Internal	4,309	5,546	6,675	1,661	491	582	584	522	1,936	175,382	4,506	39,462	115	1,413	5,986	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2015	Base	2	Duck	Internal	587	5,545	6,673	1,661	1,151	1,364	1,371	1,225	276	146,205	619	164,873	102	1,262	5,694	37%	84%	99%	59%	11%	10	58%	76%	79%	67%	46%						
2015	Base	3	Sanderling South	Internal	393	3,760	4,525	1,126	292	346	349	312	178	223,765	416	49,065	69	848	3,800	37%	84%	99%	59%	11%	93	58%	76%	79%	67%	46%						
2015	Base	4	Sanderling North	Internal	0	578	696	173	24	28	28	25	0	0	0	1,888	5	60	365	37%	84%	99%	59%	11%	123	58%	76%	79%	67%	46%						
2015	Base	5	Corolla South	Internal	303	7,031	8,463	2,106	140	164	167	148	122	272,708	281	0	97	1,199	6,132	37%	84%	99%	59%	11%	100	na	na	na	na	na						
2015	Base	6	Corolla South Central	Internal	153	1,855	2,233	556	231	272	277	246	62	292,919	142	78,497	28	341	1,609	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2015	Base	7	Corolla North Central	Internal	291	4,921	5,923	1,474	821	966	982	874	117	304,946	270	300,048	65	800	4,314	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2015	Base	8	Corolla North	Internal	283	4,995	6,012	1,496	354	416	423	376	114	314,552	263	31,427	67	824	4,316	37%	84%	99%	59%	11%	43	58%	76%	79%	67%	46%						
2015	Base	9	Carova, 4wd area	Internal	318	2,993	3,603	897	159	187	191	170	128	162,552	295	0	48	596	2,551	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2015	Base	10	Kitty Hawk	Internal	3,721	5,366	6,458	1,607	3,641	4,314	4,334	3,873	1,672	104,174	3,819	330,488	124	1,527	5,388	37%	84%	99%	59%	11%	572	58%	76%	79%	67%	46%						
2015	Base	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	5,117	8,627	10,383	2,584	1,689	2,002	2,012	1,798	2,300	83,282	5,313	369,479	220	2,709	8,828	37%	84%	99%	59%	11%	611	58%	76%	79%	67%	46%						
2015	Base	12	Collington	Internal	3,835	2,801	3,372	839	608	721	724	647	1,724	87,128	4,015	17,188	74	908	3,010	37%	84%	99%	59%	11%	4	58%	76%	79%	67%	46%						
2015	Base	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,162	5,258	6,328	1,575	4,295	5,090	5,114	4,570	972	92,348	2,204	453,273	117	1,440	5,001	37%	84%	99%	59%	11%	655	58%	76%	79%	67%	46%						
2015	Base	14	Nags Head	Internal	1,691	4,083	4,914	1,223	2,637	3,125	3,141	2,805	760	121,101	1,743	394,765	88	1,090	4,282	37%	84%	99%	59%	11%	110	58%	76%	79%	67%	46%						
2015	Base	15	Nags Head / Whalebone	Internal	1,360	6,252	7,525	1,873	3,262	3,866	3,884	3,470	611	122,246	1,381	480,425	118	1,452	6,041	37%	84%	99%	59%	11%	538	58%	76%	79%	67%	46%						
2015	Base	16	Manteo	Internal	5,484	3,500	4,213	1,049	4,114	4,875	4,897	4,376	2,449	92,388	5,644	325,405	84	1,032	3,451	37%	84%	99%	59%	11%	268	58%	76%	79%	67%	46%						
2015	Base	17	Wanchese	Internal	1,484	387	466	116	1,062	1,259	1,265	1,131	652	58,070	1,494	25,497	151	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2015	Base	18	Bodie Island	Internal	519	3,875	4,664	1,161	210	249	250	223	250	135,891	557	3,200	73	897	3,766	37%	84%	99%	59%	11%	187	58%	76%	79%	67%	46%						
2015	Base	19	Lower Currituck Peninsula - South	Internal	3,225	539	648	161	2,288	2,689	2,735	2,435	1,302	105,794	2,991	109,712	158	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2015	Base	20	Elizabeth City	External																											21,877	12,625	8,794	$80,385	$80,385	17,232
2015	Base	21	Moyock Township	Internal	8,352	402	484	120	1,412	1,660	1,688	1,503	3,372	87,353	7,744	201,827	108	0	0	na	na	na	na	na	4	58%	76%	79%	67%	46%						
2015	Base	22	Dare County Mainland	External																											911	1,236	409	$55,566	$55,566	943
2015	Base	23	Hatteras Island	External																											5,132	5,286	2,307	$103,561	$103,561	5,260
2015	Base	24	Pasquotank County (Excl. Elizabeth City), NC	External																											23,059	13,307	9,270	$80,385	$80,385	18,157
2015	Base	25	Crawford Township	Internal	8,336	676	813	202	2,424	2,849	2,897	2,579	3,366	91,132	7,730	81,230	196	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2015	Base	26	Lower Currituck Peninsula - North	Internal	1,714	266	320	80	621	730	743	661	692	94,346	1,589	33,448	81	0	0	na	na	na	na	na	0	na	na	na	na	na						
2015	Base	27	Lower Currituck Peninsula - Central	Internal	4,163	623	750	187	1,482	1,742	1,772	1,578	1,681	71,936	3,860	186,214	197	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2015	Base	28	Camden County, NC	External																											11,452	3,929	4,800	$87,637	$87,637	11,276
2015	Base	29	Balance of Massachusetts	External																											2,487,980	1,388,900	1,030,110	$128,802	$128,802	1,651,010
2015	Base	30	Balance of Connecticut	External																											2,680,814	1,732,802	1,094,278	$148,065	$148,065	1,842,228
2015	Base	31	Albemarle Peninsula, NC	External																											22,545	10,511	9,355	$83,898	$83,898	15,056
2015	Base	32	Knotts Island	External																											1,669	474	674	$75,750	$75,750	1,548
2015	Base	33	Balance of Maryland	External																											695,904	401,568	286,009	$106,442	$106,442	492,286
2015	Base	34	Balance of Delaware	External																											394,331	199,004	163,833	$96,018	$96,018	292,498
2015	Base	35	Balance of New Jersey	External																											930,470	631,248	356,130	$166,388	$166,388	553,614
2015	Base	36	Balance of Virginia	External																											2,340,597	1,329,552	987,487	$91,291	$91,291	1,789,434
2015	Base	37	Balance of North Carolina	External																											6,411,929	3,470,890	2,652,270	$98,052	$98,052	4,802,244
2015	Base	38	Balance of South Carolina	External																											4,614,537	2,572,980	1,881,055	$99,896	$99,896	3,243,835
2015	Base	39	Georgia	External																											10,658,046	5,883,376	4,080,428	$112,056	$112,056	7,283,248
2015	Base	40	Balance of West Virginia	External																											1,786,235	933,291	770,123	$95,455	$95,455	1,248,377
2015	Base	41	Balance of Ohio	External																											5,293,913	2,922,743	2,171,950	$97,650	$97,650	3,921,208
2015	Base	42	Michigan	External																											10,240,427	5,400,803	4,146,782	$112,796	$112,796	7,304,347
2015	Base	43	Balance of Pennsylvania	External																											3,658,211	2,059,309	1,497,242	$97,256	$97,256	2,462,828
2015	Base	44	Balance of New York State	External																											5,961,467	3,404,636	2,408,838	$110,453	$110,453	3,899,640
2015	Base	45	Balance of New Hampshire	External																											968,383	637,410	400,700	$129,245	$129,245	722,525
2015	Base	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	497	589	592	529	0	0	0	364,834	na	na	na	na	na	na	na	na	na	na	na	na	na	na						
2015	Base	47	Washington, DC-VA-MD-WV MSA	External																											5,960,466	4,211,085	2,361,161	$184,935	$200,678	3,979,833
2015	Base	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											6,034,362	3,713,825	2,401,800	$155,558	$173,006	3,639,022
2015	Base	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											19,675,094	11,486,583	7,482,981	$185,264	$212,738	8,892,514
2015	Base	50	Baltimore-Towson, MD MSA	External																											2,884,245	1,790,481	1,179,756	$150,768	$164,201	1,885,621
2015	Base	51	Richmond, VA MSA	External																											1,379,399	833,635	565,886	$124,458	$129,940	1,024,957
2015	Base	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											1,793,937	1,127,312	708,418	$123,582	$128,305	1,230,990
2015	Base	53	Pittsburgh, PA MSA	External																											2,370,249	1,524,242	1,015,477	$133,015	$135,815	1,578,462
2015	Base	54	Raleigh-Cary, NC MSA	External																											1,256,971	734,774	505,137	$123,153	$128,527	928,691
2015	Base	55	Cleveland-Elyria-Mentor, OH MSA	External																											2,087,097	1,342,481	875,043	$126,505	$127,024	1,424,522
2015	Base	56	Harrisburg-Carlisle, PA MSA	External																											557,832	423,174	236,046	$118,604	$119,406	403,234
2015	Base	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											878,705	459,944	355,040	$120,298	$116,014	619,884
2015	Base	58	Columbus, OH MSA	External																											1,905,334	1,269,099	802,495	$117,664	$120,825	1,406,108
2015	Base	59	Lancaster, PA MSA	External																											538,179	331,115	210,537	$118,081	$118,081	366,594
2015	Base	60	Charlottesville, VA MSA	External																											210,952	147,560	88,930	$126,563	$129,250	165,363
2015	Base	61	York-Hanover, PA MSA	External																											459,739	244,701	189,362	$108,451	$108,451	352,337
2015	Base	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											915,219	647,470	349,912	$285,780	$285,780	618,626
2015	Base	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											4,676,312	3,276,859	1,899,903	$175,469	$178,420	2,942,037
2015	Base	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,270,621	1,369,809	937,687	$130,442	$129,203	1,646,753
2015	Base	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											1,927,431	1,168,373	778,939	$122,216	$123,751	1,389,074
2015	Base	66	Akron, OH MSA	External																											704,023	439,936	296,275	$118,838	$118,447	528,639
2015	Base	67	Rochester, NY MSA	External																											1,038,791	660,503	414,778	$124,980	$128,247	682,107
2015	Base	68	Reading, PA MSA	External																											419,691	239,565	165,852	$116,113	$116,113	288,407
2015	Base	69	Durham-Chapel Hill, NC MSA	External																											551,402	415,545	231,082	$122,535	$127,375	405,125
2015	Base	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											103,833	46,181	43,894	$88,927	$88,927	74,666
2015	**Base**		**Total/Average**		**57,799**	**79,880**	**96,141**	**23,929**	**33,906**	**40,084**	**40,421**	**36,076**	**24,737**	**$103,474**	**56,874**	**4,042,245**	**2,382**	**18,397**	**74,532**	**37%**	**84%**	**99%**	**59%**	**11%**	**3,358**	**58%**	**76%**	**79%**	**67%**	**46%**	**119,809,771**	**70,920,130**	**48,059,234**	**$134,561**	**$141,270**	**78,052,358**

Source: East Carolina Univ., Woods and Poole, Delta Associates, Feb. 2010.

TABLE C-3

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - BASE CASE
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental							Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal								Annual Occ	Seasonal Occupancy						Annual Occ	Seasonal Occupancy									
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2020	Base	1	Southern Shores	Internal	4,726	6,073	7,309	1,819	621	736	739	660	2,073	225,648	4,823	84,462	122	1,500	6,540	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2020	Base	2	Duck	Internal	644	5,547	6,676	1,662	1,274	1,509	1,517	1,356	276	188,109	619	164,873	102	1,262	5,697	37%	84%	99%	59%	11%	10	58%	76%	79%	67%	46%						
2020	Base	3	Sanderling South	Internal	431	3,762	4,528	1,127	323	383	386	345	178	287,898	416	49,065	69	848	3,802	37%	84%	99%	59%	11%	93	58%	76%	79%	67%	46%						
2020	Base	4	Sanderling North	Internal	0	578	696	173	27	32	33	29	0	0	0	1,888	5	60	365	37%	84%	99%	59%	11%	123	58%	76%	79%	67%	46%						
2020	Base	5	Corolla South	Internal	349	8,034	9,669	2,407	159	187	190	170	143	344,460	328	0	111	1,370	7,354	37%	84%	99%	59%	11%	100	na	na	na	na	na						
2020	Base	6	Corolla South Central	Internal	176	2,119	2,551	635	264	310	316	281	72	369,989	165	78,497	32	390	1,920	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2020	Base	7	Corolla North Central	Internal	335	5,623	6,767	1,684	938	1,103	1,121	998	137	385,180	315	300,048	74	914	5,198	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2020	Base	8	Corolla North	Internal	327	5,708	6,870	1,710	628	738	751	668	134	397,313	307	156,427	76	941	5,182	37%	84%	99%	59%	11%	43	58%	76%	79%	67%	46%						
2020	Base	9	Carova, 4wd area	Internal	366	3,420	4,116	1,025	182	214	218	194	150	205,321	344	0	55	681	2,998	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2020	Base	10	Kitty Hawk	Internal	4,081	6,131	7,379	1,837	4,028	4,773	4,795	4,285	1,862	134,032	4,252	330,488	141	1,744	6,516	37%	84%	99%	59%	11%	572	58%	76%	79%	67%	46%						
2020	Base	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	5,613	9,124	10,982	2,733	2,109	2,500	2,512	2,245	2,445	107,152	5,647	469,479	220	2,709	8,995	37%	84%	99%	59%	11%	736	58%	76%	79%	67%	46%						
2020	Base	12	Collington	Internal	4,206	3,201	3,852	959	673	798	802	716	1,919	112,100	4,470	17,188	84	1,037	3,605	37%	84%	99%	59%	11%	4	58%	76%	79%	67%	46%						
2020	Base	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,371	5,619	6,763	1,683	4,752	5,632	5,659	5,056	1,027	118,816	2,329	453,273	120	1,486	5,287	37%	84%	99%	59%	11%	655	58%	76%	79%	67%	46%						
2020	Base	14	Nags Head	Internal	1,854	4,472	5,383	1,340	2,917	3,457	3,475	3,104	842	155,810	1,932	394,765	94	1,158	4,673	37%	84%	99%	59%	11%	110	58%	76%	79%	67%	46%						
2020	Base	15	Nags Head / Whalebone	Internal	1,491	6,488	7,809	1,944	3,778	4,477	4,499	4,019	627	157,283	1,417	580,425	118	1,452	6,092	37%	84%	99%	59%	11%	538	58%	76%	79%	67%	46%						
2020	Base	16	Manteo	Internal	6,014	3,999	4,813	1,198	4,552	5,394	5,419	4,842	2,923	118,867	6,735	325,405	96	1,179	4,080	37%	84%	99%	59%	11%	268	58%	76%	79%	67%	46%						
2020	Base	17	Wanchese	Internal	1,628	442	533	133	1,175	1,393	1,400	1,251	921	74,714	2,111	25,497	172	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2020	Base	18	Bodie Island	Internal	569	3,895	4,688	1,167	232	275	276	246	250	174,839	557	3,200	73	897	3,788	37%	84%	99%	59%	11%	187	58%	76%	79%	67%	46%						
2020	Base	19	Lower Currituck Peninsula - South	Internal	3,717	615	741	184	2,613	3,071	3,124	2,780	1,520	133,629	3,491	109,712	181	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2020	Base	20	Elizabeth City	External																											23,997	13,898	9,838	$102,561	$102,561	19,277
2020	Base	21	Moyock Township	Internal	9,624	459	552	138	1,931	2,270	2,309	2,055	3,936	110,336	9,039	351,827	124	0	0	na	na	na	na	na	104	58%	76%	79%	67%	46%						
2020	Base	22	Dare County Mainland	External																											999	1,368	456	$71,491	$71,491	1,050
2020	Base	23	Hatteras Island	External																											5,629	5,849	2,568	$133,243	$133,243	5,856
2020	Base	24	Pasquotank County (Exd. Elizabeth City), NC	External																											25,294	14,649	10,370	$102,561	$102,561	20,311
2020	Base	25	Crawford Township	Internal	9,606	772	929	231	2,767	3,253	3,309	2,945	3,929	115,109	9,023	81,230	224	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2020	Base	26	Lower Currituck Peninsula - North	Internal	1,975	304	366	91	710	834	848	755	808	119,169	1,855	33,448	92	0	0	na	na	na	na	na	0	na	na	na	na	na						
2020	Base	27	Lower Currituck Peninsula - Central	Internal	4,797	712	857	213	1,693	1,990	2,024	1,801	1,962	90,863	4,506	186,214	225	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2020	Base	28	Camden County, NC	External																											13,145	4,487	5,614	$109,597	$109,597	13,190
2020	Base	29	Balance of Massachusetts	External																											2,642,224	1,510,359	1,110,735	$166,857	$166,857	1,774,890
2020	Base	30	Balance of Connecticut	External																											2,827,724	1,871,847	1,167,161	$192,628	$192,628	1,965,153
2020	Base	31	Albemarle Peninsula, NC	External																											23,563	11,489	9,971	$108,126	$108,126	16,047
2020	Base	32	Knotts Island	External																											1,923	541	787	$95,681	$95,681	1,807
2020	Base	33	Balance of Maryland	External																											760,972	442,141	317,443	$137,535	$137,535	541,380
2020	Base	34	Balance of Delaware	External																											445,235	223,435	187,982	$124,064	$124,084	335,596
2020	Base	35	Balance of New Jersey	External																											993,468	686,929	382,695	$219,192	$219,192	594,713
2020	Base	36	Balance of Virginia	External																											2,504,438	1,445,393	1,070,681	$117,944	$117,944	1,920,027
2020	Base	37	Balance of North Carolina	External																											6,928,322	3,791,847	2,899,189	$126,301	$126,301	5,248,781
2020	Base	38	Balance of South Carolina	External																											5,031,701	2,823,919	2,078,244	$128,578	$128,578	3,583,669
2020	Base	39	Georgia	External																											11,738,271	6,491,519	4,523,485	$144,921	$144,921	8,074,070
2020	Base	40	Balance of West Virginia	External																											1,864,800	1,008,998	812,214	$123,904	$123,904	1,315,856
2020	Base	41	Balance of Ohio	External																											5,495,657	3,136,724	2,279,981	$126,970	$126,970	4,108,909
2020	Base	42	Michigan	External																											10,766,431	5,820,438	4,418,296	$146,049	$146,049	7,782,605
2020	Base	43	Balance of Pennsylvania	External																											3,837,532	2,227,937	1,585,768	$126,346	$126,346	2,579,265
2020	Base	44	Balance of New York State	External																											6,228,477	3,655,026	2,535,795	$144,266	$144,266	4,103,100
2020	Base	45	Balance of New Hampshire	External																											1,054,426	701,012	442,944	$166,383	$166,383	798,628
2020	Base	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	550	652	655	585	0	0	0	364,834	na	na	0	na	na	na	na	na	na	na	na	na	na	na						
2020	Base	47	Washington, DC-VA-MD-WV MSA	External																											6,607,534	4,658,339	2,641,514	$237,441	$257,739	4,452,379
2020	Base	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											6,385,589	4,027,727	2,572,448	$202,398	$223,913	3,897,574
2020	Base	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											20,841,977	12,325,530	7,969,079	$240,856	$277,809	9,470,176
2020	Base	50	Baltimore-Towson, MD MSA	External																											3,142,738	1,962,181	1,304,102	$194,737	$210,297	2,084,366
2020	Base	51	Richmond, VA MSA	External																											1,539,709	923,606	639,145	$159,668	$165,843	1,157,646
2020	Base	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											1,955,180	1,237,754	785,077	$158,972	$163,686	1,364,196
2020	Base	53	Pittsburgh, PA MSA	External																											2,465,721	1,643,276	1,063,432	$174,904	$178,669	1,653,003
2020	Base	54	Raleigh-Cary, NC MSA	External																											1,423,623	825,789	575,613	$157,450	$164,558	1,058,261
2020	Base	55	Cleveland-Elyria-Mentor, OH MSA	External																											2,157,967	1,440,805	916,643	$165,424	$165,799	1,492,245
2020	Base	56	Harrisburg-Carlisle, PA MSA	External																											596,624	456,168	256,045	$151,725	$152,437	437,398
2020	Base	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											960,685	503,559	390,431	$156,221	$151,786	681,676
2020	Base	58	Columbus, OH MSA	External																											2,067,885	1,386,032	884,485	$150,984	$154,789	1,549,769
2020	Base	59	Lancaster, PA MSA	External																											582,966	363,929	231,397	$152,348	$152,348	402,916
2020	Base	60	Charlottesville, VA MSA	External																											230,355	162,752	99,012	$162,592	$166,469	184,111
2020	Base	61	York-Hanover, PA MSA	External																											501,352	267,437	209,275	$138,632	$138,632	389,388
2020	Base	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											961,492	702,374	369,667	$380,062	$380,062	653,552
2020	Base	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											4,949,683	3,527,992	2,036,594	$226,715	$230,869	3,153,706
2020	Base	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,433,445	1,494,773	1,020,693	$172,157	$170,329	1,792,527
2020	Base	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											2,159,287	1,307,958	881,294	$155,866	$157,654	1,571,603
2020	Base	66	Akron, OH MSA	External																											732,246	478,170	313,033	$156,862	$156,341	558,540
2020	Base	67	Rochester, NY MSA	External																											1,077,953	707,201	432,460	$163,384	$168,006	711,185
2020	Base	68	Reading, PA MSA	External																											445,935	260,042	177,255	$150,850	$150,850	308,236
2020	Base	69	Durham-Chapel Hill, NC MSA	External																											615,597	463,938	261,062	$155,848	$162,131	457,685
2020	Base	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											108,611	50,084	46,753	$115,227	$115,227	79,594
2020	**Base**		**Total/Average**		**64,900**	**87,100**	**104,832**	**26,092**	**38,898**	**45,981**	**46,374**	**41,387**	**28,132**	**$131,023**	**64,680**	**4,562,245**	**2,609**	**19,629**	**82,094**	**37%**	**84%**	**99%**	**59%**	**11%**	**3,583**	**58%**	**76%**	**79%**	**67%**	**46%**	**128,158,383**	**77,067,218**	**51,928,726**	**$174,349**	**$183,085**	**84,365,914**

Source: East Carolina Univ., Woods and Poole, Delta Associates, Feb. 2010.

TABLE C-4

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - BASE CASE
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental						Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal								Annual Occ	Seasonal Occupancy					Annual Occ	Seasonal Occupancy									
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2025	Base	1	Southern Shores	Internal	5,005	6,130	7,378	1,836	845	1,002	1,006	899	2,073	286,131	4,823	184,462	122	1,500	6,607	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2025	Base	2	Duck	Internal	682	5,550	6,680	1,663	1,361	1,613	1,621	1,449	276	238,530	619	164,873	102	1,262	5,700	37%	84%	99%	59%	11%	10	58%	76%	79%	67%	46%						
2025	Base	3	Sanderling South	Internal	456	3,767	4,534	1,129	345	410	412	369	178	365,068	416	49,065	69	848	3,808	37%	84%	99%	59%	11%	93	58%	76%	79%	67%	46%						
2025	Base	4	Sanderling North	Internal	0	579	697	173	30	35	36	32	0	0	0	1,888	5	60	365	37%	84%	99%	59%	11%	123	58%	76%	79%	67%	46%						
2025	Base	5	Corolla South	Internal	386	8,890	10,700	2,663	176	207	210	187	159	431,384	366	0	123	1,516	8,400	37%	84%	99%	59%	11%	100	na	na	na	na	na						
2025	Base	6	Corolla South Central	Internal	194	2,345	2,823	703	408	480	488	435	80	463,356	184	148,497	35	432	2,187	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2025	Base	7	Corolla North Central	Internal	370	6,222	7,489	1,864	1,036	1,217	1,238	1,102	153	482,380	351	300,048	82	1,011	5,953	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2025	Base	8	Corolla North	Internal	361	5,820	7,005	1,743	693	815	829	738	155	497,575	355	156,427	75	930	5,099	37%	84%	99%	59%	11%	43	58%	76%	79%	67%	46%						
2025	Base	9	Carova, 4wd area	Internal	404	3,785	4,555	1,134	201	236	240	214	167	257,134	383	0	61	754	3,390	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2025	Base	10	Kitty Hawk	Internal	4,322	6,784	8,165	2,032	4,305	5,101	5,124	4,579	1,992	169,958	4,549	330,488	157	1,930	7,475	37%	84%	99%	59%	11%	572	58%	76%	79%	67%	46%						
2025	Base	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	5,944	9,276	11,164	2,779	2,339	2,772	2,785	2,489	2,445	135,873	5,647	519,479	220	2,709	9,173	37%	84%	99%	59%	11%	736	58%	76%	79%	67%	46%						
2025	Base	12	Collington	Internal	4,455	3,542	4,263	1,061	719	853	857	765	2,053	142,148	4,783	17,188	93	1,148	4,125	37%	84%	99%	59%	11%	4	58%	76%	79%	67%	46%						
2025	Base	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,511	5,688	6,846	1,704	5,078	6,018	6,047	5,403	1,027	150,664	2,329	453,273	120	1,486	5,367	37%	84%	99%	59%	11%	655	58%	76%	79%	67%	46%						
2025	Base	14	Nags Head	Internal	1,964	4,546	5,472	1,362	3,254	3,856	3,876	3,462	842	197,573	1,932	469,765	94	1,158	4,760	37%	84%	99%	59%	11%	110	58%	76%	79%	67%	46%						
2025	Base	15	Nags Head / Whalebone	Internal	1,579	6,652	8,006	1,993	4,117	4,879	4,902	4,380	627	199,442	1,417	580,425	118	1,452	6,124	37%	84%	99%	59%	11%	688	58%	76%	79%	67%	46%						
2025	Base	16	Manteo	Internal	6,369	4,426	5,327	1,326	4,865	5,763	5,790	5,174	3,397	150,728	7,829	325,405	106	1,304	4,584	37%	84%	99%	59%	11%	268	58%	76%	79%	67%	46%						
2025	Base	17	Wanchese	Internal	1,724	490	589	147	1,256	1,488	1,496	1,337	1,256	94,740	2,878	25,497	190	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2025	Base	18	Bodie Island	Internal	602	3,932	4,733	1,178	248	294	295	263	250	221,704	557	3,200	73	897	3,831	37%	84%	99%	59%	11%	187	58%	76%	79%	67%	46%						
2025	Base	19	Lower Currituck Peninsula - South	Internal	4,105	681	820	204	2,885	3,391	3,449	3,070	1,698	167,350	3,899	109,712	200	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2025	Base	20	Elizabeth City	External																											25,415	14,793	10,557	$129,178	$129,178	20,686
2025	Base	21	Moyock Township	Internal	10,629	508	611	152	2,133	2,507	2,550	2,269	4,389	138,180	10,079	351,827	137	0	0	na	na	na	na	na	104	58%	76%	79%	67%	46%						
2025	Base	22	Dare County Mainland	External																											1,058	1,461	488	$90,654	$90,654	1,124
2025	Base	23	Hatteras Island	External																											5,962	6,250	2,748	$168,958	$168,958	6,266
2025	Base	24	Pasquotank County (Excl. Elizabeth City), NC	External																											26,789	15,592	11,127	$129,178	$129,178	21,796
2025	Base	25	Crawford Township	Internal	10,609	854	1,028	256	3,242	3,811	3,876	3,450	4,381	144,157	10,060	181,230	247	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2025	Base	26	Lower Currituck Peninsula - North	Internal	2,181	336	405	101	784	921	937	834	905	149,241	2,077	33,448	102	0	0	na	na	na	na	na	0	na	na	na	na	na						
2025	Base	27	Lower Currituck Peninsula - Central	Internal	5,298	788	949	236	1,869	2,197	2,235	1,989	2,190	113,792	5,030	186,214	249	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2025	Base	28	Camden County, NC	External																											14,474	4,956	6,270	$136,136	$136,136	14,729
2025	Base	29	Balance of Massachusetts	External																											2,716,792	1,589,483	1,153,252	$213,047	$213,047	1,837,412
2025	Base	30	Balance of Connecticut	External																											2,888,791	1,955,392	1,199,307	$246,762	$246,762	2,019,497
2025	Base	31	Albemarle Peninsula, NC	External																											23,859	12,151	10,249	$137,635	$137,635	16,495
2025	Base	32	Knotts Island	External																											2,124	597	846	$119,826	$119,826	1,942
2025	Base	33	Balance of Maryland	External																											803,729	470,510	338,435	$175,410	$175,410	572,302
2025	Base	34	Balance of Delaware	External																											483,486	242,844	206,393	$159,045	$159,045	368,448
2025	Base	35	Balance of New Jersey	External																											1,026,664	723,766	395,866	$284,808	$284,808	614,974
2025	Base	36	Balance of Virginia	External																											2,593,303	1,521,255	1,117,244	$150,191	$150,191	1,983,708
2025	Base	37	Balance of North Carolina	External																											7,239,283	4,015,036	3,048,217	$160,685	$160,685	5,518,066
2025	Base	38	Balance of South Carolina	External																											5,300,958	3,002,553	2,206,642	$163,562	$163,562	3,804,858
2025	Base	39	Georgia	External																											12,476,912	6,935,701	4,814,594	$185,085	$185,085	8,593,678
2025	Base	40	Balance of West Virginia	External																											1,886,181	1,055,326	825,674	$158,538	$158,538	1,336,896
2025	Base	41	Balance of Ohio	External																											5,527,949	3,257,542	2,306,380	$162,740	$162,740	4,149,109
2025	Base	42	Michigan	External																											10,964,557	6,071,647	4,536,791	$186,366	$186,366	7,991,329
2025	Base	43	Balance of Pennsylvania	External																											3,899,738	2,333,701	1,617,688	$161,890	$161,890	2,601,846
2025	Base	44	Balance of New York State	External																											6,304,655	3,798,478	2,571,380	$185,673	$185,673	4,159,115
2025	Base	45	Balance of New Hampshire	External																											1,109,446	746,280	470,622	$211,529	$211,529	848,450
2025	Base	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	588	696	700	625	0	0	0	364,834	na	na	0	na	na	na	na	na	na	na	na	na	na	na						
2025	Base	47	Washington, DC-VA-MD-WV MSA	External																											7,063,502	4,986,319	2,836,292	$301,210	$327,942	4,780,687
2025	Base	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											6,543,570	4,228,135	2,654,088	$259,496	$285,799	4,021,270
2025	Base	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											21,378,746	12,799,892	8,177,610	$308,417	$357,518	9,717,987
2025	Base	50	Baltimore-Towson, MD MSA	External																											3,308,772	2,079,008	1,385,405	$248,142	$266,277	2,214,313
2025	Base	51	Richmond, VA MSA	External																											1,655,795	991,766	692,017	$202,724	$209,903	1,253,411
2025	Base	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											2,058,932	1,316,090	836,046	$201,800	$206,440	1,452,764
2025	Base	53	Pittsburgh, PA MSA	External																											2,485,321	1,714,120	1,073,062	$226,621	$231,606	1,667,972
2025	Base	54	Raleigh-Cary, NC MSA	External																											1,549,929	898,410	627,493	$199,515	$208,800	1,153,642
2025	Base	55	Cleveland-Elyria-Mentor, OH MSA	External																											2,162,041	1,496,116	925,740	$212,964	$213,293	1,507,053
2025	Base	56	Harrisburg-Carlisle, PA MSA	External																											617,544	475,761	267,324	$191,349	$191,949	456,666
2025	Base	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											1,014,513	533,898	412,551	$200,515	$196,181	720,296
2025	Base	58	Columbus, OH MSA	External																											2,169,378	1,465,627	937,640	$191,189	$195,833	1,642,905
2025	Base	59	Lancaster, PA MSA	External																											610,508	387,286	244,648	$194,036	$194,036	425,988
2025	Base	60	Charlottesville, VA MSA	External																											242,995	173,408	105,855	$206,039	$211,469	196,835
2025	Base	61	York-Hanover, PA MSA	External																											528,231	282,761	222,328	$174,907	$174,907	413,675
2025	Base	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											978,456	736,461	376,440	$497,318	$497,318	665,525
2025	Base	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											5,073,284	3,675,304	2,102,966	$288,579	$294,342	3,256,485
2025	Base	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,523,535	1,577,951	1,069,790	$222,506	$220,354	1,878,751
2025	Base	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											2,329,305	1,418,072	955,469	$196,825	$198,955	1,703,879
2025	Base	66	Akron, OH MSA	External																											737,938	502,699	318,833	$203,975	$203,311	568,889
2025	Base	67	Rochester, NY MSA	External																											1,083,870	732,958	434,249	$210,457	$216,854	714,127
2025	Base	68	Reading, PA MSA	External																											458,738	273,349	182,394	$193,323	$193,323	317,172
2025	Base	69	Durham-Chapel Hill, NC MSA	External																											662,105	502,028	282,577	$196,241	$204,434	495,404
2025	Base	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											110,063	52,557	47,967	$147,411	$147,411	81,729
2025	**Base**		**Total/Average**		**70,151**	**91,592**	**110,238**	**27,437**	**42,777**	**50,563**	**51,000**	**45,515**	**30,691**	**$163,718**	**70,562**	**4,957,245**	**2,780**	**20,397**	**86,947**	**37%**	**84%**	**99%**	**59%**	**11%**	**3,733**	**58%**	**76%**	**79%**	**67%**	**46%**	**132,669,198**	**81,075,293**	**54,019,553**	**$222,728**	**$234,069**	**87,790,150**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-5

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - BASE CASE
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental						Hotels								Households			
					Permanent	Seasonal			Annual Avg	Seasonal								Annual Occ	Seasonal Occupancy					Annual Occ	Seasonal Occupancy										
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2030	Base	1	Southern Shores	Internal	5,254	6,225	7,492	1,865	895	1,061	1,065	952	2,073	364,744	4,823	184,462	122	1,500	6,720	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2030	Base	2	Duck	Internal	716	5,575	6,710	1,670	1,442	1,709	1,717	1,535	276	304,064	619	164,873	102	1,262	5,728	37%	84%	99%	59%	11%	10	58%	76%	79%	67%	46%						
2030	Base	3	Sandering South	Internal	479	3,798	4,571	1,138	366	434	437	390	178	465,368	416	49,065	69	848	3,844	37%	84%	99%	59%	11%	93	58%	76%	79%	67%	46%						
2030	Base	4	Sandering North	Internal	0	580	699	174	33	39	39	35	0	0	0	1,888	5	60	367	37%	84%	99%	59%	11%	123	58%	76%	79%	67%	46%						
2030	Base	5	Corolla South	Internal	420	9,782	11,773	2,930	193	227	231	205	174	545,559	400	0	135	1,668	9,514	37%	84%	99%	59%	11%	100	na	na	na	na	na						
2030	Base	6	Corolla South Central	Internal	211	2,581	3,106	773	448	526	535	477	88	585,993	201	148,497	39	475	2,465	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2030	Base	7	Corolla North Central	Internal	403	6,846	8,240	2,051	1,136	1,335	1,358	1,209	174	610,053	400	300,048	88	1,082	6,504	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2030	Base	8	Corolla North	Internal	393	5,824	7,010	1,745	760	894	909	809	155	629,270	355	156,427	75	930	5,103	37%	84%	99%	59%	11%	43	58%	76%	79%	67%	46%						
2030	Base	9	Carova, 4wd area	Internal	440	4,164	5,012	1,247	220	259	264	235	182	325,190	419	0	67	829	3,808	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2030	Base	10	Kitty Hawk	Internal	4,537	7,464	8,984	2,236	4,560	5,404	5,429	4,851	2,104	216,653	4,805	330,488	172	2,124	8,554	37%	84%	99%	59%	11%	572	58%	76%	79%	67%	46%						
2030	Base	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	6,240	9,611	11,568	2,879	2,543	3,014	3,028	2,706	2,445	173,204	5,647	519,479	220	2,709	9,443	37%	84%	99%	59%	11%	861	58%	76%	79%	67%	46%						
2030	Base	12	Collington	Internal	4,676	3,802	4,576	1,139	762	903	907	811	2,109	181,202	4,913	17,188	97	1,194	4,391	37%	84%	99%	59%	11%	4	58%	76%	79%	67%	46%						
2030	Base	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,636	5,931	7,139	1,777	5,665	6,713	6,745	6,027	1,027	192,058	2,329	578,273	120	1,486	5,524	37%	84%	99%	59%	11%	780	58%	76%	79%	67%	46%						
2030	Base	14	Nags Head	Internal	2,062	4,685	5,639	1,404	3,447	4,085	4,106	3,668	842	251,855	1,932	469,765	94	1,158	4,923	37%	84%	99%	59%	11%	110	58%	76%	79%	67%	46%						
2030	Base	15	Nags Head / Whalebone	Internal	1,658	6,713	8,079	2,011	4,361	5,169	5,193	4,640	627	254,237	1,417	580,425	118	1,452	6,192	37%	84%	99%	59%	11%	688	58%	76%	79%	67%	46%						
2030	Base	16	Manteo	Internal	6,686	4,869	5,861	1,459	5,154	6,106	6,134	5,481	3,836	192,140	8,840	325,405	116	1,435	5,113	37%	84%	99%	59%	11%	268	58%	76%	79%	67%	46%						
2030	Base	17	Wanchese	Internal	1,810	539	648	161	1,497	1,774	1,783	1,594	1,574	120,770	3,607	125,497	210	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2030	Base	18	Bodie Island	Internal	632	4,048	4,872	1,213	263	312	313	279	250	282,616	557	3,200	73	897	3,961	37%	84%	99%	59%	11%	187	58%	76%	79%	67%	46%						
2030	Base	19	Lower Currituck Peninsula - South	Internal	4,467	749	902	224	3,335	3,920	3,987	3,549	1,873	211,643	4,302	209,712	220	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2030	Base	20	Elizabeth City	External																											26,680	15,626	11,166	$163,718	$163,718	21,878
2030	Base	21	Moyock Township	Internal	11,567	559	673	167	2,339	2,749	2,796	2,489	4,814	174,752	11,056	351,827	151	0	0	na	na	na	na	na	104	58%	76%	79%	67%	46%						
2030	Base	22	Dare County Mainland	External																											1,111	1,548	515	$115,561	$115,561	1,187
2030	Base	23	Hatteras Island	External																											6,258	6,621	2,903	$215,378	$215,378	6,619
2030	Base	24	Pasquotank County (Excl. Elizabeth City), NC	External																											28,122	16,470	11,769	$163,718	$163,718	23,052
2030	Base	25	Crawford Township	Internal	11,546	940	1,131	282	3,556	4,179	4,251	3,784	4,806	182,311	11,036	181,230	272	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2030	Base	26	Lower Currituck Peninsula - North	Internal	2,374	370	445	111	859	1,010	1,027	914	1,006	188,741	2,310	33,448	112	0	0	na	na	na	na	na	0	na	na	na	na	na						
2030	Base	27	Lower Currituck Peninsula - Central	Internal	5,766	867	1,044	260	2,050	2,409	2,451	2,181	2,411	143,910	5,537	186,214	274	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2030	Base	28	Camden County, NC	External																											15,710	5,439	6,876	$171,020	$171,020	16,154
2030	Base	29	Balance of Massachusetts	External																											2,775,466	1,662,102	1,184,081	$273,496	$273,496	1,881,077
2030	Base	30	Balance of Connecticut	External																											2,933,079	2,028,249	1,219,129	$317,560	$317,560	2,053,083
2030	Base	31	Albemarle Peninsula, NC	External																											24,017	12,772	10,431	$176,342	$176,342	16,788
2030	Base	32	Knotts Island	External																											2,312	655	846	$151,541	$151,541	1,942
2030	Base	33	Balance of Maryland	External																											841,647	496,820	356,064	$225,186	$225,186	597,380
2030	Base	34	Balance of Delaware	External																											518,748	262,330	222,927	$205,964	$205,964	397,949
2030	Base	35	Balance of New Jersey	External																											1,053,829	758,155	404,751	$372,386	$372,386	628,562
2030	Base	36	Balance of Virginia	External																											2,666,878	1,591,554	1,152,236	$192,280	$192,280	2,026,499
2030	Base	37	Balance of North Carolina	External																											7,507,173	4,230,846	3,166,011	$205,908	$205,908	5,730,802
2030	Base	38	Balance of South Carolina	External																											5,538,414	3,175,584	2,312,937	$209,710	$209,710	3,987,920
2030	Base	39	Georgia	External																											13,140,055	7,368,043	5,054,249	$238,077	$238,077	9,021,444
2030	Base	40	Balance of West Virginia	External																											1,896,720	1,096,519	830,682	$203,950	$203,950	1,344,227
2030	Base	41	Balance of Ohio	External																											5,528,681	3,361,270	2,308,288	$209,715	$209,715	4,145,192
2030	Base	42	Michigan	External																											11,099,201	6,294,889	4,609,739	$239,079	$239,079	8,119,823
2030	Base	43	Balance of Pennsylvania	External																											3,939,420	2,430,136	1,631,994	$208,676	$208,676	2,595,520
2030	Base	44	Balance of New York State	External																											6,344,603	3,923,800	2,579,053	$240,176	$240,176	4,170,519
2030	Base	45	Balance of New Hampshire	External																											1,157,829	789,580	493,648	$270,877	$270,877	889,871
2030	Base	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	622	738	741	662	0	0	0	364,834	na	na	0	na	na	na	na	na	na	na	na	na	na	na						
2030	Base	47	Washington, DC-VA-MD-WV MSA	External																											7,476,469	5,303,410	3,003,355	$385,051	$421,178	5,062,278
2030	Base	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											6,663,412	4,411,272	2,708,562	$334,449	$366,965	4,103,804
2030	Base	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											21,790,752	13,209,196	8,303,195	$396,854	$462,587	9,867,227
2030	Base	50	Baltimore-Towson, MD MSA	External																											3,454,941	2,186,510	1,452,897	$318,149	$339,774	2,322,187
2030	Base	51	Richmond, VA MSA	External																											1,761,741	1,059,867	738,126	$259,712	$268,363	1,336,926
2030	Base	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											2,150,337	1,391,466	878,903	$257,837	$262,400	1,527,235
2030	Base	53	Pittsburgh, PA MSA	External																											2,490,704	1,776,334	1,071,129	$295,152	$301,774	1,664,967
2030	Base	54	Raleigh-Cary, NC MSA	External																											1,666,608	971,516	672,857	$255,351	$267,553	1,237,044
2030	Base	55	Cleveland-Elyria-Mentor, OH MSA	External																											2,153,828	1,543,355	925,418	$275,358	$275,844	1,506,529
2030	Base	56	Harrisburg-Carlisle, PA MSA	External																											634,828	492,966	275,851	$242,666	$243,167	471,233
2030	Base	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											1,062,257	562,826	430,244	$259,386	$255,428	751,187
2030	Base	58	Columbus, OH MSA	External																											2,257,911	1,540,790	981,980	$243,690	$249,514	1,720,595
2030	Base	59	Lancaster, PA MSA	External																											634,411	409,698	255,564	$248,773	$248,773	444,997
2030	Base	60	Charlottesville, VA MSA	External																											254,171	183,270	111,652	$262,669	$270,225	207,615
2030	Base	61	York-Hanover, PA MSA	External																											551,941	296,926	233,192	$222,139	$222,139	433,889
2030	Base	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											989,755	766,362	379,404	$653,269	$653,269	670,766
2030	Base	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											5,167,291	3,803,881	2,148,084	$369,188	$377,205	3,326,350
2030	Base	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,598,727	1,654,546	1,108,719	$287,649	$285,523	1,947,117
2030	Base	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											2,484,998	1,528,811	1,020,190	$250,868	$253,480	1,819,295
2030	Base	66	Akron, OH MSA	External																											739,413	524,841	321,455	$266,564	$265,734	573,568
2030	Base	67	Rochester, NY MSA	External																											1,083,602	755,026	431,107	$272,498	$281,351	708,961
2030	Base	68	Reading, PA MSA	External																											468,857	285,696	185,541	$249,298	$249,298	322,645
2030	Base	69	Durham-Chapel Hill, NC MSA	External																											704,551	540,633	301,219	$249,395	$260,289	528,087
2030	Base	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											110,876	54,793	48,680	$189,669	$189,669	83,013
2030	**Base**		**Total/Average**		**74,973**	**96,523**	**116,173**	**28,915**	**46,506**	**54,968**	**55,449**	**49,483**	**33,023**	**$206,238**	**75,920**	**5,282,245**	**2,950**	**21,110**	**92,154**	**37%**	**84%**	**99%**	**59%**	**11%**	**3,983**	**58%**	**76%**	**79%**	**67%**	**46%**	**136,398,336**	**84,783,003**	**55,557,622**	**$286,178**	**$301,105**	**90,315,002**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-6

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - BASE CASE
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental						Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal									Annual Occ	Seasonal Occupancy					Annual Occ	Seasonal Occupancy								
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2035	Base	1	Southern Shores	Internal	5,489	6,379	7,678	1,911	944	1,119	1,124	1,005	2,073	466,671	4,823	184,462	122	1,500	6,904	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2035	Base	2	Duck	Internal	748	5,726	6,892	1,715	1,521	1,802	1,811	1,619	276	389,034	619	164,873	102	1,262	5,901	37%	84%	99%	59%	11%	10	58%	76%	79%	67%	46%						
2035	Base	3	Sanderling South	Internal	501	3,958	4,763	1,186	386	458	461	412	178	595,413	416	49,065	69	848	4,027	37%	84%	99%	59%	11%	93	58%	76%	79%	67%	46%						
2035	Base	4	Sanderling North	Internal	0	582	701	174	36	42	43	38	0	0	0	1,888	5	60	368	37%	84%	99%	59%	11%	123	58%	76%	79%	67%	46%						
2035	Base	5	Corolla South	Internal	453	10,742	12,928	3,218	211	248	252	224	188	694,631	431	0	148	1,831	10,770	37%	84%	99%	59%	11%	100	na	na	na	na	na						
2035	Base	6	Corolla South Central	Internal	228	2,834	3,411	849	489	575	585	521	95	746,114	217	148,497	42	522	2,766	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2035	Base	7	Corolla North Central	Internal	434	6,872	8,271	2,059	1,242	1,459	1,484	1,321	174	776,748	400	300,048	88	1,082	6,532	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2035	Base	8	Corolla North	Internal	423	5,842	7,032	1,750	831	977	994	885	155	801,215	355	156,427	75	930	5,121	37%	84%	99%	59%	11%	43	58%	76%	79%	67%	46%						
2035	Base	9	Carova, 4wd area	Internal	475	4,573	5,504	1,370	241	283	288	256	197	414,047	452	0	74	911	4,269	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2035	Base	10	Kitty Hawk	Internal	4,740	8,197	9,866	2,455	5,056	5,991	6,018	5,378	2,244	277,196	5,124	430,488	184	2,266	9,500	37%	84%	99%	59%	11%	722	58%	76%	79%	67%	46%						
2035	Base	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	6,519	9,960	11,988	2,984	2,682	3,179	3,194	2,854	2,445	221,605	5,647	519,479	220	2,709	9,854	37%	84%	99%	59%	11%	861	58%	76%	79%	67%	46%						
2035	Base	12	Collington	Internal	4,885	3,873	4,661	1,160	804	953	957	855	2,109	231,839	4,913	17,188	97	1,194	4,480	37%	84%	99%	59%	11%	4	58%	76%	79%	67%	46%						
2035	Base	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,754	6,136	7,385	1,838	5,975	7,081	7,115	6,357	1,027	245,728	2,329	578,273	120	1,486	5,761	37%	84%	99%	59%	11%	780	58%	76%	79%	67%	46%						
2035	Base	14	Nags Head	Internal	2,154	4,957	5,967	1,485	3,713	4,400	4,422	3,950	842	322,236	1,932	469,765	94	1,158	5,092	37%	84%	99%	59%	11%	260	58%	76%	79%	67%	46%						
2035	Base	15	Nags Head / Whalebone	Internal	1,732	6,820	8,209	2,043	4,600	5,452	5,478	4,894	627	325,283	1,417	580,425	118	1,452	6,311	37%	84%	99%	59%	11%	688	58%	76%	79%	67%	46%						
2035	Base	16	Manteo	Internal	6,985	5,347	6,436	1,602	5,436	6,440	6,470	5,781	4,237	245,833	9,762	325,405	128	1,576	5,702	37%	84%	99%	59%	11%	268	58%	76%	79%	67%	46%						
2035	Base	17	Wanchese	Internal	1,891	592	712	177	1,579	1,871	1,881	1,681	1,866	154,518	4,276	125,497	230	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2035	Base	18	Bodie Island	Internal	661	4,251	5,117	1,274	277	329	330	294	250	361,592	557	3,200	73	897	4,191	37%	84%	99%	59%	11%	187	58%	76%	79%	67%	46%						
2035	Base	19	Lower Currituck Peninsula - South	Internal	4,816	823	990	246	3,645	4,285	4,358	3,879	2,041	269,473	4,686	209,712	242	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2035	Base	20	Elizabeth City	External																											27,876	16,449	11,708	$208,263	$208,263	22,940
2035	Base	21	Moyock Township	Internal	12,471	614	739	184	2,777	3,264	3,320	2,955	5,216	222,502	11,978	476,827	165	0	0	na	na	na	na	na	104	58%	76%	79%	67%	46%						
2035	Base	22	Dare County Mainland	External																											1,160	1,633	540	$147,854	$147,854	1,244
2035	Base	23	Hatteras Island	External																											6,538	6,984	3,042	$275,565	$275,565	6,937
2035	Base	24	Pasquotank County (Excl. Elizabeth City), NC	External																											29,383	17,337	12,340	$208,263	$208,263	24,171
2035	Base	25	Crawford Township	Internal	12,448	1,032	1,242	309	3,886	4,568	4,646	4,136	5,206	232,127	11,956	181,230	299	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2035	Base	26	Lower Currituck Peninsula - North	Internal	2,559	406	489	122	939	1,104	1,123	999	1,104	240,314	2,536	33,448	123	0	0	na	na	na	na	na	0	na	na	na	na	na						
2035	Base	27	Lower Currituck Peninsula - Central	Internal	6,217	952	1,146	285	2,241	2,634	2,679	2,384	2,621	183,233	6,020	186,214	300	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2035	Base	28	Camden County, NC	External																											16,901	5,948	7,449	$216,608	$216,608	17,500
2035	Base	29	Balance of Massachusetts	External																											2,827,907	1,733,655	1,208,292	$352,361	$352,361	1,914,147
2035	Base	30	Balance of Connecticut	External																											2,971,020	2,097,108	1,232,107	$409,933	$409,933	2,075,142
2035	Base	31	Albemarle Peninsula, NC	External																											24,124	13,386	10,560	$226,821	$226,821	16,997
2035	Base	32	Knotts Island	External																											2,492	716	846	$192,949	$192,949	1,942
2035	Base	33	Balance of Maryland	External																											877,388	522,553	371,643	$290,435	$290,435	618,944
2035	Base	34	Balance of Delaware	External																											552,503	282,742	238,208	$268,720	$268,720	425,212
2035	Base	35	Balance of New Jersey	External																											1,078,560	792,642	411,122	$489,172	$489,172	638,234
2035	Base	36	Balance of Virginia	External																											2,734,215	1,661,548	1,180,439	$247,028	$247,028	2,057,381
2035	Base	37	Balance of North Carolina	External																											7,756,669	4,454,086	3,264,843	$265,232	$265,232	5,909,214
2035	Base	38	Balance of South Carolina	External																											5,761,730	3,353,632	2,405,595	$270,459	$270,459	4,147,459
2035	Base	39	Georgia	External																											13,768,332	7,812,753	5,260,425	$307,888	$307,888	9,389,452
2035	Base	40	Balance of West Virginia	External																											1,903,416	1,136,081	831,043	$263,281	$263,281	1,344,026
2035	Base	41	Balance of Ohio	External																											5,518,603	3,459,283	2,296,730	$271,209	$271,209	4,117,142
2035	Base	42	Michigan	External																											11,210,304	6,511,438	4,657,171	$307,821	$307,821	8,203,372
2035	Base	43	Balance of Pennsylvania	External																											3,970,859	2,525,544	1,636,480	$270,078	$270,078	2,573,486
2035	Base	44	Balance of New York State	External																											6,371,610	4,044,665	2,571,639	$311,698	$311,698	4,157,872
2035	Base	45	Balance of New Hampshire	External																											1,203,287	833,420	513,833	$348,788	$348,788	926,157
2035	Base	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	657	778	782	699	0	0	0	364,834	na	na	0	na	na	na	na	na	na	na	na	na	na	na						
2035	Base	47	Washington, DC-VA-MD-WV MSA	External																											7,869,066	5,626,925	3,152,674	$495,269	$544,830	5,313,961
2035	Base	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											6,768,566	4,591,751	2,747,581	$432,624	$473,239	4,162,922
2035	Base	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											22,154,432	13,598,931	8,381,949	$512,384	$600,941	9,960,816
2035	Base	50	Baltimore-Towson, MD MSA	External																											3,592,305	2,291,107	1,511,827	$409,716	$436,009	2,416,375
2035	Base	51	Richmond, VA MSA	External																											1,862,775	1,131,629	779,830	$335,050	$345,702	1,412,461
2035	Base	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											2,236,268	1,468,445	916,934	$331,009	$335,442	1,593,320
2035	Base	53	Pittsburgh, PA MSA	External																											2,491,148	1,835,788	1,062,829	$385,735	$394,547	1,652,065
2035	Base	54	Raleigh-Cary, NC MSA	External																											1,778,387	1,048,296	713,773	$329,344	$345,454	1,312,268
2035	Base	55	Cleveland-Elyria-Mentor, OH MSA	External																											2,141,526	1,587,822	920,051	$357,011	$358,015	1,497,793
2035	Base	56	Harrisburg-Carlisle, PA MSA	External																											650,628	509,451	282,777	$308,934	$309,376	483,063
2035	Base	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											1,107,271	592,200	445,130	$337,457	$334,334	777,177
2035	Base	58	Columbus, OH MSA	External																											2,340,797	1,616,606	1,021,079	$312,125	$319,581	1,789,104
2035	Base	59	Lancaster, PA MSA	External																											656,741	432,523	265,110	$320,492	$320,492	461,618
2035	Base	60	Charlottesville, VA MSA	External																											264,692	192,895	116,829	$336,286	$346,743	217,241
2035	Base	61	York-Hanover, PA MSA	External																											574,244	310,883	242,683	$283,488	$283,488	451,549
2035	Base	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											998,958	794,525	380,275	$860,375	$860,375	672,306
2035	Base	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											5,249,880	3,926,497	2,181,329	$474,015	$485,174	3,377,832
2035	Base	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,667,793	1,729,899	1,141,748	$371,794	$370,200	2,005,122
2035	Base	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											2,633,649	1,645,234	1,078,634	$322,045	$325,326	1,923,516
2035	Base	66	Akron, OH MSA	External																											739,428	546,266	322,372	$349,541	$348,533	575,203
2035	Base	67	Rochester, NY MSA	External																											1,081,223	776,018	425,262	$354,052	$366,301	699,347
2035	Base	68	Reading, PA MSA	External																											477,921	298,029	187,519	$322,900	$322,900	326,084
2035	Base	69	Durham-Chapel Hill, NC MSA	External																											745,027	581,607	318,029	$319,209	$333,910	557,558
2035	Base	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											111,460	56,980	49,115	$244,786	$244,786	83,824
2035	**Base**		**Total/Average**		**79,581**	**101,470**	**122,127**	**30,396**	**50,167**	**59,291**	**59,816**	**53,379**	**35,169**	**$261,242**	**80,847**	**5,507,245**	**3,119**	**21,685**	**97,551**	**37%**	**84%**	**99%**	**59%**	**11%**	**4,283**	**58%**	**76%**	**79%**	**67%**	**46%**	**139,809,062**	**88,473,909**	**56,771,392**	**$369,237**	**$389,093**	**92,311,496**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-7

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - BASE CASE
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households						Rental							Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal									Annual Occ	Seasonal Occupancy						Annual Occ	Seasonal Occupancy									
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2040	Base	1	Southern Shores	Internal	5,715	6,641	7,992	1,989	992	1,177	1,181	1,056	2,073	599,396	4,823	184,462	122	1,500	7,214	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2040	Base	2	Duck	Internal	779	6,095	7,336	1,826	1,599	1,894	1,903	1,701	276	499,679	619	164,873	102	1,262	6,322	37%	84%	99%	59%	11%	10	58%	76%	79%	67%	46%						
2040	Base	3	Sanderling South	Internal	521	4,296	5,171	1,287	406	481	484	433	178	764,755	416	49,065	69	848	4,417	37%	84%	99%	59%	11%	93	58%	76%	79%	67%	46%						
2040	Base	4	Sanderling North	Internal	0	583	702	175	39	46	47	42	0	0	0	1,888	5	60	369	37%	84%	99%	59%	11%	123	58%	76%	79%	67%	46%						
2040	Base	5	Corolla South	Internal	485	11,784	14,183	3,530	230	270	275	245	200	889,817	460	0	163	2,009	12,278	37%	84%	99%	59%	11%	100	na	na	na	na	na						
2040	Base	6	Corolla South Central	Internal	244	2,991	3,600	896	534	628	638	568	99	955,765	228	148,497	43	536	2,864	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2040	Base	7	Corolla North Central	Internal	465	6,996	8,421	2,096	1,355	1,592	1,619	1,442	174	995,007	400	300,048	88	1,082	6,662	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2040	Base	8	Corolla North	Internal	453	5,999	7,220	1,797	907	1,066	1,084	965	155	1,026,350	355	156,427	75	930	5,274	37%	84%	99%	59%	11%	43	58%	76%	79%	67%	46%						
2040	Base	9	Carova, 4wd area	Internal	508	5,017	6,038	1,503	263	309	314	280	210	530,391	482	0	81	999	4,796	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2040	Base	10	Kitty Hawk	Internal	4,935	8,447	10,166	2,530	5,314	6,297	6,326	5,652	2,244	356,033	5,124	430,488	184	2,266	9,839	37%	84%	99%	59%	11%	722	58%	76%	79%	67%	46%						
2040	Base	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	6,788	10,425	12,547	3,123	2,819	3,341	3,357	3,000	2,445	284,631	5,647	519,479	220	2,709	10,402	37%	84%	99%	59%	11%	861	58%	76%	79%	67%	46%						
2040	Base	12	Collington	Internal	5,087	3,987	4,798	1,194	845	1,001	1,006	899	2,109	297,776	4,913	17,188	97	1,194	4,625	37%	84%	99%	59%	11%	4	58%	76%	79%	67%	46%						
2040	Base	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,868	6,461	7,776	1,935	6,342	7,516	7,552	6,748	1,027	315,616	2,329	578,273	120	1,486	6,013	37%	84%	99%	59%	11%	905	58%	76%	79%	67%	46%						
2040	Base	14	Nags Head	Internal	2,243	5,105	6,144	1,529	3,902	4,624	4,648	4,152	842	413,882	1,932	469,765	94	1,158	5,265	37%	84%	99%	59%	11%	260	58%	76%	79%	67%	46%						
2040	Base	15	Nags Head / Whalebone	Internal	1,803	7,011	8,438	2,100	5,004	5,930	5,959	5,324	627	417,797	1,417	680,425	118	1,452	6,523	37%	84%	99%	59%	11%	688	58%	76%	79%	67%	46%						
2040	Base	16	Manteo	Internal	7,274	5,866	7,060	1,757	5,713	6,769	6,801	6,077	4,645	315,750	10,705	325,405	140	1,729	6,386	37%	84%	99%	59%	11%	268	58%	76%	79%	67%	46%						
2040	Base	17	Wanchese	Internal	1,969	649	781	194	1,660	1,967	1,977	1,767	2,181	198,465	4,996	125,497	252	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2040	Base	18	Bodie Island	Internal	688	4,511	5,430	1,351	291	345	347	309	250	464,432	557	3,200	73	897	4,484	37%	84%	99%	59%	11%	187	58%	76%	79%	67%	46%						
2040	Base	19	Lower Currituck Peninsula - South	Internal	5,155	903	1,086	270	3,977	4,675	4,755	4,232	2,193	345,193	5,037	209,712	266	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2040	Base	20	Elizabeth City	External																											29,027	17,270	12,187	$265,760	$265,760	23,879
2040	Base	21	Moyock Township	Internal	13,348	673	810	202	3,203	3,764	3,829	3,408	5,581	285,024	12,817	576,827	181	0	0	na	na	na	na	na	104	58%	76%	79%	67%	46%						
2040	Base	22	Dare County Mainland	External																											1,208	1,716	561	$189,905	$189,905	1,294
2040	Base	23	Hatteras Island	External																											6,808	7,341	3,163	$353,938	$353,938	7,213
2040	Base	24	Pasquotank County (Excl. Elizabeth City), NC	External																											30,596	18,203	12,845	$265,760	$265,760	25,160
2040	Base	25	Crawford Township	Internal	13,324	1,132	1,363	339	4,240	4,984	5,069	4,512	5,571	297,353	12,794	181,230	328	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2040	Base	26	Lower Currituck Peninsula - North	Internal	2,739	446	537	134	1,025	1,204	1,225	1,090	1,195	307,840	2,743	33,448	135	0	0	na	na	na	na	na	0	na	na	na	na	na						
2040	Base	27	Lower Currituck Peninsula - Central	Internal	6,654	1,045	1,257	313	2,445	2,873	2,923	2,601	2,813	234,720	6,461	186,214	330	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2040	Base	28	Camden County, NC	External																											18,057	6,496	7,981	$276,328	$276,328	18,749
2040	Base	29	Balance of Massachusetts	External																											2,876,957	1,805,422	1,226,000	$455,605	$455,605	1,937,010
2040	Base	30	Balance of Connecticut	External																											3,005,685	2,163,571	1,238,545	$530,924	$530,924	2,086,187
2040	Base	31	Albemarle Peninsula, NC	External																											24,209	14,018	10,637	$292,749	$292,749	17,120
2040	Base	32	Knotts Island	External																											2,668	781	846	$247,165	$247,165	1,942
2040	Base	33	Balance of Maryland	External																											911,748	547,952	385,100	$376,335	$376,335	636,985
2040	Base	34	Balance of Delaware	External																											585,200	304,345	252,021	$352,977	$352,977	449,856
2040	Base	35	Balance of New Jersey	External																											1,101,920	827,901	415,021	$645,656	$645,656	644,068
2040	Base	36	Balance of Virginia	External																											2,797,995	1,732,563	1,201,958	$318,519	$318,519	2,076,995
2040	Base	37	Balance of North Carolina	External																											7,995,102	4,689,178	3,344,159	$343,390	$343,390	6,052,314
2040	Base	38	Balance of South Carolina	External																											5,976,183	3,539,806	2,483,855	$350,810	$350,810	4,282,168
2040	Base	39	Georgia	External																											14,373,895	8,277,166	5,431,262	$400,314	$400,314	9,694,383
2040	Base	40	Balance of West Virginia	External																											1,908,296	1,174,964	826,966	$341,034	$341,034	1,336,645
2040	Base	41	Balance of Ohio	External																											5,503,785	3,554,340	2,272,852	$351,982	$351,982	4,067,127
2040	Base	42	Michigan	External																											11,309,568	6,726,763	4,679,517	$397,815	$397,815	8,242,734
2040	Base	43	Balance of Pennsylvania	External																											3,998,238	2,621,986	1,632,138	$350,958	$350,958	2,537,988
2040	Base	44	Balance of New York State	External																											6,392,510	4,164,526	2,550,949	$405,881	$405,881	4,123,791
2040	Base	45	Balance of New Hampshire	External																											1,246,924	878,436	531,029	$451,576	$451,576	957,056
2040	Base	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	690	818	822	734	0	0	0	364,834	na	na	0	na	na	na	na	na	na	na	na	na	na	na						
2040	Base	47	Washington, DC-VA-MD-WV MSA	External																											8,248,112	5,961,940	3,282,081	$641,057	$709,676	5,532,082
2040	Base	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											6,865,941	4,773,232	2,771,605	$561,727	$613,004	4,199,322
2040	Base	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											22,492,308	13,980,442	8,413,938	$663,943	$784,028	9,998,831
2040	Base	50	Baltimore-Towson, MD MSA	External																											3,724,162	2,393,823	1,561,652	$529,948	$562,490	2,496,011
2040	Base	51	Richmond, VA MSA	External																											1,960,466	1,208,478	816,631	$435,204	$448,442	1,479,116
2040	Base	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											2,318,774	1,548,344	949,893	$426,982	$431,173	1,650,591
2040	Base	53	Pittsburgh, PA MSA	External																											2,489,372	1,893,946	1,048,803	$505,878	$517,625	1,630,264
2040	Base	54	Raleigh-Cary, NC MSA	External																											1,886,705	1,129,814	749,693	$427,901	$449,266	1,378,306
2040	Base	55	Cleveland-Elyria-Mentor, OH MSA	External																											2,127,524	1,630,826	909,988	$464,227	$466,349	1,481,410
2040	Base	56	Harrisburg-Carlisle, PA MSA	External																											665,586	525,641	288,161	$394,816	$395,285	492,261
2040	Base	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											1,150,561	622,496	457,117	$441,416	$439,855	798,105
2040	Base	58	Columbus, OH MSA	External																											2,420,218	1,694,468	1,054,489	$401,752	$411,461	1,847,644
2040	Base	59	Lancaster, PA MSA	External																											678,114	456,100	273,200	$414,879	$414,879	475,705
2040	Base	60	Charlottesville, VA MSA	External																											274,800	202,376	121,373	$432,350	$446,779	225,691
2040	Base	61	York-Hanover, PA MSA	External																											595,664	324,844	250,701	$363,525	$363,525	466,467
2040	Base	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											1,007,114	821,482	379,102	$1,136,444	$1,136,444	670,233
2040	Base	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											5,326,404	4,046,211	2,202,997	$610,912	$626,446	3,411,384
2040	Base	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,733,334	1,805,253	1,168,539	$480,957	$480,606	2,052,171
2040	Base	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											2,777,460	1,769,019	1,130,023	$416,261	$420,457	2,015,159
2040	Base	66	Akron, OH MSA	External																											738,788	567,347	321,656	$459,973	$458,789	573,926
2040	Base	67	Rochester, NY MSA	External																											1,077,925	796,610	417,142	$461,619	$478,575	685,995
2040	Base	68	Reading, PA MSA	External																											486,408	310,606	188,392	$420,057	$420,057	327,604
2040	Base	69	Durham-Chapel Hill, NC MSA	External																											784,159	625,650	332,895	$411,354	$431,435	583,621
2040	Base	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											111,935	59,158	49,303	$316,704	$316,704	84,212
2040	**Base**		**Total/Average**		**84,044**	**107,062**	**128,858**	**32,072**	**53,794**	**63,573**	**64,143**	**57,238**	**37,088**	**$332,687**	**85,255**	**5,707,245**	**3,286**	**22,118**	**103,732**	**37%**	**84%**	**99%**	**59%**	**11%**	**4,408**	**58%**	**76%**	**79%**	**67%**	**46%**	**143,038,413**	**92,222,850**	**57,658,965**	**$478,448**	**$505,104**	**93,776,773**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-8

MID-CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC FORECAST – BASE CASE
NOTES ON DATA INPUTS

Internal Zones

Permanent Population — Resident population, mutually exclusive from seasonal population. Permanent population forecasts at the county level were estimated by multiplying base case employment by the ratio of Woods & Poole's population to Woods & Poole's employment. The data were distributed among the zones based on the current geographic distribution of primary homes/residential units in an electronic database of property records obtained from Dare County and Currituck County.

Seasonal (or Non-Resident) Population — Non-resident population, mutually exclusive from permanent population. Seasonal population is correlated with the health of the national economy. The better the economy, the more people take vacations. Therefore, changes in seasonal population were estimated based on changes in US GDP. US GDP forecasts were developed by East Carolina University Bureau of Business Research. Cyclicality in the US GDP forecast was based on the 10 economic cycles from 1945 - 2001, with a 5-year expansion period followed by a downturn in year 6. (See separate discussion of GDP/GRP forecasts.) The distribution of seasonal population among zones is dependent upon the geographic distribution of available hotel rooms and bedrooms in second homes and rental units. In zones where growth is limited by land availability at some point in the forecast period, seasonal population growth then becomes dependent upon new hotel rooms and bedrooms added through redevelopment of older homes. See Table A for hotel development assumptions. Redevelopment assumes that within 10 years after a home reaches 50 years old, it will be redeveloped with 50% more bedrooms. Daily averages are based on a 28 day month.

Peak Season Population — Non-resident population, mutually exclusive from permanent population. The Peak Season is assumed to be June, July, and August, based on the Catevo research. Daily averages are based on a 28 day month.

Peak of Peak Season Population — Non-resident population, mutually exclusive from permanent population. The Peak of Peak Season is assumed to be the fourth week of July and the first two weeks of August, based on the Catevo research. Daily averages are based on a 28 day month.

Spring/Fall Shoulder Season Population — Non-resident population, mutually exclusive from permanent population. The Spring and Fall Shoulder Season population is the average of the months of May and September. Daily averages are based on a 28 day month.

Average Annual Employment — Employment and GDP are highly correlated. Estimated and forecast US GDP drives US Employment, which in turn drives County Employment, from which is derived the County GRP. (USGDP=>USEMP=>CtyEMP=>CtyGRP.) Therefore, the employment forecast at the county level was estimated from a productivity ratio, which is calculated using US GDP and US Employment data developed by Woods & Poole Economics. This productivity ratio is applied to the US GDP forecast developed by the East Carolina University Bureau of Business Research. Cyclicality in the US GDP forecast was based on analysis of the 10 economic cycles from 1945 - 2001, which have produced, on average, a 5-

year expansion period followed by a downturn in year 6. The distribution of employment among zones is based on the current geographic distribution of activity presented in the property tax files, as well as new retail development at 600 SF per employee. See Table A for retail development assumptions.

Seasonal Employment — Seasonal employment is based on the health of the national economy, providing a consistent change over time in the number of visitors and employees to service those visitors. The seasonal employment forecasts are based on the average annual employment forecasts. The seasonal distribution of employment depends upon the seasonality of monthly workforce data from the Employment Security Commission of North Carolina. These data reflect total employment of all companies subject to the NC Unemployment Insurance laws. The data are by place of work and typically reflect about 97% of the actual employment in the county. Thus, they provide an actual view of employment seasonality. Seasonality factors were developed from the workforce database and then applied to the total county employment. Daily averages are based on a 28 day month.

Peak Season Employment — The Peak Season is assumed to be June, July, and August, based on the Catevo research. Daily averages are based on a 28 day month.

Peak of Peak Season Employment — The Peak of Peak Season is assumed to be the fourth week of July and the first two weeks of August, based on the Catevo research. Daily averages are based on a 28 day month.

Spring/Fall Shoulder Season Employment — The Spring and Fall Shoulder Season is the average of May and September. Daily averages are based on a 28 day month.

Number of Households — Household growth forecasts at the county level were estimated by multiplying the base case population by the ratio of Woods & Poole's households to Woods & Poole's population. These data were distributed among the zones based on the geographic distribution of primary residences in the county property records database. In some zones (e.g., Zone 4) forecasted household growth has been limited by land availability at some point during the forecast period. In Zone 9, forecasted growth has been limited because of Currituck County land use policies, lack of road access, lack of public utilities, etc.

Average Household Income — Average (mean) household income forecasts at the county level are based on Woods & Poole's household income data and the ratio of base case total income to Woods & Poole's total income. The Woods & Poole total income is calculated by multiplying Woods & Poole's average household income by Woods & Poole's households. The base case total income is calculated by multiplying base case employment by the ratio of Woods & Poole's total income to Woods & Poole's employment. The distribution among zones was based on the value of residential properties extracted from the county property tax files. The current relationship between zonal income and county income has been held constant for the forecasted base case years. The total is a weighted average, weighted by the number of households in each zone.

Vehicle Ownership — Base year vehicle ownership per household has been projected based on household growth forecasts. Vehicle ownership forecasts were distributed between zones based upon the forecasted distribution of residential units among the zones.

TABLE C-8

Retail Square Feet — Retail floor area growth forecasts were estimated from household growth, economic cycles, zone capacity, and current projects planned. See Table A for assumptions regarding the zone locations and amount of future retail development.

Number of Second Homes and Number of Rental Units — Growth forecasts for seasonal residential units were estimated in proportion to seasonal peak population growth forecasts and the development capacity of each zone. In zones with limited development capacity, permanent household growth was given a higher priority than seasonal home development, and the number of second homes and rental units was capped at the point when we estimated that the development capacity was reached. (Note: redevelopment of existing rental units may continue, however, resulting in a larger number of bedrooms. See following note.) In addition, no foreseeable rental home development was estimated for zones 17 (Wanchese), and 19, 21, 25, 26, and 27 (Currituck mainland), because these are not considered to be rental home locations. Second homes are defined as non-permanent residences that are not available to rent and are for the exclusive use of the owner, who maintains a primary residence elsewhere. Rental units are available to seasonal visitors, but they may also be used by the owners. See Tables B, C, D, and E for estimated future development capacity.

Number of Bedrooms in Rental Units — Based on forecasted growth from new construction and bedrooms added by the redevelopment of older existing units. A dwelling unit is assumed to be subject to redevelopment when it is 50 years old, and we have assumed that redevelopment will increase the number of bedrooms in the unit by 50%.

Annual and Seasonal Occupancy of Rental Units — Annual and seasonal occupancy patterns are based on Realtor surveys conducted by Catevo and previous studies. Definitions of the Peak, Peak of Peak, and Shoulder seasons follow the same pattern established above for population and employment. The off-season is defined as October through April.

Number of Hotel Rooms — The forecasted number of hotel rooms in each zone was estimated based on our 2009 hotel room inventory to which we added new hotel rooms that we have assumed will be built during the forecast period. Assumptions regarding the number and location of new hotel rooms were based on currently planned projects (in Zone 5) seasonal population growth patterns, and land availability. See Table A for assumptions regarding zone locations and amount of future hotel development.

Annual Occupancy of Hotels — Hotel occupancy data for Dare and Currituck Counties are based on lodging occupancy surveys conducted by Smith Travel Research and Randall Travel Marketing.

Seasonal Occupancy of Hotels — Seasonal lodging occupancy patterns are based on lodging occupancy surveys conducted by Smith Travel Research and Randall Travel Marketing. Definitions of the Peak, Peak of Peak, and Shoulder seasons follow the same pattern established above for population, employment, and rental units.

External Zones

Population - Forecast data were estimated by multiplying the base case total employment by the ratio of Woods & Poole's population to Woods & Poole's employment.

TABLE C-8

At-Place Employment - Forecast data were estimated by multiplying the base case GDP by a productivity ratio which is calculated using US GDP and US Employment data developed by Woods & Poole.

Number of Households - Forecast data were estimated by multiplying the base case population by the ratio of Woods & Poole's households to Woods & Poole's population.

Average Household Income - Forecast data were estimated by multiplying Woods & Poole's average household income by the ratio of the base case total income to Woods & Poole's total income. Woods & Poole's total income is calculated by multiplying Woods & Poole's average household income by Woods & Poole's households. The base case total income is calculated by multiplying base case employment by the ratio of Woods & Poole's total income to Woods & Poole's employment. The total is a weighted average weighted by the number of households.

Weighted Average Household Income - Unweighted average household income forecasts are presented for Zones 20-45 and 70. For the MSAs in Zones 47 to 69, average household income was weighted by the number of rental contracts in the Catevo database that were generated in each zone. The total is a weighted average, weighted by the number of households.

Vehicle Ownership - Vehicle ownership is calculated based on the number of vehicles available per household reported in the 2000 Census. Forecasts are based on base case household growth forecasts.

TABLE C-9

BASE CASE CALCULATIONS

Internal Zones

County Level

ECU US GDP = Assumed an expansion lasted for first 5 years of forecast; downturn in year 6 (based on the 10 cycles from 1945-2001)

Population = Employment * (W&P Population/W&P Employment)

Employment = US Employment * (W&P County Employment/W&P US Employment)

US Employment = ECU US GDP/Productivity
Productivity = W&P GDP/W&P Employment

Households = Population * (W&P Households/W&P Population)

Household Income = (Total Income/W&P Total Income) * W&P Household Income

Total Income = Employment * (W&P Total Income/W&P Employment)
W&P Total Income = W&P Household Income * W&P Households

TAZ Level

Population = Current Year County Population * (2009 Zone Population/2009 County Population)

Seasonal Population = Current Year ECU US GDP * (2009 Zone Seasonal Pop / 2009 ECU US GDP)

Note: We accounted for each zone's capacity for all types of homes (permanent and seasonal). In zones that have reached capacity, we grew seasonal population by the bedroom and hotel room growth.

Employment = Previous Year Employment * Growth in County Employment + Employment in New Retail and Hotels

Note: For New Retail and Hotels, we assumed 1 employee for every 600 SF of new retail space and 0.5 employee per new hotel room.

Seasonal Employment = Current Year Employment * (2009 Seasonal Employment/2009 Employment)

Households = Current Year County Households * (2009 Zone Households/2009 County Households)

Note: We accounted for the zone's capacity for all types of homes (permanent and seasonal). If the zone has reached capacity, no additional households were added.

Household Income = Current Year County Household Income * (2009 Zone Household Income/2009 County Household Income)

Vehicle Ownership = Current Year Households * (2009 Zone Vehicle Ownership/2009 Zone Household)

Retail SF = Assigned retail space in zones where supported by growth. Roughly 100,000-150,000 SF for every 2,000-3,000 net additional households.

Non-Resident Homes = Previous Year NR Homes * (1+ ECU US GDP Annual Growth)

Note: We define Non-Resident Homes as 2nd Homes and Rental Homes. 2nd Homes = 7.5% of seasonal units; Rental Units = 92.5% of seasonal units.
We accounted for the zone's capacity for all types of homes (permanent and seasonal). If the zone has reached capacity, no additional households were added. There is no foreseeable rental community in zones 17,19,21,25, 26 & 27. Therefore there are no rental units or bedrooms.

# of Rental Bedrooms = Previous Year's # of Rental BRs + BRs in New Rental Units + BRs Gained through Redevelopment of Existing homes

Note: We accounted for the zone's capacity and didn't see any foreseeable rental community in zones 17,19,21,25, 26 & 27. Therefore there are no rental units or bedrooms in those zones.
BRs Gained through Redevelopment = BRs in Homes to be Redeveloped * 50%

Rental Occupancy = Unchanged from base year

# of Hotels = 100 rooms currently planned; forecast based on seasonal population growth and land availability.

Hotel Occupancy = Unchanged from base year

External Zones

Population = Current Year Employment * (W&P Population/W&P Employment)

Employment = Current Year ECU US GDP/W&P Productivity

W&P Productivity = W&P GDP/W&P Employment

Households = Current Year Population * (W&P Households/W&P Population)

Household Income = (Current Year Total Income/W&P Total Income) * W&P Household Income

Total Income = Current Year Employment * (W&P Total Income/W&P Employment)
W&P Total Income = W&P Households * W&P Household Income

Weighted Household Income = Zones 47-69 are weighted by frequency of rental home contracts.
Note: Frequency is based on Catevo Realtor survey data, comprising 160,000+ records

Vehicle Ownership = Current Year Households * 2000 Census Vehicle to Household Ratio

Note: W&P = Woods & Poole Economics; ECU = East Carolina University; Current Year = Current Forecasted Year; Previous Year = Previous Forecasted Year.

Source: Delta Associates, ECU Bureau of Business Research, February 2010.

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6/24/2010

TABLE C-10

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - HIGH CASI
BASE YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental							Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal									Annual Occ	Seasonal Occupancy						Annual Occ	Seasonal Occupancy								
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2009	High	1	Southern Shores	Internal	3,994	4,913	5,913	1,472	445	527	529	473	1,748	$137,330	4,067	39,462	101	1,251	5,020	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2009	High	2	Duck	Internal	544	4,949	5,957	1,483	1,043	1,235	1,241	1,109	238	$114,484	535	164,873	94	1,156	5,049	37%	84%	99%	59%	11%	10	58%	76%	79%	67%	46%						
2009	High	3	Sanderling South	Internal	364	3,356	4,040	1,005	265	314	316	282	159	$175,216	371	49,065	63	777	3,344	37%	84%	99%	59%	11%	93	58%	76%	79%	67%	46%						
2009	High	4	Sanderling North	Internal	0	578	696	173	21	24	25	22	0	$0	0	1,888	5	60	365	37%	84%	99%	59%	11%	123	58%	76%	79%	67%	46%						
2009	High	5	Corolla South	Internal	262	6,229	7,497	1,866	77	90	92	82	103	$232,608	237	0	86	1,062	5,154	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2009	High	6	Corolla South Central	Internal	132	1,643	1,978	492	202	237	241	215	52	$249,847	119	78,497	25	302	1,360	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2009	High	7	Corolla North Central	Internal	251	4,359	5,247	1,306	615	723	735	655	99	$260,106	227	230,048	57	709	3,607	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2009	High	8	Corolla North	Internal	244	4,425	5,326	1,326	309	363	369	329	96	$268,299	221	31,427	59	730	3,622	37%	84%	99%	59%	11%	43	58%	76%	79%	67%	46%						
2009	High	9	Carova, 4wd area	Internal	274	2,652	3,191	794	139	164	166	148	108	$138,650	248	0	43	528	2,194	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2009	High	10	Kitty Hawk	Internal	3,449	4,753	5,721	1,424	3,229	3,826	3,844	3,435	1,509	$81,572	3,447	330,488	110	1,352	4,467	37%	84%	99%	59%	11%	422	58%	76%	79%	67%	46%						
2009	High	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	4,744	7,642	9,198	2,289	1,529	1,813	1,822	1,628	2,076	$65,213	4,795	369,479	195	2,400	7,244	37%	84%	99%	59%	11%	611	58%	76%	79%	67%	46%						
2009	High	12	Collington	Internal	3,555	2,481	2,987	743	551	653	656	586	1,556	$68,225	3,624	17,188	65	804	2,532	37%	84%	99%	59%	11%	4	58%	76%	79%	67%	46%						
2009	High	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,004	4,658	5,606	1,395	3,815	4,521	4,543	4,059	877	$72,312	1,989	403,273	103	1,275	4,154	37%	84%	99%	59%	11%	655	58%	76%	79%	67%	46%						
2009	High	14	Nags Head	Internal	1,567	3,617	4,353	1,083	2,275	2,696	2,710	2,420	686	$94,826	1,574	319,765	78	966	3,594	37%	84%	99%	59%	11%	110	58%	76%	79%	67%	46%						
2009	High	15	Nags Head / Whalebone	Internal	1,260	5,538	6,666	1,659	2,954	3,500	3,517	3,142	552	$95,723	1,247	480,425	104	1,287	5,162	37%	84%	99%	59%	11%	538	58%	76%	79%	67%	46%						
2009	High	16	Manteo	Internal	5,083	3,101	3,732	929	3,726	4,414	4,435	3,963	2,224	$72,343	5,126	325,405	74	914	2,921	37%	84%	99%	59%	11%	268	58%	76%	79%	67%	46%						
2009	High	17	Wanchese	Internal	1,376	343	413	103	962	1,140	1,146	1,024	602	$45,471	1,379	25,497	133	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2009	High	18	Bodie Island	Internal	481	3,541	4,262	1,061	190	225	226	202	210	$106,408	470	3,200	68	845	3,445	37%	84%	99%	59%	11%	187	58%	76%	79%	67%	46%						
2009	High	19	Lower Currituck Peninsula - South	Internal	2,781	477	574	143	1,997	2,347	2,388	2,125	1,096	$90,237	2,517	109,712	140	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2009	High	20	Elizabeth City	External																											20,277	11,599	7,884	$65,419	$65,419	15,448
2009	High	21	Moyock Township	Internal	7,201	356	428	107	1,232	1,449	1,473	1,312	2,838	$74,508	6,517	201,827	96	0	0	na	na	na	na	na	4	58%	76%	79%	67%	46%						
2009	High	22	Dare County Mainland	External																											844	1,119	369	$43,510	$43,510	851
2009	High	23	Hatteras Island	External																											4,758	4,787	2,082	$81,092	$81,092	4,748
2009	High	24	Pasquotank County (Excl. Elizabeth City), NC	External																											21,373	12,225	8,310	$65,419	$65,419	16,277
2009	High	25	Crawford Township	Internal	7,188	599	720	179	2,115	2,486	2,529	2,251	2,833	$77,731	6,505	81,230	173	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2009	High	26	Lower Currituck Peninsula - North	Internal	1,478	236	284	71	542	637	648	577	582	$80,473	1,337	33,448	72	0	0	na	na	na	na	na	0	na	na	na	na	na						
2009	High	27	Lower Currituck Peninsula - Central	Internal	3,590	552	665	165	1,294	1,521	1,547	1,377	1,415	$61,358	3,249	186,214	174	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2009	High	28	Camden County, NC	External																											9,933	3,454	4,037	$74,159	$74,159	9,484
2009	High	29	Balance of Massachusetts	External																											2,407,231	1,286,452	969,890	$101,449	$101,449	1,560,397
2009	High	30	Balance of Connecticut	External																											2,616,307	1,618,007	1,044,574	$115,480	$115,480	1,758,295
2009	High	31	Albemarle Peninsula, NC	External																											22,257	9,761	8,946	$69,164	$69,164	14,398
2009	High	32	Knotts Island	External																											1,439	413	567	$64,612	$64,612	1,303
2009	High	33	Balance of Maryland	External																											647,726	366,578	259,145	$84,774	$84,774	451,573
2009	High	34	Balance of Delaware	External																											350,663	178,365	141,624	$77,334	$77,334	252,866
2009	High	35	Balance of New Jersey	External																											894,079	586,296	336,527	$129,386	$129,386	523,359
2009	High	36	Balance of Virginia	External																											2,242,764	1,235,300	923,008	$72,453	$72,453	1,695,153
2009	High	37	Balance of North Carolina	External																											6,065,127	3,206,603	2,452,259	$78,315	$78,315	4,440,715
2009	High	38	Balance of South Carolina	External																											4,311,829	2,365,876	1,714,621	$79,503	$79,503	2,957,051
2009	High	39	Georgia	External																											9,822,815	5,375,426	3,698,353	$88,702	$88,702	6,601,274
2009	High	40	Balance of West Virginia	External																											1,765,795	872,386	745,574	$75,474	$75,474	1,209,411
2009	High	41	Balance of Ohio	External																											5,269,630	2,752,862	2,114,378	$76,540	$76,540	3,825,478
2009	High	42	Michigan	External																											10,035,072	5,071,428	3,964,515	$88,826	$88,826	6,983,293
2009	High	43	Balance of Pennsylvania	External																											3,594,865	1,922,969	1,441,525	$76,687	$76,687	2,403,851
2009	High	44	Balance of New York State	External																											5,887,672	3,209,802	2,336,426	$86,077	$86,077	3,784,892
2009	High	45	Balance of New Hampshire	External																											906,630	582,666	365,126	$102,255	$102,255	658,450
2009	High	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	450	533	536	479	0	$0	0	364,834	na	na	na	na	na	na	na	na	na	na	na	na	na	na						
2009	High	47	Washington, DC-VA-MD-WV MSA	External																											5,443,194	3,838,226	2,114,661	$146,754	$159,621	3,564,348
2009	High	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											5,865,190	3,458,435	2,280,959	$121,503	$135,928	3,455,933
2009	High	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											19,098,169	10,827,773	7,155,467	$144,547	$164,812	8,503,307
2009	High	50	Baltimore-Towson, MD MSA	External																											2,697,617	1,645,813	1,074,633	$119,057	$131,244	1,717,602
2009	High	51	Richmond, VA MSA	External																											1,247,375	760,143	500,228	$99,745	$105,094	906,034
2009	High	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											1,677,344	1,039,248	643,354	$98,389	$103,615	1,117,931
2009	High	53	Pittsburgh, PA MSA	External																											2,353,378	1,427,897	991,366	$102,934	$105,021	1,540,983
2009	High	54	Raleigh-Cary, NC MSA	External																											1,112,618	656,500	440,056	$99,306	$103,246	809,040
2009	High	55	Cleveland-Elyria-Mentor, OH MSA	External																											2,087,637	1,269,327	854,312	$98,156	$98,860	1,390,773
2009	High	56	Harrisburg-Carlisle, PA MSA	External																											534,815	396,606	220,572	$94,455	$95,385	376,800
2009	High	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											818,121	422,839	325,373	$95,086	$91,547	568,087
2009	High	58	Columbus, OH MSA	External																											1,791,654	1,170,993	734,375	$93,386	$96,160	1,286,750
2009	High	59	Lancaster, PA MSA	External																											507,385	302,854	193,371	$93,078	$93,078	336,704
2009	High	60	Charlottesville, VA MSA	External																											196,719	134,934	80,247	$100,903	$102,857	149,217
2009	High	61	York-Hanover, PA MSA	External																											429,522	225,013	172,601	$87,024	$87,024	321,150
2009	High	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											897,717	601,179	338,005	$215,327	$215,327	597,575
2009	High	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											4,543,803	3,071,881	1,802,378	$137,716	$139,690	2,791,018
2009	High	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,171,185	1,266,738	872,478	$98,606	$98,331	1,532,234
2009	High	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											1,733,739	1,048,744	686,456	$98,414	$100,054	1,224,150
2009	High	66	Akron, OH MSA	External																											699,175	409,640	286,241	$91,341	$91,050	510,736
2009	High	67	Rochester, NY MSA	External																											1,034,524	622,615	406,988	$96,756	$98,957	669,296
2009	High	68	Reading, PA MSA	External																											405,808	222,402	157,825	$90,985	$90,985	274,449
2009	High	69	Durham-Chapel Hill, NC MSA	External																											498,482	374,076	204,096	$98,665	$102,532	357,814
2009	High	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											102,390	43,060	41,978	$71,789	$71,789	71,334
2009	**High**		**Total/Average**		**51,822**	**70,998**	**85,451**	**21,268**	**29,975**	**35,440**	**35,734**	**31,894**	**21,659**	**$84,003**	**49,801**	**3,847,245**	**2,120**	**16,417**	**63,233**	**37%**	**84%**	**99%**	**59%**	**11%**	**3,108**	**58%**	**76%**	**79%**	**67%**	**46%**	**114,846,647**	**65,911,311**	**45,117,761**	**$105,764**	**$110,994**	**73,241,830**

Source: East Carolina Univ., Woods and Poole, Delta Associations, February 2010.

TABLE C-11

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - HIGH CASE
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental							Hotels								Households			
					Permanent	Seasonal			Annual Avg.	Seasonal								Annual Occ	Seasonal Occupancy						Annual Occ	Seasonal Occupancy										
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2015	High	1	Southern Shores	Internal	4,566	5,877	7,074	1,761	520	617	619	554	2,052	185,863	4,775	39,462	121	1,497	6,475	42%	89%	99%	63%	13%	0	na	na	na	na	na						
2015	High	2	Duck	Internal	622	5,636	6,784	1,688	1,220	1,446	1,453	1,298	274	154,942	616	164,873	102	1,263	5,701	42%	89%	99%	63%	13%	10	62%	79%	82%	71%	49%						
2015	High	3	Sanderling South	Internal	416	3,822	4,600	1,145	310	367	369	330	178	237,138	414	49,065	69	849	3,805	42%	89%	99%	63%	13%	93	62%	79%	82%	71%	49%						
2015	High	4	Sanderling North	Internal	0	578	696	173	25	30	30	27	0	0	0	1,888	5	60	365	42%	89%	99%	63%	13%	123	62%	79%	82%	71%	49%						
2015	High	5	Corolla South	Internal	321	7,451	8,968	2,232	146	171	174	155	130	289,005	298	0	103	1,270	6,645	42%	89%	99%	63%	13%	100	na	na	na	na	na						
2015	High	6	Corolla South Central	Internal	162	1,966	2,366	589	245	288	293	261	65	310,425	150	78,497	29	362	1,739	42%	89%	99%	63%	13%	0	na	na	na	na	na						
2015	High	7	Corolla North Central	Internal	308	5,215	6,277	1,562	864	1,015	1,032	919	124	323,170	286	300,048	69	848	4,685	42%	89%	99%	63%	13%	0	na	na	na	na	na						
2015	High	8	Corolla North	Internal	300	5,294	6,372	1,586	583	685	697	621	121	333,350	279	156,427	71	873	4,679	42%	89%	99%	63%	13%	43	62%	79%	82%	71%	49%						
2015	High	9	Carova, 4wd area	Internal	337	3,172	3,818	950	169	199	202	180	136	172,267	312	0	51	632	2,736	42%	89%	99%	63%	13%	0	na	na	na	na	na						
2015	High	10	Kitty Hawk	Internal	3,943	5,686	6,844	1,703	3,854	4,566	4,588	4,099	1,772	110,400	4,047	330,488	131	1,618	5,849	42%	89%	99%	63%	13%	572	62%	79%	82%	71%	49%						
2015	High	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	5,423	9,098	10,950	2,725	1,790	2,121	2,132	1,905	2,420	88,259	5,590	369,479	222	2,732	8,972	42%	89%	99%	63%	13%	611	62%	79%	82%	71%	49%						
2015	High	12	Collington	Internal	4,064	2,969	3,573	889	645	764	768	686	1,827	92,335	4,255	17,188	78	962	3,258	42%	89%	99%	63%	13%	4	62%	79%	82%	71%	49%						
2015	High	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,291	5,534	6,661	1,658	4,546	5,388	5,414	4,837	1,063	97,867	2,412	453,273	118	1,452	5,075	42%	89%	99%	63%	13%	655	62%	79%	82%	71%	49%						
2015	High	14	Nags Head	Internal	1,792	4,327	5,208	1,296	2,787	3,303	3,320	2,966	805	128,338	1,848	394,765	94	1,156	4,622	42%	89%	99%	63%	13%	110	62%	79%	82%	71%	49%						
2015	High	15	Nags Head / Whalebone	Internal	1,441	6,343	7,635	1,900	3,623	4,294	4,315	3,855	677	129,552	1,531	580,425	114	1,406	5,828	42%	89%	99%	63%	13%	538	62%	79%	82%	71%	49%						
2015	High	16	Manteo	Internal	5,811	3,709	4,464	1,111	4,360	5,166	5,190	4,638	2,588	97,909	5,963	325,405	89	1,093	3,709	42%	89%	99%	63%	13%	268	62%	79%	82%	71%	49%						
2015	High	17	Wanchese	Internal	1,573	410	494	123	1,126	1,334	1,341	1,198	683	61,541	1,565	25,497	160	0	0	na	na	na	na	na	8	62%	79%	82%	71%	49%						
2015	High	18	Bodie Island	Internal	550	3,885	4,676	1,164	222	264	265	236	263	144,012	588	3,200	72	884	3,698	42%	89%	99%	63%	13%	187	62%	79%	82%	71%	49%						
2015	High	19	Lower Currituck Peninsula - South	Internal	3,418	571	687	171	2,425	2,850	2,899	2,580	1,380	112,116	3,169	109,712	168	0	0	na	na	na	na	na	12	62%	79%	82%	71%	49%						
2015	High	20	Elizabeth City	Extemal																											23,184	13,380	9,320	$85,189	$85,189	18,262
2015	High	21	Moyock Township	Internal	8,851	426	512	128	1,496	1,759	1,789	1,592	3,573	92,573	8,207	201,827	115	0	0	na	na	na	na	na	4	62%	79%	82%	71%	49%						
2015	High	22	Dare County Mainland	Extemal																											965	1,310	434	$58,886	$58,886	1,000
2015	High	23	Hatteras Island	Extemal																											5,439	5,602	2,445	$109,750	$109,750	5,575
2015	High	24	Pasquotank County (Excl. Elizabeth City), NC	Extemal																											24,437	14,102	9,824	$85,189	$85,189	19,242
2015	High	25	Crawford Township	Internal	8,834	716	862	214	2,568	3,019	3,071	2,733	3,567	96,578	8,191	81,230	207	0	0	na	na	na	na	na	8	62%	79%	82%	71%	49%						
2015	High	26	Lower Currituck Peninsula - North	Internal	1,816	282	339	84	659	774	787	701	733	99,984	1,684	33,448	86	0	0	na	na	na	na	na	0	na	na	na	na	na						
2015	High	27	Lower Currituck Peninsula - Central	Internal	4,412	661	795	198	1,571	1,847	1,878	1,672	1,781	76,235	4,091	186,214	208	0	0	na	na	na	na	na	12	62%	79%	82%	71%	49%						
2015	High	28	Camden County, NC	Extemal																											12,136	4,164	5,087	$92,874	$92,874	11,950
2015	High	29	Balance of Massachusetts	Extemal																											2,636,664	1,471,902	1,091,670	$136,499	$136,499	1,749,676
2015	High	30	Balance of Connecticut	Extemal																											2,841,022	1,836,356	1,159,673	$156,914	$156,914	1,952,321
2015	High	31	Albemarle Peninsula, NC	Extemal																											23,892	11,139	9,914	$88,912	$88,912	15,956
2015	High	32	Knotts Island	Extemal																											1,769	502	714	$80,277	$80,277	1,640
2015	High	33	Balance of Maryland	Extemal																											737,492	425,566	303,101	$112,803	$112,803	521,706
2015	High	34	Balance of Delaware	Extemal																											417,897	210,897	173,624	$101,756	$101,756	309,978
2015	High	35	Balance of New Jersey	Extemal																											986,076	668,972	377,413	$176,331	$176,331	586,698
2015	High	36	Balance of Virginia	Extemal																											2,480,473	1,409,007	1,046,500	$96,747	$96,747	1,896,373
2015	High	37	Balance of North Carolina	Extemal																											6,795,113	3,678,314	2,810,772	$103,911	$103,911	5,089,231
2015	High	38	Balance of South Carolina	Extemal																											4,890,306	2,726,744	1,993,469	$105,866	$105,866	3,437,690
2015	High	39	Georgia	Extemal																											11,294,981	6,234,972	4,324,278	$118,753	$118,753	7,718,502
2015	High	40	Balance of West Virginia	Extemal																											1,892,982	989,065	816,146	$101,160	$101,160	1,322,982
2015	High	41	Balance of Ohio	Extemal																											5,610,283	3,097,409	2,301,748	$103,486	$103,486	4,155,543
2015	High	42	Michigan	Extemal																											10,852,405	5,723,560	4,394,598	$119,537	$119,537	7,740,863
2015	High	43	Balance of Pennsylvania	Extemal																											3,876,829	2,182,375	1,586,719	$103,068	$103,068	2,610,009
2015	High	44	Balance of New York State	Extemal																											6,317,730	3,608,100	2,552,793	$117,054	$117,054	4,132,686
2015	High	45	Balance of New Hampshire	Extemal																											1,026,255	675,502	424,646	$136,969	$136,969	765,704
2015	High	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	527	624	627	560	0	0	0	364,834	na	na	na	na	na	na	na	na	na	na	na	na	na	na						
2015	High	47	Washington, DC-VA-MD-WV MSA	Extemal																											6,316,669	4,462,744	2,502,266	$195,987	$212,671	4,217,672
2015	High	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	Extemal																											6,394,982	3,935,767	2,545,334	$164,854	$183,345	3,856,493
2015	High	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	Extemal																											20,850,897	12,173,033	7,930,171	$196,336	$225,452	9,423,939
2015	High	50	Baltimore-Towson, MD MSA	Extemal																											3,056,610	1,897,482	1,250,259	$159,778	$174,014	1,998,308
2015	High	51	Richmond, VA MSA	Extemal																											1,461,833	883,454	599,704	$131,896	$137,705	1,086,209
2015	High	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	Extemal																											1,901,144	1,194,681	750,754	$130,967	$135,973	1,304,555
2015	High	53	Pittsburgh, PA MSA	Extemal																											2,511,897	1,615,332	1,076,163	$140,964	$143,931	1,672,792
2015	High	54	Raleigh-Cary, NC MSA	Extemal																											1,332,089	778,685	535,324	$130,513	$136,208	984,191
2015	High	55	Cleveland-Elyria-Mentor, OH MSA	Extemal																											2,211,824	1,422,709	927,336	$134,065	$134,615	1,509,653
2015	High	56	Harrisburg-Carlisle, PA MSA	Extemal																											591,169	448,463	250,152	$125,692	$126,542	427,332
2015	High	57	Allentown-Bethlehem-Easton, PA-NJ MSA	Extemal																											931,217	487,431	376,258	$127,487	$122,947	656,929
2015	High	58	Columbus, OH MSA	Extemal																											2,019,199	1,344,942	850,453	$124,696	$128,046	1,490,138
2015	High	59	Lancaster, PA MSA	Extemal																											570,341	350,903	223,119	$125,138	$125,138	388,502
2015	High	60	Charlottesville, VA MSA	Extemal																											223,559	156,378	94,245	$134,127	$136,974	175,245
2015	High	61	York-Hanover, PA MSA	Extemal																											487,213	259,325	200,678	$114,932	$114,932	373,393
2015	High	62	Bridgeport-Stamford-Norwalk, CT MSA	Extemal																											969,913	686,163	370,823	$302,858	$302,858	655,596
2015	High	63	Boston-Cambridge-Quincy, MA-NH MSA	Extemal																											4,955,773	3,472,687	2,013,443	$185,955	$189,083	3,117,856
2015	High	64	Cincinnati-Middletown OH-KY-IN MSA	Extemal																											2,406,316	1,451,670	993,724	$138,237	$136,925	1,745,165
2015	High	65	Charlotte-Gastonia-Concord NC-SC MSA	Extemal																											2,042,616	1,238,196	825,489	$129,520	$131,147	1,472,086
2015	High	66	Akron, OH MSA	Extemal																											746,096	466,227	313,981	$125,940	$125,525	560,231
2015	High	67	Rochester, NY MSA	Extemal																											1,100,870	699,975	439,566	$132,449	$135,911	722,870
2015	High	68	Reading, PA MSA	Extemal																											444,772	253,882	175,763	$123,052	$123,052	305,642
2015	High	69	Durham-Chapel Hill, NC MSA	Extemal																											584,354	440,378	244,892	$129,858	$134,987	429,336
2015	High	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	Extemal																											110,038	48,941	46,517	$94,241	$94,241	79,128
2015	**High**		**Total/Average**		**61,253**	**83,629**	**100,655**	**25,052**	**36,281**	**42,891**	**43,253**	**38,603**	**26,215**	**$109,611**	**60,271**	**4,267,245**	**2,481**	**18,956**	**77,839**	**42%**	**89%**	**99%**	**63%**	**13%**	**3,358**	**62%**	**79%**	**82%**	**71%**	**49%**	**126,969,726**	**75,158,390**	**50,931,303**	**$142,602**	**$149,712**	**82,716,847**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-12

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - HIGH CASE
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental							Hotels								Households			
					Permanent	Seasonal			Annual Avg	Seasonal								Annual Occ	Seasonal Occupancy					Annual Occ	Seasonal Occupancy										
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2020	High	1	Southern Shores	Internal	5,339	6,185	7,445	1,853	693	822	825	737	2,076	254,939	4,831	84,462	121	1,497	6,529	42%	89%	99%	63%	13%	0	na	na	na	na	na						
2020	High	2	Duck	Internal	727	5,639	6,787	1,689	1,439	1,705	1,714	1,532	274	212,526	616	164,873	102	1,263	5,703	42%	89%	99%	63%	13%	10	62%	79%	82%	71%	49%						
2020	High	3	Sanderling South	Internal	487	3,825	4,603	1,146	365	433	436	390	178	325,270	414	49,065	69	849	3,808	42%	89%	99%	63%	13%	93	62%	79%	82%	71%	49%						
2020	High	4	Sanderling North	Internal	0	578	696	173	31	36	37	33	0	0	0	1,888	5	60	365	42%	89%	99%	63%	13%	123	62%	79%	82%	71%	49%						
2020	High	5	Corolla South	Internal	395	9,077	10,925	2,719	177	208	212	189	161	389,173	371	0	125	1,547	8,626	42%	89%	99%	63%	13%	100	na	na	na	na	na						
2020	High	6	Corolla South Central	Internal	199	2,395	2,882	717	415	488	496	442	81	418,016	187	148,497	36	441	2,244	42%	89%	99%	63%	13%	0	na	na	na	na	na						
2020	High	7	Corolla North Central	Internal	379	6,352	7,646	1,903	1,051	1,236	1,257	1,119	155	435,179	356	300,048	84	1,033	6,117	42%	89%	99%	63%	13%	0	na	na	na	na	na						
2020	High	8	Corolla North	Internal	369	5,865	7,043	1,814	710	834	849	756	172	448,887	395	156,427	74	914	4,980	42%	89%	99%	63%	13%	43	62%	79%	82%	71%	49%						
2020	High	9	Carova, 4wd area	Internal	414	3,864	4,651	1,158	206	242	246	219	169	231,973	389	0	62	770	3,456	42%	89%	99%	63%	13%	0	na	na	na	na	na						
2020	High	10	Kitty Hawk	Internal	4,611	6,927	8,337	2,075	4,546	5,387	5,411	4,835	2,104	151,430	4,803	330,488	160	1,971	7,620	42%	89%	99%	63%	13%	572	62%	79%	82%	71%	49%						
2020	High	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	6,341	9,333	11,233	2,796	2,360	2,797	2,810	2,511	2,420	121,061	5,590	469,479	222	2,732	9,121	42%	89%	99%	63%	13%	736	62%	79%	82%	71%	49%						
2020	High	12	Collington	Internal	4,752	3,616	4,352	1,083	760	902	906	809	2,170	126,652	5,054	17,188	92	1,138	4,063	42%	89%	99%	63%	13%	4	62%	79%	82%	71%	49%						
2020	High	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,679	5,586	6,723	1,673	5,363	6,355	6,386	5,706	1,063	134,240	2,412	453,273	118	1,452	5,133	42%	89%	99%	63%	13%	655	62%	79%	82%	71%	49%						
2020	High	14	Nags Head	Internal	2,095	4,552	5,478	1,363	3,288	3,896	3,916	3,498	845	176,035	1,937	394,765	94	1,156	4,664	42%	89%	99%	63%	13%	110	62%	79%	82%	71%	49%						
2020	High	15	Nags Head / Whalebone	Internal	1,685	6,379	7,677	1,911	4,444	5,267	5,293	4,729	677	177,700	1,531	680,425	114	1,406	5,866	42%	89%	99%	63%	13%	538	62%	79%	82%	71%	49%						
2020	High	16	Manteo	Internal	6,795	4,518	5,438	1,354	5,393	6,390	6,420	5,736	3,762	134,297	8,669	475,405	108	1,332	4,678	42%	89%	99%	63%	13%	268	62%	79%	82%	71%	49%						
2020	High	17	Wanchese	Internal	1,839	500	602	150	1,328	1,574	1,582	1,413	1,501	84,412	3,439	25,497	194	0	0	na	na	na	na	na	8	62%	79%	82%	71%	49%						
2020	High	18	Bodie Island	Internal	643	3,902	4,697	1,169	262	311	312	278	263	197,535	588	3,200	72	884	3,717	42%	89%	99%	63%	13%	187	62%	79%	82%	71%	49%						
2020	High	19	Lower Currituck Peninsula - South	Internal	4,199	695	837	208	3,119	3,665	3,728	3,319	1,722	150,975	3,954	209,712	205	0	0	na	na	na	na	na	12	62%	79%	82%	71%	49%						
2020	High	20	Elizabeth City	External																											27,112	15,702	11,115	$115,875	$115,875	21,779
2020	High	21	Moyock Township	Internal	10,873	519	624	155	2,150	2,527	2,571	2,288	4,451	124,659	10,223	351,827	140	0	0	na	na	na	na	na	104	62%	79%	82%	71%	49%						
2020	High	22	Dare County Mainland	External																											1,129	1,545	515	$80,771	$80,771	1,187
2020	High	23	Hatteras Island	External																											6,360	6,608	2,901	$150,539	$150,539	6,617
2020	High	24	Pasquotank County (Excl. Elizabeth City), NC	External																											28,577	16,550	11,716	$115,875	$115,875	22,948
2020	High	25	Crawford Township	Internal	10,853	872	1,050	261	3,127	3,675	3,738	3,327	4,443	130,051	10,204	81,230	253	0	0	na	na	na	na	na	8	62%	79%	82%	71%	49%						
2020	High	26	Lower Currituck Peninsula - North	Internal	2,231	343	413	103	802	942	958	853	917	134,638	2,106	33,448	104	0	0	na	na	na	na	na	0	na	na	na	na	na						
2020	High	27	Lower Currituck Peninsula - Central	Internal	5,420	805	969	241	1,913	2,248	2,286	2,035	2,221	102,658	5,101	186,214	254	0	0	na	na	na	na	na	12	62%	79%	82%	71%	49%						
2020	High	28	Camden County, NC	External																											14,852	5,070	6,343	$123,824	$123,824	14,902
2020	High	29	Balance of Massachusetts	External																											2,985,203	1,706,414	1,254,916	$188,516	$188,516	2,005,283
2020	High	30	Balance of Connecticut	External																											3,194,783	2,114,826	1,318,666	$217,633	$217,633	2,220,244
2020	High	31	Albemarle Peninsula, NC	External																											26,622	12,980	11,265	$122,161	$122,161	18,130
2020	High	32	Knotts Island	External																											2,173	611	846	$108,101	$108,101	1,942
2020	High	33	Balance of Maryland	External																											859,751	499,534	358,649	$155,388	$155,388	611,654
2020	High	34	Balance of Delaware	External																											503,030	252,438	212,384	$140,191	$140,191	379,159
2020	High	35	Balance of New Jersey	External																											1,122,427	776,098	432,372	$247,644	$247,644	671,910
2020	High	36	Balance of Virginia	External																											2,829,531	1,633,015	1,209,663	$133,254	$133,254	2,169,260
2020	High	37	Balance of North Carolina	External																											7,827,667	4,284,056	3,275,524	$142,695	$142,695	5,930,110
2020	High	38	Balance of South Carolina	External																											5,684,851	3,190,483	2,348,015	$145,268	$145,268	4,048,855
2020	High	39	Georgia	External																											13,261,982	7,334,164	5,110,665	$163,732	$163,732	9,122,142
2020	High	40	Balance of West Virginia	External																											2,106,864	1,139,973	917,645	$139,988	$139,988	1,486,663
2020	High	41	Balance of Ohio	External																											6,209,033	3,543,893	2,575,939	$143,451	$143,451	4,642,274
2020	High	42	Michigan	External																											12,163,990	6,575,972	4,991,822	$165,007	$165,007	8,792,842
2020	High	43	Balance of Pennsylvania	External																											4,335,671	2,517,139	1,791,612	$142,746	$142,746	2,914,072
2020	High	44	Balance of New York State	External																											7,036,978	4,129,474	2,864,959	$162,993	$162,993	4,635,711
2020	High	45	Balance of New Hampshire	External																											1,191,298	792,008	500,441	$187,981	$187,981	902,296
2020	High	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	621	736	740	661	0	0	0	364,834	na	na	0	na	na	na	na	na	na	na	na	na	na	na						
2020	High	47	Washington, DC-VA-MD-WV MSA	External																											7,465,239	5,263,024	2,984,401	$268,263	$291,195	5,030,330
2020	High	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											7,214,483	4,550,554	2,906,370	$228,671	$252,979	4,403,507
2020	High	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											23,547,413	13,925,471	9,003,522	$272,121	$313,870	10,699,472
2020	High	50	Baltimore-Towson, MD MSA	External																											3,550,688	2,216,886	1,473,384	$220,016	$237,595	2,354,931
2020	High	51	Richmond, VA MSA	External																											1,739,575	1,043,496	722,110	$180,394	$187,370	1,307,916
2020	High	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											2,208,976	1,398,423	886,985	$179,608	$184,933	1,541,279
2020	High	53	Pittsburgh, PA MSA	External																											2,785,789	1,856,585	1,201,473	$197,608	$201,862	1,867,574
2020	High	54	Raleigh-Cary, NC MSA	External																											1,608,419	932,982	650,331	$177,888	$185,919	1,195,630
2020	High	55	Cleveland-Elyria-Mentor, OH MSA	External																											2,438,087	1,627,831	1,035,630	$186,897	$187,321	1,685,949
2020	High	56	Harrisburg-Carlisle, PA MSA	External																											674,070	515,382	289,282	$171,420	$172,224	494,176
2020	High	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											1,085,388	568,925	441,112	$176,499	$171,489	770,162
2020	High	58	Columbus, OH MSA	External																											2,336,312	1,565,949	999,298	$170,583	$174,882	1,750,939
2020	High	59	Lancaster, PA MSA	External																											658,639	411,170	261,434	$172,124	$172,124	455,218
2020	High	60	Charlottesville, VA MSA	External																											260,257	183,878	111,865	$183,697	$188,078	208,010
2020	High	61	York-Hanover, PA MSA	External																											566,431	302,152	236,440	$156,628	$156,628	439,933
2020	High	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											1,086,300	793,547	417,653	$429,397	$429,397	738,388
2020	High	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											5,592,187	3,985,950	2,300,959	$256,144	$260,837	3,563,080
2020	High	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,749,323	1,688,805	1,153,186	$194,504	$192,439	2,025,210
2020	High	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											2,439,578	1,477,740	995,692	$176,098	$178,119	1,775,608
2020	High	66	Akron, OH MSA	External																											827,297	540,240	353,667	$177,223	$176,635	631,042
2020	High	67	Rochester, NY MSA	External																											1,217,879	799,001	488,597	$184,593	$189,815	803,502
2020	High	68	Reading, PA MSA	External																											503,820	293,798	200,264	$170,431	$170,431	348,248
2020	High	69	Durham-Chapel Hill, NC MSA	External																											695,506	524,161	294,950	$176,078	$183,177	517,096
2020	High	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											122,710	56,585	52,821	$130,184	$130,184	89,926
2020	**High**		**Total/Average**		**73,325**	**92,327**	**111,106**	**27,714**	**44,562**	**52,676**	**53,128**	**47,415**	**31,827**	**$146,178**	**73,170**	**4,982,245**	**2,807**	**20,442**	**86,692**	**42%**	**89%**	**99%**	**63%**	**13%**	**3,583**	**62%**	**79%**	**82%**	**71%**	**49%**	**144,794,247**	**87,071,089**	**58,669,398**	**$196,981**	**$206,851**	**95,317,107**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-13

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - HIGH CASI
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental							Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal								Annual Occ	Seasonal Occupancy						Annual Occ	Seasonal Occupancy									
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2025	High	1	Southern Shores	Internal	5,935	6,250	7,523	1,872	969	1,149	1,153	1,031	2,076	339,307	4,831	184,462	121	1,497	6,605	42%	89%	99%	63%	13%	0	na	na	na	na	na						
2025	High	2	Duck	Internal	809	5,642	6,791	1,690	1,614	1,913	1,922	1,718	274	282,859	616	164,873	102	1,263	5,707	42%	89%	99%	63%	13%	10	62%	79%	82%	71%	49%						
2025	High	3	Sanderling South	Internal	541	3,830	4,610	1,147	410	486	489	437	178	432,913	414	49,065	69	849	3,814	42%	89%	99%	63%	13%	93	62%	79%	82%	71%	49%						
2025	High	4	Sanderling North	Internal	0	579	697	173	36	42	43	38	0	0	0	1,888	5	60	365	42%	89%	99%	63%	13%	123	62%	79%	82%	71%	49%						
2025	High	5	Corolla South	Internal	458	10,543	12,689	3,158	205	242	246	219	189	511,554	434	0	146	1,797	10,414	42%	89%	99%	63%	13%	100	na	na	na	na	na						
2025	High	6	Corolla South Central	Internal	230	2,781	3,348	833	481	565	575	512	95	549,467	218	148,497	42	512	2,700	42%	89%	99%	63%	13%	0	na	na	na	na	na						
2025	High	7	Corolla North Central	Internal	439	6,816	8,204	2,042	1,219	1,432	1,457	1,297	197	572,028	452	300,048	86	1,062	6,341	42%	89%	99%	63%	13%	0	na	na	na	na	na						
2025	High	8	Corolla North	Internal	428	5,866	7,043	1,814	823	967	984	876	172	590,046	395	156,427	74	914	4,981	42%	89%	99%	63%	13%	43	62%	79%	82%	71%	49%						
2025	High	9	Carova, 4wd area	Internal	480	4,488	5,402	1,344	238	280	285	254	198	304,921	454	0	72	894	4,118	42%	89%	99%	63%	13%	0	na	na	na	na	na						
2025	High	10	Kitty Hawk	Internal	5,125	8,045	9,683	2,410	5,174	6,130	6,159	5,503	2,312	201,544	5,280	330,488	179	2,203	8,811	42%	89%	99%	63%	13%	722	62%	79%	82%	71%	49%						
2025	High	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	7,049	9,505	11,440	2,847	2,732	3,238	3,254	2,908	2,420	161,124	5,590	519,479	222	2,732	9,321	42%	89%	99%	63%	13%	736	62%	79%	82%	71%	49%						
2025	High	12	Collington	Internal	5,283	3,731	4,490	1,118	853	1,011	1,016	908	2,155	168,565	5,021	17,188	93	1,151	4,143	42%	89%	99%	63%	13%	4	62%	79%	82%	71%	49%						
2025	High	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,978	5,755	6,927	1,724	6,293	7,457	7,493	6,695	1,063	178,664	2,412	578,273	118	1,452	5,226	42%	89%	99%	63%	13%	755	62%	79%	82%	71%	49%						
2025	High	14	Nags Head	Internal	2,329	4,644	5,589	1,391	3,832	4,541	4,564	4,077	845	234,291	1,937	469,765	94	1,156	4,770	42%	89%	99%	63%	13%	110	62%	79%	82%	71%	49%						
2025	High	15	Nags Head / Whalebone	Internal	1,873	6,549	7,882	1,962	5,068	6,006	6,035	5,392	677	236,507	1,531	680,425	114	1,406	5,902	42%	89%	99%	63%	13%	688	62%	79%	82%	71%	49%						
2025	High	16	Manteo	Internal	7,553	5,248	6,316	1,572	6,099	7,226	7,260	6,487	4,870	178,740	11,223	475,405	125	1,547	5,532	42%	89%	99%	63%	13%	368	62%	79%	82%	71%	49%						
2025	High	17	Wanchese	Internal	2,044	581	699	174	1,667	1,976	1,986	1,775	2,331	112,347	5,341	125,497	226	0	0	na	na	na	na	na	8	62%	79%	82%	71%	49%						
2025	High	18	Bodie Island	Internal	714	3,948	4,751	1,183	294	349	350	312	263	262,906	588	3,200	72	884	3,768	42%	89%	99%	63%	13%	187	62%	79%	82%	71%	49%						
2025	High	19	Lower Currituck Peninsula - South	Internal	4,868	808	972	242	3,781	4,444	4,521	4,024	2,044	198,451	4,694	309,712	238	0	0	na	na	na	na	na	12	62%	79%	82%	71%	49%						
2025	High	20	Elizabeth City	External																											30,138	17,543	12,519	$153,185	$153,185	24,530
2025	High	21	Moyock Township	Internal	12,604	602	725	180	2,492	2,929	2,980	2,652	5,235	163,860	12,022	351,827	162	0	0	na	na	na	na	na	104	62%	79%	82%	71%	49%						
2025	High	22	Dare County Mainland	External																											1,255	1,733	578	$107,502	$107,502	1,333
2025	High	23	Hatteras Island	External																											7,070	7,412	3,259	$200,358	$200,358	7,431
2025	High	24	Pasquotank County (Excl. Elizabeth City), NC	External																											31,767	18,490	13,195	$153,185	$153,185	25,846
2025	High	25	Crawford Township	Internal	12,581	1,013	1,219	303	3,978	5,456	5,536	4,293	5,225	170,947	12,000	231,230	293	0	0	na	na	na	na	na	108	62%	79%	82%	71%	49%						
2025	High	26	Lower Currituck Peninsula - North	Internal	2,586	399	480	119	929	1,092	1,111	989	1,103	176,977	2,533	33,448	121	0	0	na	na	na	na	na	0	na	na	na	na	na						
2025	High	27	Lower Currituck Peninsula - Central	Internal	6,283	935	1,125	280	2,217	2,605	2,650	2,359	2,628	134,940	6,035	186,214	295	0	0	na	na	na	na	na	12	62%	79%	82%	71%	49%						
2025	High	28	Camden County, NC	External																											17,163	5,877	7,435	$161,436	$161,436	17,466
2025	High	29	Balance of Massachusetts	External																											3,221,691	1,884,879	1,367,577	$252,640	$252,640	2,178,884
2025	High	30	Balance of Connecticut	External																											3,425,655	2,318,790	1,422,191	$292,621	$292,621	2,394,808
2025	High	31	Albemarle Peninsula, NC	External																											28,293	14,410	12,153	$163,214	$163,214	19,560
2025	High	32	Knotts Island	External																											2,519	708	846	$142,095	$142,095	1,942
2025	High	33	Balance of Maryland	External																											953,097	557,952	401,331	$208,009	$208,009	678,661
2025	High	34	Balance of Delaware	External																											573,339	287,975	244,750	$188,602	$188,602	436,922
2025	High	35	Balance of New Jersey	External																											1,217,464	858,273	469,435	$337,737	$337,737	729,263
2025	High	36	Balance of Virginia	External																											3,075,252	1,803,970	1,324,876	$178,103	$178,103	2,352,368
2025	High	37	Balance of North Carolina	External																											8,584,659	4,761,205	3,614,709	$190,547	$190,547	6,543,565
2025	High	38	Balance of South Carolina	External																											6,286,108	3,560,559	2,616,733	$193,959	$193,959	4,511,968
2025	High	39	Georgia	External																											14,795,669	8,224,658	5,709,357	$219,482	$219,482	10,190,760
2025	High	40	Balance of West Virginia	External																											2,236,716	1,251,452	979,120	$188,001	$188,001	1,585,349
2025	High	41	Balance of Ohio	External																											6,555,284	3,862,936	2,735,007	$192,985	$192,985	4,920,195
2025	High	42	Michigan	External																											13,002,251	7,200,025	5,379,926	$221,001	$221,001	9,476,468
2025	High	43	Balance of Pennsylvania	External																											4,624,480	2,767,405	1,918,325	$191,976	$191,976	3,085,383
2025	High	44	Balance of New York State	External																											7,476,336	4,504,401	3,049,255	$220,179	$220,179	4,932,061
2025	High	45	Balance of New Hampshire	External																											1,315,629	884,971	558,084	$250,841	$250,841	1,006,130
2025	High	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	697	826	830	741	0	0	0	364,834	na	na	0	na	na	na	na	na	na	na	na	na	na	na						
2025	High	47	Washington, DC-VA-MD-WV MSA	External																											8,376,210	5,912,996	3,363,400	$357,188	$388,888	5,669,148
2025	High	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											7,759,652	5,013,907	3,147,334	$307,722	$338,913	4,768,598
2025	High	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											25,351,853	15,178,672	9,697,368	$365,735	$423,961	11,524,014
2025	High	50	Baltimore-Towson, MD MSA	External																											3,923,687	2,465,379	1,642,874	$294,258	$315,763	2,625,829
2025	High	51	Richmond, VA MSA	External																											1,963,514	1,176,080	820,624	$240,399	$248,912	1,486,349
2025	High	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											2,441,572	1,560,677	991,420	$239,304	$244,806	1,722,751
2025	High	53	Pittsburgh, PA MSA	External																											2,947,202	2,032,678	1,272,484	$268,737	$274,648	1,977,954
2025	High	54	Raleigh-Cary, NC MSA	External																											1,837,974	1,065,374	744,108	$236,594	$247,604	1,368,039
2025	High	55	Cleveland-Elyria-Mentor, OH MSA	External																											2,563,843	1,774,159	1,097,782	$252,542	$252,932	1,787,130
2025	High	56	Harrisburg-Carlisle, PA MSA	External																											732,311	564,178	317,005	$226,910	$227,622	541,535
2025	High	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											1,203,054	633,120	489,221	$237,780	$232,640	854,158
2025	High	58	Columbus, OH MSA	External																											2,572,543	1,738,005	1,111,895	$226,720	$232,227	1,948,229
2025	High	59	Lancaster, PA MSA	External																											723,967	459,261	290,114	$230,096	$230,096	505,155
2025	High	60	Charlottesville, VA MSA	External																											288,154	205,635	125,527	$244,331	$250,769	233,415
2025	High	61	York-Hanover, PA MSA	External																											626,400	335,310	263,646	$207,413	$207,413	490,554
2025	High	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											1,160,296	873,327	446,398	$589,741	$589,741	789,209
2025	High	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											6,016,123	4,358,337	2,493,790	$342,209	$349,043	3,861,682
2025	High	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,992,518	1,871,204	1,268,604	$263,858	$261,305	2,227,905
2025	High	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											2,762,192	1,681,612	1,133,037	$233,404	$235,929	2,020,534
2025	High	66	Akron, OH MSA	External																											875,080	596,123	378,086	$241,883	$241,095	674,614
2025	High	67	Rochester, NY MSA	External																											1,285,300	869,174	514,952	$249,569	$257,155	846,843
2025	High	68	Reading, PA MSA	External																											543,992	324,149	216,290	$229,251	$229,251	376,116
2025	High	69	Durham-Chapel Hill, NC MSA	External																											785,153	595,327	335,092	$232,711	$242,427	587,472
2025	High	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											130,518	62,324	56,881	$174,806	$174,806	96,918
2025	**High**		**Total/Average**		**83,188**	**98,557**	**118,605**	**29,581**	**52,101**	**62,364**	**62,897**	**55,495**	**36,552**	**$190,354**	**84,023**	**5,682,245**	**3,069**	**21,378**	**92,519**	**42%**	**89%**	**99%**	**63%**	**13%**	**4,183**	**62%**	**79%**	**82%**	**71%**	**49%**	**157,324,944**	**96,142,632**	**64,058,594**	**$264,121**	**$277,570**	**104,105,042**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-14

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - HIGH CASE
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental						Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal									Annual Occ	Seasonal Occupancy					Annual Occ	Seasonal Occupancy								
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2030	High	1	Southern Shores	Internal	6,521	6,356	7,650	1,904	1,074	1,274	1,279	1,143	2,076	452,713	4,831	184,462	121	1,497	6,728	42%	89%	99%	63%	13%	0	na	na	na	na	na					
2030	High	2	Duck	Internal	888	5,673	6,828	1,699	1,790	2,121	2,131	1,905	274	377,398	616	164,873	102	1,263	5,742	42%	89%	99%	63%	13%	10	62%	79%	82%	71%	49%					
2030	High	3	Sanderling South	Internal	595	3,868	4,656	1,159	454	539	542	485	178	577,605	414	49,065	69	849	3,857	42%	89%	99%	63%	13%	93	62%	79%	82%	71%	49%					
2030	High	4	Sanderling North	Internal	0	581	697	174	41	48	49	43	0	0	0	1,888	5	60	367	42%	89%	99%	63%	13%	123	62%	79%	82%	71%	49%					
2030	High	5	Corolla South	Internal	521	12,141	14,612	3,637	236	277	282	251	216	677,137	497	0	168	2,070	12,397	42%	89%	99%	63%	13%	100	na	na	na	na	na					
2030	High	6	Corolla South Central	Internal	262	2,946	3,546	883	552	649	660	588	119	727,323	273	148,497	42	518	2,800	42%	89%	99%	63%	13%	0	na	na	na	na	na					
2030	High	7	Corolla North Central	Internal	500	6,818	8,205	2,042	1,399	1,644	1,672	1,488	197	757,185	452	300,048	86	1,062	6,343	42%	89%	99%	63%	13%	0	na	na	na	na	na					
2030	High	8	Corolla North	Internal	487	5,871	7,050	1,816	945	1,110	1,129	1,005	172	781,036	395	156,427	74	914	4,986	42%	89%	99%	63%	13%	43	62%	79%	82%	71%	49%					
2030	High	9	Carova, 4wd area	Internal	546	5,169	6,221	1,548	346	407	414	368	255	403,620	585	40,000	95	1,167	5,554	42%	89%	99%	63%	13%	0	na	na	na	na	na					
2030	High	10	Kitty Hawk	Internal	5,631	8,170	9,833	2,447	5,916	7,009	7,042	6,292	2,312	268,905	5,280	430,488	179	2,203	8,973	42%	89%	99%	63%	13%	722	62%	79%	82%	71%	49%					
2030	High	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	7,745	9,860	11,867	2,954	3,097	3,670	3,688	3,296	2,420	214,977	5,590	519,479	222	2,732	9,610	42%	89%	99%	63%	13%	861	62%	79%	82%	71%	49%					
2030	High	12	Collington	Internal	5,804	3,785	4,556	1,134	946	1,121	1,126	1,006	2,155	224,905	5,021	17,188	93	1,151	4,210	42%	89%	99%	63%	13%	4	62%	79%	82%	71%	49%					
2030	High	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	3,272	6,015	7,240	1,802	7,040	8,343	8,383	7,490	1,063	238,379	2,412	578,273	118	1,452	5,397	42%	89%	99%	63%	13%	880	62%	79%	82%	71%	49%					
2030	High	14	Nags Head	Internal	2,559	4,801	5,779	1,438	4,249	5,035	5,060	4,520	845	312,598	1,937	469,765	94	1,156	4,952	42%	89%	99%	63%	13%	110	62%	79%	82%	71%	49%					
2030	High	15	Nags Head / Whalebone	Internal	2,058	6,620	7,967	1,983	5,749	6,813	6,846	6,116	677	315,554	1,531	755,425	114	1,406	5,979	42%	89%	99%	63%	13%	688	62%	79%	82%	71%	49%					
2030	High	16	Manteo	Internal	8,299	6,044	7,274	1,810	7,013	8,309	8,348	7,459	6,033	238,480	13,902	625,405	144	1,781	6,465	42%	89%	99%	63%	13%	368	62%	79%	82%	71%	49%					
2030	High	17	Wanchese	Internal	2,246	669	805	200	1,849	2,191	2,202	1,968	3,225	149,897	7,390	125,497	260	0	0	na	na	na	na	na	8	62%	79%	82%	71%	49%					
2030	High	18	Bodie Island	Internal	785	4,085	4,917	1,224	326	387	388	346	263	350,777	588	3,200	72	884	3,920	42%	89%	99%	63%	13%	187	62%	79%	82%	71%	49%					
2030	High	19	Lower Currituck Peninsula - South	Internal	5,545	930	1,119	279	4,340	5,101	5,189	4,618	2,369	262,687	5,442	309,712	274	0	0	na	na	na	na	na	12	62%	79%	82%	71%	49%					
2030	High	20	Elizabeth City	External																											33,115	19,395	13,859	$203,203	$203,203	27,155
2030	High	21	Moyock Township	Internal	14,357	694	835	208	2,911	3,421	3,480	3,097	6,025	216,899	13,837	351,827	187	0	0	na	na	na	na	na	204	62%	79%	82%	71%	49%					
2030	High	22	Dare County Mainland	External																											1,378	1,922	639	$143,432	$143,432	1,473
2030	High	23	Hatteras Island	External																											7,767	8,218	3,603	$267,323	$267,323	8,216
2030	High	24	Pasquotank County (Excl. Elizabeth City), NC	External																											34,905	20,442	14,607	$203,203	$203,203	28,612
2030	High	25	Crawford Township	Internal	14,331	1,167	1,404	349	4,752	6,365	6,461	5,117	6,014	226,281	13,812	331,230	338	0	0	na	na	na	na	na	108	62%	79%	82%	71%	49%					
2030	High	26	Lower Currituck Peninsula - North	Internal	2,946	459	553	138	1,067	1,254	1,275	1,135	1,292	234,262	2,966	33,448	140	0	0	na	na	na	na	na	0	na	na	na	na	na					
2030	High	27	Lower Currituck Peninsula - Central	Internal	7,157	1,076	1,295	322	2,544	2,991	3,042	2,708	3,038	178,618	6,977	186,214	340	0	0	na	na	na	na	na	12	62%	79%	82%	71%	49%					
2030	High	28	Camden County, NC	External																											19,499	6,751	8,534	$212,266	$212,266	20,050
2030	High	29	Balance of Massachusetts	External																											3,444,850	2,062,966	1,469,656	$339,458	$339,458	2,334,753
2030	High	30	Balance of Connecticut	External																											3,640,476	2,517,419	1,513,157	$394,149	$394,149	2,548,243
2030	High	31	Albemarle Peninsula, NC	External																											29,809	15,852	12,947	$218,872	$218,872	20,837
2030	High	32	Knotts Island	External																											2,870	813	846	$188,089	$188,089	1,942
2030	High	33	Balance of Maryland	External																											1,044,635	616,643	441,939	$279,496	$279,496	741,455
2030	High	34	Balance of Delaware	External																											643,859	325,596	276,692	$255,638	$255,638	493,926
2030	High	35	Balance of New Jersey	External																											1,307,990	941,007	502,369	$462,198	$462,198	780,158
2030	High	36	Balance of Virginia	External																											3,310,073	1,975,404	1,430,132	$238,654	$238,654	2,515,248
2030	High	37	Balance of North Carolina	External																											9,317,746	5,251,237	3,929,587	$255,568	$255,568	7,112,951
2030	High	38	Balance of South Carolina	External																											6,874,163	3,941,469	2,870,769	$260,288	$260,288	4,949,722
2030	High	39	Georgia	External																											16,309,160	9,145,060	6,273,228	$295,496	$295,496	11,197,227
2030	High	40	Balance of West Virginia	External																											2,354,168	1,360,977	1,031,025	$253,138	$253,138	1,668,426
2030	High	41	Balance of Ohio	External																											6,862,083	4,171,937	2,864,998	$260,294	$260,294	5,144,925
2030	High	42	Michigan	External																											13,776,095	7,813,084	5,721,511	$296,739	$296,739	10,078,153
2030	High	43	Balance of Pennsylvania	External																											4,889,525	3,016,234	2,025,597	$259,004	$259,004	3,221,505
2030	High	44	Balance of New York State	External																											7,874,788	4,870,137	3,201,066	$298,102	$298,102	5,176,360
2030	High	45	Balance of New Hampshire	External																											1,437,073	980,010	612,706	$336,207	$336,207	1,104,490
2030	High	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	773	916	920	822	0	0	0	364,834	na	na	0	na	na	na	na	na	na	na	na	na	na	na					
2030	High	47	Washington, DC-VA-MD-WV MSA	External																											9,279,636	6,582,481	3,727,701	$477,917	$522,757	6,283,193
2030	High	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											8,270,487	5,475,179	3,361,811	$415,112	$455,469	5,093,556
2030	High	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											27,046,224	16,394,977	10,305,751	$492,567	$574,154	12,246,995
2030	High	50	Baltimore-Towson, MD MSA	External																											4,288,201	2,713,851	1,803,306	$394,880	$421,720	2,882,250
2030	High	51	Richmond, VA MSA	External																											2,186,636	1,315,485	916,147	$322,349	$333,087	1,659,364
2030	High	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											2,668,953	1,727,058	1,090,876	$320,022	$325,685	1,895,572
2030	High	53	Pittsburgh, PA MSA	External																											3,091,409	2,204,749	1,329,462	$366,337	$374,555	2,066,522
2030	High	54	Raleigh-Cary, NC MSA	External																											2,068,559	1,205,825	835,136	$316,937	$332,081	1,535,393
2030	High	55	Cleveland-Elyria-Mentor, OH MSA	External																											2,673,286	1,915,580	1,148,609	$341,768	$342,372	1,869,872
2030	High	56	Harrisburg-Carlisle, PA MSA	External																											787,935	611,860	342,381	$301,192	$301,814	584,885
2030	High	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											1,318,451	698,568	534,010	$321,945	$317,032	932,358
2030	High	58	Columbus, OH MSA	External																											2,802,472	1,912,396	1,218,813	$302,463	$309,691	2,135,567
2030	High	59	Lancaster, PA MSA	External																											787,418	508,508	317,201	$308,772	$308,772	552,320
2030	High	60	Charlottesville, VA MSA	External																											315,472	227,471	138,581	$326,019	$335,398	257,687
2030	High	61	York-Hanover, PA MSA	External																											685,058	368,538	289,433	$275,715	$275,715	538,534
2030	High	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											1,228,463	951,192	470,908	$810,824	$810,824	832,541
2030	High	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											6,413,532	4,721,297	2,666,156	$458,229	$468,179	4,128,596
2030	High	64	Cincinnati-Middletown OH-KY-IN MSA	External																											3,225,485	2,053,588	1,376,118	$357,024	$354,386	2,416,720
2030	High	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											3,084,328	1,897,528	1,266,239	$311,372	$314,614	2,258,071
2030	High	66	Akron, OH MSA	External																											917,744	651,421	398,983	$330,854	$329,824	711,900
2030	High	67	Rochester, NY MSA	External																											1,344,944	937,122	535,082	$338,219	$349,208	879,947
2030	High	68	Reading, PA MSA	External																											581,936	354,600	230,289	$309,423	$309,423	400,460
2030	High	69	Durham-Chapel Hill, NC MSA	External																											874,474	671,022	373,867	$309,544	$323,066	655,451
2030	High	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											137,617	68,008	60,421	$235,414	$235,414	103,034
2030	**High**		**Total/Average**		**93,054**	**103,798**	**124,912**	**31,151**	**59,406**	**70,994**	**71,608**	**63,268**	**41,220**	**$249,233**	**94,747**	**6,147,245**	**3,335**	**22,163**	**98,280**	**42%**	**89%**	**99%**	**63%**	**13%**	**4,533**	**62%**	**79%**	**82%**	**71%**	**49%**	**169,294,747**	**105,230,880**	**68,956,748**	**$355,199**	**$373,726**	**112,096,614**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-15

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - HIGH CASE
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental						Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal									Annual Occ	Seasonal Occupancy					Annual Occ	Seasonal Occupancy								
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2035	High	1	Southern Shores	Internal	7,123	6,528	7,857	1,955	1,185	1,405	1,410	1,261	2,076	605,615	4,831	184,462	121	1,497	6,928	42%	89%	99%	63%	13%	0	na	na	na	na	na					
2035	High	2	Duck	Internal	970	5,861	7,054	1,756	1,974	2,339	2,350	2,101	274	504,864	616	164,873	102	1,263	5,953	42%	89%	99%	63%	13%	10	62%	79%	82%	71%	49%					
2035	High	3	Sanderling South	Internal	650	4,066	4,894	1,218	501	594	598	534	178	772,689	414	49,065	69	849	4,081	42%	89%	99%	63%	13%	93	62%	79%	82%	71%	49%					
2035	High	4	Sanderling North	Internal	0	983	702	175	47	55	56	50	0	0	0	1,888	5	60	369	42%	89%	99%	63%	13%	123	62%	79%	82%	71%	49%					
2035	High	5	Corolla South	Internal	588	13,940	16,778	4,176	270	317	322	287	244	901,448	560	0	193	2,377	14,695	42%	89%	99%	63%	13%	100	na	na	na	na	na					
2035	High	6	Corolla South Central	Internal	296	2,950	3,550	884	631	742	754	672	119	968,258	273	148,497	42	518	2,803	42%	89%	99%	63%	13%	0	na	na	na	na	na					
2035	High	7	Corolla North Central	Internal	563	6,851	8,246	2,052	1,598	1,879	1,911	1,701	197	1,008,013	452	300,048	86	1,062	6,377	42%	89%	99%	63%	13%	0	na	na	na	na	na					
2035	High	8	Corolla North	Internal	549	5,893	7,076	1,822	1,079	1,269	1,290	1,149	172	1,039,766	395	156,427	74	914	5,006	42%	89%	99%	63%	13%	43	62%	79%	82%	71%	49%					
2035	High	9	Carova, 4wd area	Internal	616	5,934	7,142	1,778	712	837	851	758	425	537,324	976	140,000	163	2,004	9,924	42%	89%	99%	63%	13%	300	na	na	na	na	na					
2035	High	10	Kitty Hawk	Internal	6,151	8,504	10,236	2,548	6,599	7,819	7,855	7,019	2,312	359,727	5,280	430,488	179	2,203	9,255	42%	89%	99%	63%	13%	872	62%	79%	82%	71%	49%					
2035	High	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	8,460	10,244	12,329	3,069	3,415	4,048	4,067	3,635	2,420	287,584	5,590	519,479	222	2,732	10,058	42%	89%	99%	63%	13%	861	62%	79%	82%	71%	49%					
2035	High	12	Collington	Internal	6,340	3,862	4,649	1,157	1,043	1,236	1,242	1,110	2,155	300,865	5,021	17,188	93	1,151	4,304	42%	89%	99%	63%	13%	4	62%	79%	82%	71%	49%					
2035	High	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	3,574	6,243	7,514	1,870	7,764	9,201	9,245	8,260	1,063	318,891	2,412	578,273	118	1,452	5,656	42%	89%	99%	63%	13%	880	62%	79%	82%	71%	49%					
2035	High	14	Nags Head	Internal	2,795	5,074	6,106	1,520	4,764	5,645	5,674	5,069	845	418,177	1,937	469,765	94	1,156	5,115	42%	89%	99%	63%	13%	260	62%	79%	82%	71%	49%					
2035	High	15	Nags Head / Whalebone	Internal	2,248	6,736	8,108	2,018	6,340	7,514	7,550	6,745	677	422,132	1,531	755,425	114	1,406	6,107	42%	89%	99%	63%	13%	688	62%	79%	82%	71%	49%					
2035	High	16	Manteo	Internal	9,065	6,939	8,352	2,079	7,734	9,163	9,206	8,226	7,197	319,026	16,585	625,405	166	2,045	7,540	42%	89%	99%	63%	13%	368	62%	79%	82%	71%	49%					
2035	High	17	Wanchese	Internal	2,453	768	924	230	2,039	2,416	2,429	2,170	4,121	200,524	9,442	125,497	299	0	0	na	na	na	na	na	8	62%	79%	82%	71%	49%					
2035	High	18	Bodie Island	Internal	857	4,316	5,194	1,293	359	426	428	382	263	469,250	588	3,200	72	884	4,175	42%	89%	99%	63%	13%	187	62%	79%	82%	71%	49%					
2035	High	19	Lower Currituck Peninsula - South	Internal	6,250	1,068	1,285	320	4,960	5,830	5,930	5,278	2,681	349,705	6,156	309,712	314	0	0	na	na	na	na	na	12	62%	79%	82%	71%	49%					
2035	High	20	Elizabeth City	External																											36,176	21,346	15,193	$270,270	$270,270	29,770
2035	High	21	Moyock Township	Internal	16,184	796	959	239	3,554	4,177	4,249	3,782	6,806	288,749	15,630	476,827	215	0	0	na	na	na	na	na	204	62%	79%	82%	71%	49%					
2035	High	22	Dare County Mainland	External																											1,506	2,119	701	$191,875	$191,875	1,614
2035	High	23	Hatteras Island	External																											8,485	9,063	3,948	$357,610	$357,610	9,002
2035	High	24	Pasquotank County (Excl. Elizabeth City), NC	External																											38,131	22,499	16,014	$270,270	$270,270	31,368
2035	High	25	Crawford Township	Internal	16,154	1,340	1,612	401	5,605	7,367	7,481	6,024	6,794	301,239	15,602	431,230	388	0	0	na	na	na	na	na	108	62%	79%	82%	71%	49%					
2035	High	26	Lower Currituck Peninsula - North	Internal	3,321	527	635	158	1,219	1,433	1,457	1,297	1,464	311,864	3,363	33,448	160	0	0	na	na	na	na	na	0	na	na	na	na	na					
2035	High	27	Lower Currituck Peninsula - Central	Internal	8,067	1,236	1,487	370	2,908	3,418	3,476	3,094	3,435	237,788	7,889	186,214	390	0	0	na	na	na	na	na	12	62%	79%	82%	71%	49%					
2035	High	28	Camden County, NC	External																											21,933	7,719	9,667	$281,100	$281,100	22,711
2035	High	29	Balance of Massachusetts	External																											3,669,876	2,249,826	1,568,044	$457,272	$457,272	2,484,058
2035	High	30	Balance of Connecticut	External																											3,855,599	2,721,492	1,598,950	$531,985	$531,985	2,692,986
2035	High	31	Albemarle Peninsula, NC	External																											31,307	17,372	13,704	$294,354	$294,354	22,057
2035	High	32	Knotts Island	External																											3,235	929	846	$250,396	$250,396	1,942
2035	High	33	Balance of Maryland	External																											1,138,618	678,135	482,294	$376,908	$376,908	803,225
2035	High	34	Balance of Delaware	External																											717,003	366,925	309,131	$348,728	$348,728	551,813
2035	High	35	Balance of New Jersey	External																											1,399,685	1,028,641	533,528	$634,816	$634,816	828,259
2035	High	36	Balance of Virginia	External																											3,548,289	2,156,250	1,531,897	$320,577	$320,577	2,669,937
2035	High	37	Balance of North Carolina	External																											10,066,107	5,780,227	4,236,904	$344,201	$344,201	7,668,598
2035	High	38	Balance of South Carolina	External																											7,477,203	4,352,128	3,121,827	$350,985	$350,985	5,382,306
2035	High	39	Georgia	External																											17,867,658	10,138,890	6,826,643	$399,558	$399,558	12,185,029
2035	High	40	Balance of West Virginia	External																											2,470,131	1,474,333	1,078,474	$341,669	$341,669	1,744,190
2035	High	41	Balance of Ohio	External																											7,161,689	4,489,236	2,980,548	$351,957	$351,957	5,342,962
2035	High	42	Michigan	External																											14,548,013	8,450,126	6,043,778	$399,471	$399,471	10,645,810
2035	High	43	Balance of Pennsylvania	External																											5,153,125	3,277,490	2,123,718	$350,489	$350,489	3,339,705
2035	High	44	Balance of New York State	External																											8,268,666	5,248,907	3,337,308	$404,501	$404,501	5,395,819
2035	High	45	Balance of New Hampshire	External																											1,561,548	1,081,559	666,819	$452,635	$452,635	1,201,907
2035	High	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	852	1,010	1,015	907	0	0	0	364,834	na	na	0	na	na	na	na	na	na	na	na	na	na	na					
2035	High	47	Washington, DC-VA-MD-WV MSA	External																											10,211,969	7,302,263	4,091,338	$642,728	$707,045	6,896,118
2035	High	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											8,783,810	5,958,890	3,565,634	$561,431	$614,140	5,402,374
2035	High	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											28,750,600	17,647,820	10,877,556	$664,939	$779,863	12,926,508
2035	High	50	Baltimore-Towson, MD MSA	External																											4,661,863	2,973,252	1,961,952	$531,702	$565,824	3,135,816
2035	High	51	Richmond, VA MSA	External																											2,417,390	1,468,556	1,012,013	$434,807	$448,630	1,833,001
2035	High	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											2,902,085	1,905,653	1,189,938	$429,562	$435,315	2,067,709
2035	High	53	Pittsburgh, PA MSA	External																											3,232,852	2,382,368	1,379,271	$500,582	$512,017	2,143,944
2035	High	54	Raleigh-Cary, NC MSA	External																											2,307,877	1,360,411	926,289	$427,401	$448,308	1,702,977
2035	High	55	Cleveland-Elyria-Mentor, OH MSA	External																											2,779,135	2,060,573	1,193,984	$463,306	$464,609	1,943,740
2035	High	56	Harrisburg-Carlisle, PA MSA	External																											844,344	661,133	366,969	$400,914	$401,488	626,889
2035	High	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											1,436,945	768,519	577,661	$437,930	$433,877	1,008,570
2035	High	58	Columbus, OH MSA	External																											3,037,736	2,097,927	1,325,090	$405,056	$414,732	2,321,784
2035	High	59	Lancaster, PA MSA	External																											852,276	561,301	344,043	$415,914	$415,914	599,058
2035	High	60	Charlottesville, VA MSA	External																											343,500	250,327	151,614	$436,410	$449,981	281,922
2035	High	61	York-Hanover, PA MSA	External																											745,217	403,443	314,939	$367,893	$367,893	585,991
2035	High	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											1,296,384	1,031,084	493,496	$1,116,540	$1,116,540	872,475
2035	High	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											6,812,958	5,095,556	2,830,789	$615,147	$629,628	4,383,533
2035	High	64	Cincinnati-Middletown OH-KY-IN MSA	External																											3,462,091	2,244,951	1,481,687	$482,491	$480,422	2,602,119
2035	High	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											3,417,780	2,135,080	1,399,782	$417,929	$422,187	2,496,216
2035	High	66	Akron, OH MSA	External																											959,582	708,909	418,353	$453,612	$452,303	746,461
2035	High	67	Rochester, NY MSA	External																											1,403,142	1,007,067	551,877	$459,465	$475,362	907,568
2035	High	68	Reading, PA MSA	External																											620,215	386,763	243,350	$419,040	$419,040	423,171
2035	High	69	Durham-Chapel Hill, NC MSA	External																											966,848	754,772	412,718	$414,249	$433,327	723,563
2035	High	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											144,645	73,946	63,738	$317,668	$317,668	108,781
2035	**High**		**Total/Average**		**103,275**	**110,258**	**132,688**	**33,086**	**67,150**	**80,138**	**80,846**	**71,508**	**45,920**	**$328,778**	**105,544**	**6,472,245**	**3,677**	**23,572**	**108,346**	**42%**	**89%**	**99%**	**63%**	**13%**	**5,133**	**62%**	**79%**	**82%**	**71%**	**49%**	**181,435,228**	**114,815,762**	**73,674,017**	**$479,173**	**$504,940**	**119,795,357**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-16

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - HIGH CASE
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households						Rental							Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal										Annual Occ	Seasonal Occupancy					Annual Occ	Seasonal Occupancy									
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2040	High	1	Southern Shores	Internal	7,749	6,824	8,213	2,044	1,301	1,543	1,549	1,385	2,076	812,689	4,831	184,462	121	1,497	7,273	42%	89%	99%	63%	13%	0	na	na	na	na	na						
2040	High	2	Duck	Internal	1,056	6,295	7,576	1,886	2,168	2,568	2,581	2,307	274	677,488	616	164,873	102	1,263	6,440	42%	89%	99%	63%	13%	10	62%	79%	82%	71%	49%						
2040	High	3	Sanderling South	Internal	707	4,452	5,358	1,334	550	652	656	587	178	1,036,889	414	49,065	69	849	4,519	42%	89%	99%	63%	13%	93	62%	79%	82%	71%	49%						
2040	High	4	Sanderling North	Internal	0	583	702	175	53	63	64	57	0	0	0	1,888	5	60	369	42%	89%	99%	63%	13%	123	62%	79%	82%	71%	49%						
2040	High	5	Corolla South	Internal	657	14,734	17,734	4,414	307	361	367	327	349	1,206,454	802	0	193	2,377	14,963	42%	89%	99%	63%	13%	100	na	na	na	na	na						
2040	High	6	Corolla South Central	Internal	331	2,953	3,554	885	719	845	860	765	119	1,295,870	273	148,497	42	518	2,807	42%	89%	99%	63%	13%	0	na	na	na	na	na						
2040	High	7	Corolla North Central	Internal	630	7,004	8,430	2,098	1,822	2,141	2,178	1,939	197	1,349,076	452	300,048	86	1,062	6,535	42%	89%	99%	63%	13%	0	na	na	na	na	na						
2040	High	8	Corolla North	Internal	614	6,092	7,315	1,884	1,230	1,446	1,471	1,309	172	1,391,572	395	156,427	74	914	5,195	42%	89%	99%	63%	13%	43	62%	79%	82%	71%	49%						
2040	High	9	Carova, 4wd area	Internal	689	6,802	8,187	2,038	812	954	971	864	595	719,129	1,367	140,000	232	2,863	14,432	42%	89%	99%	63%	13%	300	na	na	na	na	na						
2040	High	10	Kitty Hawk	Internal	6,692	8,772	10,558	2,628	7,246	8,586	8,626	7,707	2,312	482,726	5,280	430,488	179	2,203	9,601	42%	89%	99%	63%	13%	872	62%	79%	82%	71%	49%						
2040	High	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	9,203	10,725	12,909	3,213	3,750	4,445	4,467	3,991	2,420	385,916	5,590	519,479	222	2,732	10,620	42%	89%	99%	63%	13%	861	62%	79%	82%	71%	49%						
2040	High	12	Collington	Internal	6,897	3,994	4,807	1,196	1,145	1,358	1,364	1,219	2,155	403,738	5,021	17,188	93	1,151	4,466	42%	89%	99%	63%	13%	4	62%	79%	82%	71%	49%						
2040	High	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	3,888	6,568	7,905	1,968	8,588	10,178	10,226	9,137	1,063	427,927	2,412	578,273	118	1,452	5,900	42%	89%	99%	63%	13%	1005	62%	79%	82%	71%	49%						
2040	High	14	Nags Head	Internal	3,041	5,224	6,287	1,565	5,231	6,199	6,231	5,566	845	561,161	1,937	469,765	94	1,156	5,288	42%	89%	99%	63%	13%	260	62%	79%	82%	71%	49%						
2040	High	15	Nags Head / Whalebone	Internal	2,445	6,955	8,371	2,083	6,962	8,251	8,290	7,407	677	566,468	1,531	755,425	114	1,406	6,345	42%	89%	99%	63%	13%	688	62%	79%	82%	71%	49%						
2040	High	16	Manteo	Internal	9,862	7,954	9,573	2,383	8,493	10,062	10,109	9,033	8,349	428,108	19,238	625,405	190	2,344	8,803	42%	89%	99%	63%	13%	368	62%	79%	82%	71%	49%						
2040	High	17	Wanchese	Internal	2,669	880	1,059	264	2,412	2,858	2,873	2,567	5,007	269,088	11,471	225,497	342	0	0	na	na	na	na	na	8	62%	79%	82%	71%	49%						
2040	High	18	Bodie Island	Internal	933	4,584	5,518	1,373	395	468	470	419	263	629,698	588	3,200	72	884	4,472	42%	89%	99%	63%	13%	187	62%	79%	82%	71%	49%						
2040	High	19	Lower Currituck Peninsula - South	Internal	6,990	1,224	1,473	367	5,654	6,645	6,759	6,016	2,979	468,029	6,841	309,712	360	0	0	na	na	na	na	na	12	62%	79%	82%	71%	49%						
2040	High	20	Elizabeth City	External																											39,356	23,415	16,523	$360,329	$360,329	32,376
2040	High	21	Moyock Township	Internal	18,098	913	1,099	273	4,227	4,968	5,053	4,498	7,577	386,448	17,401	576,827	246	0	0	na	na	na	na	na	204	62%	79%	82%	71%	49%						
2040	High	22	Dare County Mainland	External																											1,638	2,327	761	$257,482	$257,482	1,754
2040	High	23	Hatteras Island	External																											9,230	9,953	4,289	$479,885	$479,885	9,780
2040	High	24	Pasquotank County (Excl. Elizabeth City), NC	External																											41,483	24,680	17,416	$360,329	$360,329	34,113
2040	High	25	Crawford Township	Internal	18,065	1,535	1,848	460	6,388	8,289	8,418	6,858	7,563	403,164	17,369	431,230	445	0	0	na	na	na	na	na	108	62%	79%	82%	71%	49%						
2040	High	26	Lower Currituck Peninsula - North	Internal	3,714	604	728	181	1,389	1,633	1,661	1,478	1,623	417,384	3,727	33,448	184	0	0	na	na	na	na	na	0	na	na	na	na	na						
2040	High	27	Lower Currituck Peninsula - Central	Internal	9,022	1,416	1,705	424	3,314	3,896	3,963	3,527	3,820	318,244	8,773	186,214	447	0	0	na	na	na	na	na	12	62%	79%	82%	71%	49%						
2040	High	28	Camden County, NC	External																											24,482	8,807	10,821	$374,659	$374,659	25,421
2040	High	29	Balance of Massachusetts	External																											3,900,711	2,447,874	1,662,267	$617,731	$617,731	2,626,287
2040	High	30	Balance of Connecticut	External																											4,075,245	2,933,469	1,679,276	$719,851	$719,851	2,828,547
2040	High	31	Albemarle Peninsula, NC	External																											32,823	19,007	14,422	$396,922	$396,922	23,212
2040	High	32	Knotts Island	External																											3,617	1,059	846	$335,118	$335,118	1,942
2040	High	33	Balance of Maryland	External																											1,236,190	742,938	522,137	$510,252	$510,252	863,654
2040	High	34	Balance of Delaware	External																											793,441	412,644	341,702	$478,583	$478,583	609,935
2040	High	35	Balance of New Jersey	External																											1,494,034	1,122,507	562,704	$875,410	$875,410	873,257
2040	High	36	Balance of Virginia	External																											3,793,650	2,349,089	1,629,670	$431,863	$431,863	2,816,086
2040	High	37	Balance of North Carolina	External																											10,840,125	6,357,803	4,534,164	$465,583	$465,583	8,206,005
2040	High	38	Balance of South Carolina	External																											8,102,783	4,799,431	3,367,725	$475,644	$475,644	5,805,960
2040	High	39	Georgia	External																											19,488,786	11,222,561	7,363,954	$542,765	$542,765	13,144,089
2040	High	40	Balance of West Virginia	External																											2,587,356	1,593,070	1,121,238	$462,389	$462,389	1,812,285
2040	High	41	Balance of Ohio	External																											7,462,284	4,819,137	3,081,636	$477,234	$477,234	5,514,398
2040	High	42	Michigan	External																											15,334,031	9,120,453	6,344,704	$539,376	$539,376	11,175,876
2040	High	43	Balance of Pennsylvania	External																											5,420,995	3,555,009	2,212,927	$475,846	$475,846	3,441,121
2040	High	44	Balance of New York State	External																											8,667,259	5,646,455	3,458,693	$550,313	$550,313	5,591,225
2040	High	45	Balance of New Hampshire	External																											1,690,637	1,191,024	719,994	$612,267	$612,267	1,297,620
2040	High	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	936	1,109	1,114	996	0	0	0	364,834	na	na	0	na	na	na	na	na	na	na	na	na	na	na	11,183,169	8,083,471	4,449,996	$869,174	$962,211	7,500,651
2040	High	47	Washington, DC-VA-MD-WV MSA	External																											9,309,157	6,471,767	3,757,869	$761,615	$831,140	5,693,633
2040	High	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											30,496,102	18,955,325	11,408,003	$900,204	$1,063,021	13,556,873
2040	High	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											5,049,389	3,245,655	2,117,359	$718,528	$762,650	3,384,206
2040	High	50	Baltimore-Towson, MD MSA	External																											2,658,090	1,638,510	1,107,225	$590,070	$608,018	2,005,453
2040	High	51	Richmond, VA MSA	External																											3,143,900	2,099,316	1,287,908	$578,922	$584,604	2,237,947
2040	High	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											3,375,205	2,567,899	1,422,015	$685,892	$701,819	2,210,386
2040	High	53	Pittsburgh, PA MSA	External																											2,558,081	1,531,854	1,016,468	$580,167	$609,136	1,868,771
2040	High	54	Raleigh-Cary, NC MSA	External																											2,884,594	2,211,149	1,233,803	$629,421	$632,298	2,008,564
2040	High	55	Cleveland-Elyria-Mentor, OH MSA	External																											902,432	712,688	390,702	$535,309	$535,946	667,430
2040	High	56	Harrisburg-Carlisle, PA MSA	External																											1,559,983	844,009	619,780	$598,493	$596,375	1,082,108
2040	High	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											3,281,442	2,297,437	1,429,724	$544,714	$557,877	2,505,120
2040	High	58	Columbus, OH MSA	External																											919,418	618,401	370,417	$562,512	$562,512	644,982
2040	High	59	Lancaster, PA MSA	External																											372,586	274,391	164,564	$586,200	$605,763	306,002
2040	High	60	Charlottesville, VA MSA	External																											807,628	440,439	339,911	$492,884	$492,884	632,457
2040	High	61	York-Hanover, PA MSA	External																											1,365,492	1,113,803	514,004	$1,540,843	$1,540,843	908,732
2040	High	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											7,221,783	5,486,038	2,986,924	$828,302	$849,364	4,625,311
2040	High	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											3,705,979	2,447,645	1,584,358	$652,103	$651,628	2,782,428
2040	High	64	Cincinnati-Middletown OH-KY-IN MSA	External																											3,765,808	2,398,517	1,532,137	$564,386	$570,075	2,732,245
2040	High	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											1,001,683	769,235	436,116	$623,652	$622,048	778,155
2040	High	66	Akron, OH MSA	External																											1,461,500	1,080,081	565,581	$625,884	$648,874	930,103
2040	High	67	Rochester, NY MSA	External																											659,495	421,134	255,431	$569,533	$569,533	444,180
2040	High	68	Reading, PA MSA	External																											1,063,198	848,284	451,355	$557,733	$584,960	791,300
2040	High	69	Durham-Chapel Hill, NC MSA	External																											151,766	80,209	66,847	$429,402	$429,402	114,178
2040	High	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																																
2040	**High**		**Total/Average**		**113,951**	**117,088**	**140,908**	**35,134**	**75,093**	**89,519**	**90,321**	**79,960**	**50,614**	**$437,641**	**116,330**	**6,672,245**	**4,029**	**24,729**	**118,029**	**42%**	**89%**	**99%**	**63%**	**13%**	**5,258**	**62%**	**79%**	**82%**	**71%**	**49%**	**193,938,037**	**125,039,968**	**78,176,367**	**$648,703**	**$684,845**	**127,146,157**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

EXHIBIT C-17

MID-CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC FORECAST – HIGH CASE
NOTES ON DATA INPUTS

Internal Zones

The methodology in the high case is essentially identical to the methodology in the base case, replacing the base case multiplier with the high case multiplier. The following variables slightly differ from the base case and are detailed below.

Seasonal (or Non-Resident) Population — Redevelopment assumes that within 8 years after a home reaches 50 years old, it will be redeveloped with 50% more bedrooms.

Seasonal Employment — We assumed that a recreational attraction plus retail and hotel rooms will be built in Zone 25 near the western terminus of the bridge in 2020-2025. Seasonal employment will be 1,080 jobs.

Average Household Income — Average (mean) household income forecasts at the county level were estimated based on base case household income data and the ratio of high case total income to base case total income. The base case total income is calculated by multiplying base case employment by the ratio of Woods & Poole's total income to Woods & Poole's employment. The high case total income is calculated by multiplying high case employment by the ratio of base case total income to base case employment. The distribution among zones was based on the value of residential properties extracted from the county property tax files. The current relationship between zonal income and county income has been held constant for the forecasted base case years. The total is a weighted average, weighted by the number of households in each zone.

Number of Second Homes and Number of Rental Units — We assumed that the 4-wheel drive area (Zone 9) will be opened up to development with a paved road and public utilities, resulting in the development of a major resort with a 300-room hotel, 100,000 SF of retail, and about 1,900 residential units. The time period is 2030-2040.

External Zones

The methodology in the high case is essentially identical to the methodology in the base case, replacing the base case multiplier with the high case multiplier. The following variables slightly differ from the base case and are detailed below.

Average Household Income - Forecast data were estimated by multiplying the base case average household income by the ratio of the high case total income to base case total income. The base case total income is calculated by multiplying base case employment by the ratio of Woods & Poole's total income to Woods & Poole's employment. The high case total Income is calculated by multiplying high case employment to the ratio of base case total income to base case employment. The total is a weighted average, weighted by the number of households.

TABLE C-18

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - LOW CASI
BASE YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental							Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal									Annual Occ	Seasonal Occupancy						Annual Occ	Seasonal Occupancy								
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2009	Low	1	Southern Shores	Internal	3,994	4,913	5,913	1,472	445	527	529	473	1,748	$137,330	4,067	39,462	101	1,251	5,020	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2009	Low	2	Duck	Internal	544	4,949	5,957	1,483	1,043	1,235	1,241	1,109	238	$114,484	535	164,873	94	1,156	5,049	37%	84%	99%	59%	11%	10	58%	76%	79%	67%	46%						
2009	Low	3	Sanderling South	Internal	364	3,356	4,040	1,005	265	314	316	282	159	$175,216	371	49,065	63	777	3,344	37%	84%	99%	59%	11%	93	58%	76%	79%	67%	46%						
2009	Low	4	Sanderling North	Internal	0	578	696	173	21	24	25	22	0	$0	0	1,888	5	60	365	37%	84%	99%	59%	11%	123	58%	76%	79%	67%	46%						
2009	Low	5	Corolla South	Internal	262	6,229	7,497	1,866	77	90	92	82	103	$232,608	237	0	86	1,062	5,154	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2009	Low	6	Corolla South Central	Internal	132	1,643	1,978	492	202	237	241	215	52	$249,847	119	78,497	25	302	1,360	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2009	Low	7	Corolla North Central	Internal	251	4,359	5,247	1,306	615	723	735	655	99	$260,106	227	230,048	57	709	3,607	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2009	Low	8	Corolla North	Internal	244	4,425	5,326	1,326	309	363	369	329	96	$268,299	221	31,427	59	730	3,622	37%	84%	99%	59%	11%	43	58%	76%	79%	67%	46%						
2009	Low	9	Carova, 4wd area	Internal	274	2,652	3,191	794	139	164	166	148	108	$138,650	248	0	43	528	2,194	37%	84%	99%	59%	11%	0	na	na	na	na	na						
2009	Low	10	Kitty Hawk	Internal	3,449	4,753	5,721	1,424	3,229	3,826	3,844	3,435	1,509	$81,572	3,447	330,488	110	1,352	4,467	37%	84%	99%	59%	11%	422	58%	76%	79%	67%	46%						
2009	Low	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	4,744	7,642	9,198	2,289	1,529	1,813	1,822	1,628	2,076	$65,213	4,795	369,479	195	2,400	7,244	37%	84%	99%	59%	11%	611	58%	76%	79%	67%	46%						
2009	Low	12	Collington	Internal	3,555	2,481	2,987	743	551	653	656	586	1,556	$68,225	3,624	17,188	65	804	2,532	37%	84%	99%	59%	11%	4	58%	76%	79%	67%	46%						
2009	Low	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,004	4,658	5,606	1,395	3,815	4,521	4,543	4,059	877	$72,312	1,989	403,273	103	1,275	4,154	37%	84%	99%	59%	11%	655	58%	76%	79%	67%	46%						
2009	Low	14	Nags Head	Internal	1,567	3,617	4,353	1,083	2,275	2,696	2,710	2,420	686	$94,826	1,574	319,765	78	966	3,594	37%	84%	99%	59%	11%	110	58%	76%	79%	67%	46%						
2009	Low	15	Nags Head / Whalebone	Internal	1,260	5,538	6,666	1,659	2,954	3,500	3,517	3,142	552	$95,723	1,247	480,425	104	1,287	5,162	37%	84%	99%	59%	11%	538	58%	76%	79%	67%	46%						
2009	Low	16	Manteo	Internal	5,083	3,101	3,732	929	3,726	4,414	4,435	3,963	2,224	$72,343	5,126	325,405	74	914	2,921	37%	84%	99%	59%	11%	268	58%	76%	79%	67%	46%						
2009	Low	17	Wanchese	Internal	1,376	343	413	103	962	1,140	1,146	1,024	602	$45,471	1,379	25,497	133	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2009	Low	18	Bodie Island	Internal	481	3,541	4,262	1,061	190	225	226	202	210	$106,408	470	3,200	68	845	3,445	37%	84%	99%	59%	11%	187	58%	76%	79%	67%	46%						
2009	Low	19	Lower Currituck Peninsula - South	Internal	2,781	477	574	143	1,997	2,347	2,388	2,125	1,096	$90,237	2,517	109,712	140	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2009	Low	20	Elizabeth City	External																											20,277	11,599	7,884	$65,419	$65,419	15,448
2009	Low	21	Moyock Township	Internal	7,201	356	428	107	1,232	1,449	1,473	1,312	2,838	$74,508	6,517	201,827	96	0	0	na	na	na	na	na	4	58%	76%	79%	67%	46%						
2009	Low	22	Dare County Mainland	External																											844	1,119	369	$43,510	$43,510	851
2009	Low	23	Hatteras Island	External																											4,758	4,787	2,082	$81,092	$81,092	4,748
2009	Low	24	Pasquotank County (Excl. Elizabeth City), NC	External																											21,373	12,225	8,310	$65,419	$65,419	16,277
2009	Low	25	Crawford Township	Internal	7,188	599	720	179	2,115	2,486	2,529	2,251	2,833	$77,731	6,505	81,230	173	0	0	na	na	na	na	na	8	58%	76%	79%	67%	46%						
2009	Low	26	Lower Currituck Peninsula - North	Internal	1,478	236	284	71	542	637	648	577	582	$80,473	1,337	33,448	72	0	0	na	na	na	na	na	0	na	na	na	na	na						
2009	Low	27	Lower Currituck Peninsula - Central	Internal	3,590	552	665	165	1,294	1,521	1,547	1,377	1,415	$61,358	3,249	186,214	174	0	0	na	na	na	na	na	12	58%	76%	79%	67%	46%						
2009	Low	28	Camden County, NC	External																											9,933	3,454	4,037	$74,159	$74,159	9,484
2009	Low	29	Balance of Massachusetts	External																											2,407,231	1,286,452	969,890	$101,449	$101,449	1,560,397
2009	Low	30	Balance of Connecticut	External																											2,616,307	1,618,007	1,044,574	$115,480	$115,480	1,758,295
2009	Low	31	Albemarle Peninsula, NC	External																											22,257	9,761	8,946	$69,164	$69,164	14,398
2009	Low	32	Knotts Island	External																											1,439	413	567	$64,612	$64,612	1,303
2009	Low	33	Balance of Maryland	External																											647,726	366,578	259,145	$84,774	$84,774	451,573
2009	Low	34	Balance of Delaware	External																											350,663	178,365	141,624	$77,334	$77,334	252,866
2009	Low	35	Balance of New Jersey	External																											894,079	586,296	336,527	$129,386	$129,386	523,359
2009	Low	36	Balance of Virginia	External																											2,242,764	1,235,300	923,008	$72,453	$72,453	1,695,153
2009	Low	37	Balance of North Carolina	External																											6,065,127	3,206,603	2,452,259	$78,315	$78,315	4,440,715
2009	Low	38	Balance of South Carolina	External																											4,311,829	2,365,876	1,714,621	$79,503	$79,503	2,957,051
2009	Low	39	Georgia	External																											9,822,815	5,375,426	3,698,353	$88,702	$88,702	6,601,274
2009	Low	40	Balance of West Virginia	External																											1,765,795	872,386	745,574	$75,474	$75,474	1,209,411
2009	Low	41	Balance of Ohio	External																											5,269,630	2,752,862	2,114,378	$76,540	$76,540	3,825,478
2009	Low	42	Michigan	External																											10,035,072	5,071,428	3,964,515	$88,826	$88,826	6,983,293
2009	Low	43	Balance of Pennsylvania	External																											3,594,865	1,922,969	1,441,525	$76,687	$76,687	2,403,851
2009	Low	44	Balance of New York State	External																											5,887,672	3,209,802	2,336,426	$86,077	$86,077	3,784,892
2009	Low	45	Balance of New Hampshire	External																											906,630	582,666	365,126	$102,255	$102,255	658,450
2009	Low	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	450	533	536	479	0	$0	0	364,834	na	na	na	na	na	na	na	na	na	na	na	na	na	na						
2009	Low	47	Washington, DC-VA-MD-WV MSA	External																											5,443,194	3,838,226	2,114,661	$146,754	$159,621	3,564,348
2009	Low	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											5,865,190	3,458,435	2,280,959	$121,503	$135,928	3,455,933
2009	Low	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											19,098,169	10,827,773	7,155,467	$144,547	$164,812	8,503,307
2009	Low	50	Baltimore-Towson, MD MSA	External																											2,697,617	1,645,813	1,074,633	$119,057	$131,244	1,717,602
2009	Low	51	Richmond, VA MSA	External																											1,247,375	760,143	500,228	$99,745	$105,094	906,034
2009	Low	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											1,677,344	1,039,248	643,354	$98,389	$103,615	1,117,931
2009	Low	53	Pittsburgh, PA MSA	External																											2,353,378	1,427,897	991,366	$102,934	$105,021	1,540,983
2009	Low	54	Raleigh-Cary, NC MSA	External																											1,112,618	656,500	440,056	$99,306	$103,246	809,040
2009	Low	55	Cleveland-Elyria-Mentor, OH MSA	External																											2,087,637	1,269,327	854,312	$98,156	$98,860	1,390,773
2009	Low	56	Harrisburg-Carlisle, PA MSA	External																											534,815	396,606	220,572	$94,455	$95,385	376,800
2009	Low	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											818,121	422,839	325,373	$95,086	$91,547	568,087
2009	Low	58	Columbus, OH MSA	External																											1,791,654	1,170,993	734,375	$93,386	$96,160	1,286,750
2009	Low	59	Lancaster, PA MSA	External																											507,385	302,854	193,371	$93,078	$93,078	336,704
2009	Low	60	Charlottesville, VA MSA	External																											196,719	134,934	80,247	$100,903	$102,857	149,217
2009	Low	61	York-Hanover, PA MSA	External																											429,522	225,013	172,601	$87,024	$87,024	321,150
2009	Low	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											897,717	601,179	338,005	$215,327	$215,327	597,575
2009	Low	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											4,543,803	3,071,881	1,802,378	$137,716	$139,690	2,791,018
2009	Low	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,171,185	1,266,738	872,478	$98,606	$98,331	1,532,234
2009	Low	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											1,733,739	1,048,744	686,456	$98,414	$100,054	1,224,150
2009	Low	66	Akron, OH MSA	External																											699,175	409,640	286,241	$91,341	$91,050	510,736
2009	Low	67	Rochester, NY MSA	External																											1,034,524	622,615	406,988	$96,756	$98,957	669,296
2009	Low	68	Reading, PA MSA	External																											405,808	222,402	157,825	$90,985	$90,985	274,449
2009	Low	69	Durham-Chapel Hill, NC MSA	External																											498,482	374,076	204,096	$98,665	$102,532	357,814
2009	Low	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											102,390	43,060	41,978	$71,789	$71,789	71,334
2009	**Low**		**Total/Average**		**51,822**	**70,998**	**85,451**	**21,268**	**29,975**	**35,440**	**35,734**	**31,894**	**21,659**	**$84,003**	**49,801**	**3,847,245**	**2,120**	**16,417**	**63,233**	**37%**	**84%**	**99%**	**59%**	**11%**	**3,108**	**58%**	**76%**	**79%**	**67%**	**46%**	**114,846,647**	**65,911,311**	**45,117,761**	**$105,764**	**$110,994**	**73,241,830**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-19

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - LOW CASI
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental							Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal									Annual Occ	Seasonal Occupancy						Annual Occ	Seasonal Occupancy								
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2015	Low	1	Southern Shores	Internal	4,184	5,386	6,482	1,613	477	565	567	507	1,880	170,309	4,375	39,462	110	1,352	5,633	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2015	Low	2	Duck	Internal	570	5,426	6,530	1,625	1,118	1,325	1,331	1,190	256	141,976	575	164,873	101	1,248	5,605	32%	79%	97%	55%	9%	10	54%	73%	76%	63%	43%						
2015	Low	3	Sanderling South	Internal	382	3,679	4,428	1,102	284	336	339	303	171	217,293	399	49,065	68	839	3,737	32%	79%	97%	55%	9%	93	54%	73%	76%	63%	43%						
2015	Low	4	Sanderling North	Internal	0	578	696	173	23	27	28	25	0	0	0	1,888	5	60	365	32%	79%	97%	55%	9%	123	54%	73%	76%	63%	43%						
2015	Low	5	Corolla South	Internal	295	6,828	8,218	2,045	137	161	163	145	119	264,820	273	0	93	1,147	5,762	32%	79%	97%	55%	9%	100	na	na	na	na	na						
2015	Low	6	Corolla South Central	Internal	148	1,801	2,168	540	225	264	269	239	60	284,447	137	78,497	26	327	1,515	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2015	Low	7	Corolla North Central	Internal	282	4,779	5,751	1,431	801	942	958	852	114	296,126	262	300,048	62	765	4,047	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2015	Low	8	Corolla North	Internal	275	4,851	5,838	1,453	343	404	411	366	111	305,454	255	31,427	64	788	4,054	32%	79%	97%	55%	9%	43	54%	73%	76%	63%	43%						
2015	Low	9	Carova, 4wd area	Internal	309	2,907	3,498	871	155	182	185	165	125	157,851	286	0	46	570	2,417	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2015	Low	10	Kitty Hawk	Internal	3,613	5,210	6,271	1,561	3,538	4,192	4,211	3,763	1,624	101,161	3,708	330,488	118	1,461	5,056	32%	79%	97%	55%	9%	572	54%	73%	76%	63%	43%						
2015	Low	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	4,969	8,377	10,083	2,510	1,640	1,944	1,953	1,746	2,233	80,874	5,159	369,479	210	2,592	8,249	32%	79%	97%	55%	9%	611	54%	73%	76%	63%	43%						
2015	Low	12	Collington	Internal	3,724	2,720	3,274	815	591	700	704	629	1,674	84,608	3,899	17,188	70	869	2,830	32%	79%	97%	55%	9%	4	54%	73%	76%	63%	43%						
2015	Low	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,099	5,106	6,145	1,529	4,091	4,849	4,872	4,353	944	89,677	2,140	403,273	112	1,378	4,694	32%	79%	97%	55%	9%	655	54%	73%	76%	63%	43%						
2015	Low	14	Nags Head	Internal	1,642	3,965	4,772	1,188	2,564	3,038	3,054	2,728	738	117,598	1,693	394,765	85	1,043	4,038	32%	79%	97%	55%	9%	110	54%	73%	76%	63%	43%						
2015	Low	15	Nags Head / Whalebone	Internal	1,320	6,071	7,307	1,819	3,167	3,754	3,772	3,370	593	118,710	1,341	480,425	113	1,390	5,715	32%	79%	97%	55%	9%	538	54%	73%	76%	63%	43%						
2015	Low	16	Manteo	Internal	5,325	3,399	4,091	1,018	3,995	4,734	4,756	4,250	2,393	89,715	5,515	325,405	80	987	3,265	32%	79%	97%	55%	9%	268	54%	73%	76%	63%	43%						
2015	Low	17	Wanchese	Internal	1,441	376	453	113	1,032	1,222	1,229	1,098	648	56,391	1,484	25,497	144	0	0	na	na	na	na	na	8	54%	73%	76%	63%	43%						
2015	Low	18	Bodie Island	Internal	504	3,881	4,672	1,163	204	242	243	216	226	131,961	506	3,200	74	912	3,758	32%	79%	97%	55%	9%	187	54%	73%	76%	63%	43%						
2015	Low	19	Lower Currituck Peninsula - South	Internal	3,132	523	630	157	2,222	2,612	2,656	2,364	1,265	102,734	2,904	109,712	152	0	0	na	na	na	na	na	12	54%	73%	76%	63%	43%						
2015	Low	20	Elizabeth City	External																											21,244	12,260	8,540	$78,060	$78,060	16,733
2015	Low	21	Moyock Township	Internal	8,110	390	470	117	1,371	1,612	1,639	1,459	3,274	84,826	7,520	201,827	104	0	0	na	na	na	na	na	4	54%	73%	76%	63%	43%						
2015	Low	22	Dare County Mainland	External																											884	1,200	397	$53,958	$53,958	916
2015	Low	23	Hatteras Island	External																											4,984	5,133	2,240	$100,566	$100,566	5,108
2015	Low	24	Pasquotank County (Excl. Elizabeth City), NC	External																											22,392	12,922	9,001	$78,060	$78,060	17,631
2015	Low	25	Crawford Township	Internal	8,095	656	790	197	2,353	2,766	2,814	2,504	3,268	88,496	7,506	81,230	187	0	0	na	na	na	na	na	8	54%	73%	76%	63%	43%						
2015	Low	26	Lower Currituck Peninsula - North	Internal	1,664	258	311	77	603	709	721	642	672	91,617	1,543	33,448	77	0	0	na	na	na	na	na	0	na	na	na	na	na						
2015	Low	27	Lower Currituck Peninsula - Central	Internal	4,043	605	729	181	1,440	1,692	1,721	1,532	1,632	69,855	3,749	186,214	188	0	0	na	na	na	na	na	12	54%	73%	76%	63%	43%						
2015	Low	28	Camden County, NC	External																											11,121	3,815	4,661	$85,102	$85,102	10,950
2015	Low	29	Balance of Massachusetts	External																											2,416,018	1,348,727	1,000,315	$125,076	$125,076	1,603,256
2015	Low	30	Balance of Connecticut	External																											2,603,274	1,682,682	1,062,627	$143,783	$143,783	1,788,943
2015	Low	31	Albemarle Peninsula, NC	External																											21,893	10,207	9,084	$81,471	$81,471	14,621
2015	Low	32	Knotts Island	External																											1,621	460	654	$73,559	$73,559	1,503
2015	Low	33	Balance of Maryland	External																											675,776	389,953	277,736	$103,363	$103,363	478,047
2015	Low	34	Balance of Delaware	External																											382,925	193,248	159,094	$93,241	$93,241	284,038
2015	Low	35	Balance of New Jersey	External																											903,557	612,990	345,829	$161,575	$161,575	537,601
2015	Low	36	Balance of Virginia	External																											2,272,898	1,291,096	958,925	$88,651	$88,651	1,737,677
2015	Low	37	Balance of North Carolina	External																											6,226,471	3,370,498	2,575,555	$95,216	$95,216	4,663,344
2015	Low	38	Balance of South Carolina	External																											4,481,066	2,498,559	1,826,647	$97,007	$97,007	3,150,010
2015	Low	39	Georgia	External																											10,349,773	5,713,205	3,962,406	$108,815	$108,815	7,072,588
2015	Low	40	Balance of West Virginia	External																											1,734,570	906,297	747,848	$92,694	$92,694	1,212,269
2015	Low	41	Balance of Ohio	External																											5,140,792	2,838,206	2,109,129	$94,826	$94,826	3,807,791
2015	Low	42	Michigan	External																											9,944,233	5,244,590	4,026,841	$109,533	$109,533	7,093,077
2015	Low	43	Balance of Pennsylvania	External																											3,552,401	1,999,746	1,453,936	$94,443	$94,443	2,391,593
2015	Low	44	Balance of New York State	External																											5,789,038	3,306,160	2,339,165	$107,258	$107,258	3,786,847
2015	Low	45	Balance of New Hampshire	External																											940,374	618,974	389,110	$125,507	$125,507	701,627
2015	Low	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	483	572	575	513	0	0	0	364,834	na	na	na	na	na	na	na	na	na	na	na	na	na	na						
2015	Low	47	Washington, DC-VA-MD-WV MSA	External																											5,788,066	4,089,284	2,292,867	$179,586	$194,874	3,864,721
2015	Low	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											5,859,824	3,606,406	2,332,330	$151,059	$168,002	3,533,767
2015	Low	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											19,106,012	11,154,345	7,266,543	$179,905	$206,585	8,635,307
2015	Low	50	Baltimore-Towson, MD MSA	External																											2,800,821	1,738,693	1,145,633	$146,407	$159,452	1,831,082
2015	Low	51	Richmond, VA MSA	External																											1,339,501	809,523	549,518	$120,858	$126,182	995,311
2015	Low	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											1,742,049	1,094,706	687,928	$120,008	$124,594	1,195,385
2015	Low	53	Pittsburgh, PA MSA	External																											2,301,692	1,480,155	986,105	$129,168	$131,886	1,532,806
2015	Low	54	Raleigh-Cary, NC MSA	External																											1,220,614	713,521	490,526	$119,591	$124,810	901,830
2015	Low	55	Cleveland-Elyria-Mentor, OH MSA	External																											2,026,730	1,303,651	849,733	$122,846	$123,350	1,383,319
2015	Low	56	Harrisburg-Carlisle, PA MSA	External																											541,697	410,934	229,219	$115,174	$115,952	391,571
2015	Low	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											853,289	446,641	344,771	$116,819	$112,658	601,954
2015	Low	58	Columbus, OH MSA	External																											1,850,224	1,232,392	779,284	$114,261	$117,330	1,365,438
2015	Low	59	Lancaster, PA MSA	External																											522,613	321,538	204,447	$114,666	$114,666	355,990
2015	Low	60	Charlottesville, VA MSA	External																											204,850	143,292	86,358	$122,902	$125,512	160,580
2015	Low	61	York-Hanover, PA MSA	External																											446,442	237,623	183,885	$105,314	$105,314	342,146
2015	Low	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											888,747	628,743	339,791	$277,514	$277,514	600,733
2015	Low	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											4,541,054	3,182,079	1,844,950	$170,394	$173,260	2,856,942
2015	Low	64	Cincinnati-Middletown,OH-KY-IN MSA	External																											2,204,946	1,330,189	910,565	$126,669	$125,466	1,599,122
2015	Low	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											1,871,682	1,134,579	756,409	$118,681	$120,172	1,348,896
2015	Low	66	Akron, OH MSA	External																											683,660	427,211	287,706	$115,401	$115,021	513,349
2015	Low	67	Rochester, NY MSA	External																											1,008,745	641,399	402,781	$121,365	$124,538	662,378
2015	Low	68	Reading, PA MSA	External																											407,552	232,636	161,055	$112,755	$112,755	280,065
2015	Low	69	Durham-Chapel Hill, NC MSA	External																											535,453	403,526	224,398	$118,991	$123,691	393,407
2015	Low	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											100,830	44,845	42,624	$86,355	$86,355	72,506
2015	**Low**		**Total/Average**		**56,127**	**77,774**	**93,607**	**23,298**	**32,856**	**38,842**	**39,169**	**34,958**	**24,022**	**$100,399**	**55,230**	**3,992,245**	**2,289**	**17,728**	**70,740**	**32%**	**79%**	**97%**	**55%**	**9%**	**3,358**	**54%**	**73%**	**76%**	**63%**	**43%**	**116,344,399**	**68,868,840**	**46,669,170**	**$130,669**	**$137,184**	**75,794,775**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-20

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - LOW CASI
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental							Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal								Annual Occ	Seasonal Occupancy						Annual Occ	Seasonal Occupancy									
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2020	Low	1	Southern Shores	Internal	4,443	5,958	7,171	1,785	586	695	697	623	2,027	212,153	4,716	84,462	120	1,477	5,860	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2020	Low	2	Duck	Internal	605	5,561	6,693	1,666	1,198	1,419	1,426	1,275	290	176,859	651	164,873	101	1,248	5,608	32%	79%	97%	55%	9%	10	54%	73%	76%	63%	43%						
2020	Low	3	Sanderling South	Internal	405	3,772	4,540	1,130	304	360	363	324	188	270,681	438	49,065	68	839	3,740	32%	79%	97%	55%	9%	93	54%	73%	76%	63%	43%						
2020	Low	4	Sanderling North	Internal	0	578	696	173	26	30	31	27	0	0	0	1,888	5	60	365	32%	79%	97%	55%	9%	123	54%	73%	76%	63%	43%						
2020	Low	5	Corolla South	Internal	329	7,553	9,091	2,263	151	177	181	161	134	323,859	309	0	102	1,253	6,523	32%	79%	97%	55%	9%	100	na	na	na	na	na						
2020	Low	6	Corolla South Central	Internal	165	1,993	2,398	597	365	429	436	388	68	347,862	155	148,497	29	357	1,708	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2020	Low	7	Corolla North Central	Internal	315	5,286	6,363	1,584	886	1,041	1,059	942	129	362,144	296	300,048	68	836	4,597	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2020	Low	8	Corolla North	Internal	307	5,366	6,459	1,608	380	446	454	404	126	373,552	288	31,427	70	861	4,593	32%	79%	97%	55%	9%	43	54%	73%	76%	63%	43%						
2020	Low	9	Carova, 4wd area	Internal	344	3,216	3,870	963	171	201	205	182	141	193,042	323	0	51	623	2,698	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2020	Low	10	Kitty Hawk	Internal	3,837	5,764	6,937	1,727	3,790	4,490	4,511	4,031	1,750	126,016	3,997	330,488	129	1,596	5,784	32%	79%	97%	55%	9%	572	54%	73%	76%	63%	43%						
2020	Low	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	5,277	9,163	11,029	2,745	1,757	2,082	2,093	1,870	2,400	100,744	5,545	369,479	223	2,750	8,407	32%	79%	97%	55%	9%	611	54%	73%	76%	63%	43%						
2020	Low	12	Collington	Internal	3,955	3,009	3,622	901	633	750	754	673	1,804	105,396	4,203	17,188	77	949	3,204	32%	79%	97%	55%	9%	4	54%	73%	76%	63%	43%						
2020	Low	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,229	5,648	6,798	1,692	4,383	5,194	5,219	4,663	1,026	111,711	2,327	403,273	121	1,487	4,904	32%	79%	97%	55%	9%	655	54%	73%	76%	63%	43%						
2020	Low	14	Nags Head	Internal	1,744	4,386	5,279	1,314	2,747	3,255	3,271	2,922	795	146,491	1,825	394,765	92	1,140	4,310	32%	79%	97%	55%	9%	110	54%	73%	76%	63%	43%						
2020	Low	15	Nags Head / Whalebone	Internal	1,402	6,509	7,835	1,950	3,561	4,220	4,241	3,789	632	147,877	1,429	580,425	117	1,448	5,767	32%	79%	97%	55%	9%	538	54%	73%	76%	63%	43%						
2020	Low	16	Manteo	Internal	5,655	3,760	4,526	1,126	4,280	5,071	5,095	4,552	2,580	111,758	5,944	325,405	87	1,079	3,679	32%	79%	97%	55%	9%	268	54%	73%	76%	63%	43%						
2020	Low	17	Wanchese	Internal	1,530	416	501	125	1,105	1,310	1,316	1,176	698	70,246	1,599	25,497	158	0	0	na	na	na	na	na	8	54%	73%	76%	63%	43%						
2020	Low	18	Bodie Island	Internal	535	3,993	4,806	1,196	218	259	260	232	233	164,383	520	3,200	74	912	3,779	32%	79%	97%	55%	9%	187	54%	73%	76%	63%	43%						
2020	Low	19	Lower Currituck Peninsula - South	Internal	3,494	579	696	173	2,456	2,887	2,937	2,614	1,429	125,637	3,282	109,712	166	0	0	na	na	na	na	na	12	54%	73%	76%	63%	43%						
2020	Low	20	Elizabeth City	External																											22,562	13,067	9,250	$96,428	$96,428	18,124
2020	Low	21	Moyock Township	Internal	9,048	432	519	129	1,830	2,151	2,188	1,947	3,701	103,738	8,499	351,827	113	0	0	na	na	na	na	na	104	54%	73%	76%	63%	43%						
2020	Low	22	Dare County Mainland	External																											939	1,286	428	$67,216	$67,216	987
2020	Low	23	Hatteras Island	External																											5,293	5,499	2,415	$125,274	$125,274	5,506
2020	Low	24	Pasquotank County (Excl. Elizabeth City), NC	External																											23,781	13,773	9,750	$96,428	$96,428	19,097
2020	Low	25	Crawford Township	Internal	9,032	726	874	217	2,602	3,058	3,111	2,769	3,694	108,225	8,483	81,230	205	0	0	na	na	na	na	na	8	54%	73%	76%	63%	43%						
2020	Low	26	Lower Currituck Peninsula - North	Internal	1,857	286	344	86	667	784	798	710	759	112,042	1,744	33,448	85	0	0	na	na	na	na	na	0	na	na	na	na	na						
2020	Low	27	Lower Currituck Peninsula - Central	Internal	4,510	670	806	201	1,592	1,871	1,903	1,694	1,845	85,429	4,236	186,214	206	0	0	na	na	na	na	na	12	54%	73%	76%	63%	43%						
2020	Low	28	Camden County, NC	External																											12,359	4,219	5,279	$103,043	$103,043	12,401
2020	Low	29	Balance of Massachusetts	External																											2,484,206	1,420,032	1,044,307	$156,878	$156,878	1,668,743
2020	Low	30	Balance of Connecticut	External																											2,658,613	1,759,901	1,097,359	$181,108	$181,108	1,847,628
2020	Low	31	Albemarle Peninsula, NC	External																											22,154	10,802	9,374	$101,659	$101,659	15,088
2020	Low	32	Knotts Island	External																											1,808	509	740	$89,959	$89,959	1,699
2020	Low	33	Balance of Maryland	External																											715,462	415,699	298,458	$129,310	$129,310	509,002
2020	Low	34	Balance of Delaware	External																											418,608	210,072	176,740	$116,663	$116,663	315,526
2020	Low	35	Balance of New Jersey	External																											934,054	645,848	359,808	$206,083	$206,083	559,146
2020	Low	36	Balance of Virginia	External																											2,354,660	1,358,952	1,006,649	$110,890	$110,890	1,805,200
2020	Low	37	Balance of North Carolina	External																											6,513,975	3,565,076	2,725,803	$118,747	$118,747	4,934,879
2020	Low	38	Balance of South Carolina	External																											4,730,781	2,655,035	1,953,955	$120,888	$120,888	3,369,349
2020	Low	39	Georgia	External																											11,036,266	6,103,295	4,252,959	$136,254	$136,254	7,591,202
2020	Low	40	Balance of West Virginia	External																											1,753,276	948,655	763,640	$116,494	$116,494	1,237,162
2020	Low	41	Balance of Ohio	External																											5,166,991	2,949,133	2,143,627	$119,376	$119,376	3,863,177
2020	Low	42	Michigan	External																											10,122,547	5,472,348	4,154,060	$137,314	$137,314	7,317,168
2020	Low	43	Balance of Pennsylvania	External																											3,608,029	2,094,696	1,490,932	$118,789	$118,789	2,425,013
2020	Low	44	Balance of New York State	External																											5,855,985	3,436,438	2,384,142	$135,638	$135,638	3,857,715
2020	Low	45	Balance of New Hampshire	External																																
2020	Low	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	517	613	616	550	0	0	0	364,834	na	na	0	na	na	na	na	na	na	na	na	na	na	na	991,366	659,088	416,454	$156,433	$156,433	750,866
2020	Low	47	Washington, DC-VA-MD-WV MSA	External																											6,212,372	4,379,748	2,483,538	$223,241	$242,325	4,186,106
2020	Low	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											6,003,700	3,786,850	2,418,603	$190,294	$210,522	3,664,480
2020	Low	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											19,595,527	11,588,404	7,492,490	$226,452	$261,194	8,903,814
2020	Low	50	Baltimore-Towson, MD MSA	External																											2,954,787	1,844,833	1,226,111	$183,091	$197,720	1,959,711
2020	Low	51	Richmond, VA MSA	External																											1,447,627	868,370	600,921	$150,119	$155,925	1,088,413
2020	Low	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											1,838,251	1,163,730	738,125	$149,465	$153,897	1,282,611
2020	Low	53	Pittsburgh, PA MSA	External																											2,318,259	1,545,000	999,834	$164,444	$167,984	1,554,145
2020	Low	54	Raleigh-Cary, NC MSA	External																											1,338,483	776,402	541,188	$148,034	$154,717	994,972
2020	Low	55	Cleveland-Elyria-Mentor, OH MSA	External																											2,028,910	1,354,638	861,824	$155,530	$155,883	1,403,002
2020	Low	56	Harrisburg-Carlisle, PA MSA	External																											560,943	428,887	240,732	$142,651	$143,321	411,240
2020	Low	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											903,231	473,444	367,082	$146,878	$142,709	640,908
2020	Low	58	Columbus, OH MSA	External																											1,944,216	1,303,140	831,589	$141,954	$145,532	1,457,085
2020	Low	59	Lancaster, PA MSA	External																											548,102	342,164	217,559	$143,237	$143,237	378,820
2020	Low	60	Charlottesville, VA MSA	External																											216,579	153,018	93,091	$152,868	$156,514	173,100
2020	Low	61	York-Hanover, PA MSA	External																											471,368	251,443	196,759	$130,341	$130,341	366,101
2020	Low	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											903,990	660,369	347,559	$357,333	$357,333	614,467
2020	Low	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											4,653,669	3,317,001	1,914,796	$213,156	$217,062	2,965,100
2020	Low	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,287,913	1,405,379	959,651	$161,861	$160,143	1,685,325
2020	Low	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											2,030,152	1,229,736	828,588	$146,544	$148,225	1,477,613
2020	Low	66	Akron, OH MSA	External																											688,454	449,573	294,312	$147,480	$146,991	525,136
2020	Low	67	Rochester, NY MSA	External																											1,013,486	664,907	406,597	$153,613	$157,959	668,653
2020	Low	68	Reading, PA MSA	External																											419,266	244,491	166,654	$141,828	$141,828	289,802
2020	Low	69	Durham-Chapel Hill, NC MSA	External																											578,781	436,192	245,449	$146,528	$152,435	430,313
2020	Low	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co, NC	External																											102,116	47,089	43,957	$108,336	$108,336	74,834
2020	**Low**		**Total/Average**		**61,019**	**84,625**	**101,853**	**25,350**	**36,203**	**42,795**	**43,162**	**38,520**	**26,449**	**$123,963**	**60,811**	**4,357,245**	**2,465**	**18,917**	**75,526**	**32%**	**79%**	**97%**	**55%**	**9%**	**3,458**	**54%**	**73%**	**76%**	**63%**	**43%**	**120,493,899**	**72,458,230**	**48,823,140**	**$163,922**	**$172,136**	**79,320,429**

Source: East Carolina Univ., Woods and
Poole, Delta Associates, February 2010.

TABLE C-21

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - LOW CASE
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households						Rental							Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal										Annual Occ	Seasonal Occupancy						Annual Occ	Seasonal Occupancy								
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2025	Low	1	Southern Shores	Internal	4,592	6,207	7,471	1,859	611	724	727	650	2,081	262,509	4,843	84,462	121	1,492	5,927	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2025	Low	2	Duck	Internal	626	5,564	6,697	1,667	1,249	1,480	1,487	1,329	290	218,837	651	164,873	101	1,248	5,612	32%	79%	97%	55%	9%	10	54%	73%	76%	63%	43%						
2025	Low	3	Sanderling South	Internal	419	3,776	4,545	1,131	317	376	378	338	188	334,929	438	49,065	68	839	3,745	32%	79%	97%	55%	9%	93	54%	73%	76%	63%	43%						
2025	Low	4	Sanderling North	Internal	0	579	697	173	28	32	33	29	0	0	0	1,888	5	60	365	32%	79%	97%	55%	9%	123	54%	73%	76%	63%	43%						
2025	Low	5	Corolla South	Internal	354	8,156	9,817	2,443	163	191	195	173	146	395,770	335	0	108	1,337	7,121	32%	79%	97%	55%	9%	100	na	na	na	na	na						
2025	Low	6	Corolla South Central	Internal	178	2,152	2,590	645	393	462	470	419	74	425,102	169	148,497	31	381	1,861	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2025	Low	7	Corolla North Central	Internal	340	5,708	6,870	1,710	954	1,122	1,141	1,016	140	442,556	322	300,048	72	892	5,028	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2025	Low	8	Corolla North	Internal	331	5,795	6,974	1,736	409	481	489	435	137	456,497	313	31,427	74	919	4,903	32%	79%	97%	55%	9%	43	54%	73%	76%	63%	43%						
2025	Low	9	Carova, 4wd area	Internal	371	3,472	4,179	1,040	184	217	221	196	153	235,906	351	0	54	665	2,928	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2025	Low	10	Kitty Hawk	Internal	3,965	6,224	7,491	1,865	3,952	4,682	4,704	4,203	1,828	155,927	4,174	330,488	138	1,702	6,360	32%	79%	97%	55%	9%	572	54%	73%	76%	63%	43%						
2025	Low	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	5,453	9,324	11,222	2,793	1,918	2,273	2,284	2,041	2,400	124,656	5,545	419,479	223	2,750	8,583	32%	79%	97%	55%	9%	611	54%	73%	76%	63%	43%						
2025	Low	12	Collington	Internal	4,087	3,250	3,911	973	660	782	786	702	1,884	130,413	4,388	17,188	82	1,012	3,347	32%	79%	97%	55%	9%	4	54%	73%	76%	63%	43%						
2025	Low	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,304	5,778	6,955	1,731	4,570	5,416	5,442	4,862	1,025	138,226	2,324	403,273	121	1,488	4,981	32%	79%	97%	55%	9%	655	54%	73%	76%	63%	43%						
2025	Low	14	Nags Head	Internal	1,802	4,665	5,614	1,397	2,864	3,394	3,411	3,047	825	181,262	1,892	394,765	95	1,174	4,393	32%	79%	97%	55%	9%	110	54%	73%	76%	63%	43%						
2025	Low	15	Nags Head / Whalebone	Internal	1,449	6,686	8,047	2,003	3,791	4,493	4,515	4,034	632	182,977	1,429	580,425	117	1,448	5,804	32%	79%	97%	55%	9%	688	54%	73%	76%	63%	43%						
2025	Low	16	Manteo	Internal	5,844	4,060	4,887	1,216	4,463	5,288	5,312	4,747	2,820	138,285	6,497	325,405	93	1,151	3,982	32%	79%	97%	55%	9%	268	54%	73%	76%	63%	43%						
2025	Low	17	Wanchese	Internal	1,582	449	541	135	1,319	1,563	1,571	1,404	855	86,919	1,959	125,497	168	0	0	na	na	na	na	na	8	54%	73%	76%	63%	43%						
2025	Low	18	Bodie Island	Internal	553	4,028	4,849	1,207	227	270	271	242	233	203,401	520	3,200	74	912	3,818	32%	79%	97%	55%	9%	187	54%	73%	76%	63%	43%						
2025	Low	19	Lower Currituck Peninsula - South	Internal	3,766	625	752	187	2,817	3,311	3,368	2,998	1,553	153,534	3,567	209,712	177	0	0	na	na	na	na	na	12	54%	73%	76%	63%	43%						
2025	Low	20	Elizabeth City	External																											23,317	13,572	9,685	$118,513	$118,513	18,978
2025	Low	21	Moyock Township	Internal	9,751	466	561	140	1,972	2,318	2,358	2,098	4,022	126,772	9,236	351,827	121	0	0	na	na	na	na	na	104	54%	73%	76%	63%	43%						
2025	Low	22	Dare County Mainland	External																											971	1,341	447	$83,170	$83,170	1,031
2025	Low	23	Hatteras Island	External																											5,469	5,734	2,521	$155,009	$155,009	5,749
2025	Low	24	Pasquotank County (Excl. Elizabeth City), NC	External																											24,577	14,305	10,209	$118,513	$118,513	19,996
2025	Low	25	Crawford Township	Internal	9,733	784	943	235	2,985	3,509	3,569	3,177	4,014	132,256	9,219	181,230	218	0	0	na	na	na	na	na	8	54%	73%	76%	63%	43%						
2025	Low	26	Lower Currituck Peninsula - North	Internal	2,001	309	371	92	719	845	859	765	825	136,920	1,895	33,448	90	0	0	na	na	na	na	na	0	na	na	na	na	na						
2025	Low	27	Lower Currituck Peninsula - Central	Internal	4,861	723	870	217	1,715	2,016	2,050	1,825	2,005	104,398	4,604	186,214	219	0	0	na	na	na	na	na	12	54%	73%	76%	63%	43%						
2025	Low	28	Camden County, NC	External																											13,279	4,547	5,752	$124,897	$124,897	13,513
2025	Low	29	Balance of Massachusetts	External																											2,492,500	1,458,259	1,058,043	$195,458	$195,458	1,685,720
2025	Low	30	Balance of Connecticut	External																											2,650,300	1,793,960	1,100,296	$226,390	$226,390	1,852,772
2025	Low	31	Albemarle Peninsula, NC	External																											21,889	11,148	9,403	$126,272	$126,272	15,133
2025	Low	32	Knotts Island	External																											1,949	548	804	$109,933	$109,933	1,846
2025	Low	33	Balance of Maryland	External																											737,375	431,666	310,494	$160,928	$160,928	525,054
2025	Low	34	Balance of Delaware	External																											443,571	222,795	189,354	$145,914	$145,914	338,030
2025	Low	35	Balance of New Jersey	External																											941,906	664,014	363,184	$261,295	$261,295	564,203
2025	Low	36	Balance of Virginia	External																											2,379,206	1,395,664	1,025,007	$137,792	$137,792	1,819,938
2025	Low	37	Balance of North Carolina	External																											6,641,626	3,683,565	2,796,564	$147,419	$147,419	5,062,509
2025	Low	38	Balance of South Carolina	External																											4,863,324	2,754,670	2,024,468	$150,059	$150,059	3,490,739
2025	Low	39	Georgia	External																											11,446,850	6,363,107	4,417,114	$169,805	$169,805	7,884,206
2025	Low	40	Balance of West Virginia	External																											1,730,463	968,201	757,508	$145,449	$145,449	1,226,525
2025	Low	41	Balance of Ohio	External																											5,071,576	2,988,608	2,115,972	$149,305	$149,305	3,806,569
2025	Low	42	Michigan	External																											10,059,351	5,570,387	4,162,245	$170,980	$170,980	7,331,585
2025	Low	43	Balance of Pennsylvania	External																											3,577,785	2,141,037	1,484,136	$148,525	$148,525	2,387,044
2025	Low	44	Balance of New York State	External																											5,784,158	3,484,885	2,359,094	$170,344	$170,344	3,815,749
2025	Low	45	Balance of New Hampshire	External																											1,017,853	684,669	431,768	$194,066	$194,066	778,404
2025	Low	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	539	639	642	574	0	0	0	364,834	na	na	0	na	na	na	na	na	na	na	na	na	na	na						
2025	Low	47	Washington, DC-VA-MD-WV MSA	External																											6,480,357	4,574,661	2,602,135	$276,343	$300,868	4,386,006
2025	Low	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											6,003,350	3,879,071	2,434,974	$238,073	$262,204	3,689,284
2025	Low	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											19,613,771	11,743,165	7,502,487	$282,955	$328,002	8,915,694
2025	Low	50	Baltimore-Towson, MD MSA	External																											3,035,608	1,907,370	1,271,029	$227,656	$244,294	2,031,505
2025	Low	51	Richmond, VA MSA	External																											1,519,096	909,889	634,886	$185,988	$192,574	1,149,932
2025	Low	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											1,888,952	1,207,437	767,024	$185,140	$189,397	1,332,828
2025	Low	53	Pittsburgh, PA MSA	External																											2,280,139	1,572,606	984,473	$207,911	$212,485	1,530,268
2025	Low	54	Raleigh-Cary, NC MSA	External																											1,421,971	824,240	575,689	$183,044	$191,562	1,058,400
2025	Low	55	Cleveland-Elyria-Mentor, OH MSA	External																											1,983,549	1,372,600	849,313	$195,382	$195,684	1,382,635
2025	Low	56	Harrisburg-Carlisle, PA MSA	External																											566,561	436,483	245,254	$175,552	$176,102	418,965
2025	Low	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											930,757	489,821	378,492	$183,961	$179,985	660,830
2025	Low	58	Columbus, OH MSA	External																											1,990,280	1,344,629	860,231	$175,404	$179,665	1,507,271
2025	Low	59	Lancaster, PA MSA	External																											560,106	355,313	224,450	$178,016	$178,016	390,820
2025	Low	60	Charlottesville, VA MSA	External																											222,934	159,092	97,116	$189,029	$194,011	180,584
2025	Low	61	York-Hanover, PA MSA	External																											484,622	259,417	203,973	$160,467	$160,467	379,523
2025	Low	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											897,677	675,660	345,362	$456,260	$456,260	610,581
2025	Low	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											4,654,447	3,371,880	1,929,351	$264,754	$270,041	2,987,638
2025	Low	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,315,198	1,447,680	981,471	$204,137	$202,162	1,723,646
2025	Low	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											2,137,004	1,301,000	876,588	$180,576	$182,529	1,563,211
2025	Low	66	Akron, OH MSA	External																											677,016	461,198	292,511	$187,135	$186,526	521,923
2025	Low	67	Rochester, NY MSA	External																											994,388	672,447	398,399	$193,082	$198,951	655,171
2025	Low	68	Reading, PA MSA	External																											420,866	250,782	167,336	$177,363	$177,363	290,987
2025	Low	69	Durham-Chapel Hill, NC MSA	External																											607,443	460,582	259,248	$180,040	$187,556	454,505
2025	Low	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											100,977	48,218	44,007	$135,241	$135,241	74,982
2025	**Low**		**Total/Average**		**64,360**	**88,781**	**106,855**	**26,595**	**38,819**	**45,883**	**46,283**	**41,304**	**28,129**	**$151,875**	**64,673**	**4,707,245**	**2,572**	**19,470**	**78,757**	**32%**	**79%**	**97%**	**55%**	**9%**	**3,608**	**54%**	**73%**	**76%**	**63%**	**43%**	**121,716,367**	**74,381,923**	**49,559,864**	**$204,340**	**$214,745**	**80,542,483**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-22

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - LOW CASE
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental						Hotels								Households			
					Permanent	Seasonal			Annual Avg.	Seasonal									Annual Occ	Seasonal Occupancy					Annual Occ	Seasonal Occupancy									
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2030	Low	1	Southern Shores	Internal	4,710	6,303	7,586	1,888	632	750	753	673	2,081	326,999	4,843	84,462	121	1,492	6,029	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2030	Low	2	Duck	Internal	642	5,585	6,722	1,673	1,293	1,532	1,539	1,376	290	272,599	651	164,873	101	1,248	5,635	32%	79%	97%	55%	9%	10	54%	73%	76%	63%	43%						
2030	Low	3	Sanderling South	Internal	430	3,803	4,577	1,139	328	389	392	350	188	417,210	438	49,065	68	839	3,775	32%	79%	97%	55%	9%	93	54%	73%	76%	63%	43%						
2030	Low	4	Sanderling North	Internal	0	580	698	174	30	35	35	31	0	0	0	1,888	5	60	366	32%	79%	97%	55%	9%	123	54%	73%	76%	63%	43%						
2030	Low	5	Corolla South	Internal	377	8,769	10,555	2,627	174	205	208	186	156	489,103	358	0	115	1,420	7,736	32%	79%	97%	55%	9%	100	na	na	na	na	na						
2030	Low	6	Corolla South Central	Internal	190	2,314	2,785	693	421	495	504	448	79	525,352	180	148,497	33	404	2,013	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2030	Low	7	Corolla North Central	Internal	361	6,137	7,387	1,839	1,023	1,202	1,223	1,088	150	546,922	344	300,048	77	947	5,457	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2030	Low	8	Corolla North	Internal	352	6,103	7,345	1,828	439	515	524	467	144	564,150	331	31,427	76	940	4,906	32%	79%	97%	55%	9%	43	54%	73%	76%	63%	43%						
2030	Low	9	Carova, 4wd area	Internal	395	3,733	4,493	1,118	198	232	236	210	163	291,538	375	0	57	706	3,166	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2030	Low	10	Kitty Hawk	Internal	4,067	6,692	8,054	2,005	4,091	4,847	4,870	4,351	1,887	194,233	4,308	330,488	147	1,808	6,997	32%	79%	97%	55%	9%	572	54%	73%	76%	63%	43%						
2030	Low	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	5,594	9,666	11,634	2,896	2,050	2,429	2,441	2,181	2,400	155,280	5,545	419,479	223	2,750	8,834	32%	79%	97%	55%	9%	736	54%	73%	76%	63%	43%						
2030	Low	12	Collington	Internal	4,192	3,494	4,205	1,047	683	810	814	727	1,945	162,451	4,530	17,188	87	1,075	3,396	32%	79%	97%	55%	9%	4	54%	73%	76%	63%	43%						
2030	Low	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,363	5,911	7,114	1,771	4,731	5,607	5,634	5,034	1,025	172,183	2,324	403,273	121	1,488	5,123	32%	79%	97%	55%	9%	655	54%	73%	76%	63%	43%						
2030	Low	14	Nags Head	Internal	1,848	4,796	5,772	1,437	2,965	3,513	3,531	3,155	825	225,792	1,892	394,765	95	1,174	4,533	32%	79%	97%	55%	9%	110	54%	73%	76%	63%	43%						
2030	Low	15	Nags Head / Whalebone	Internal	1,486	6,742	8,114	2,020	4,096	4,855	4,878	4,358	632	227,928	1,429	680,425	117	1,448	5,863	32%	79%	97%	55%	9%	688	54%	73%	76%	63%	43%						
2030	Low	16	Manteo	Internal	5,994	4,365	5,254	1,308	4,620	5,474	5,500	4,914	3,034	172,257	6,992	325,405	99	1,222	4,279	32%	79%	97%	55%	9%	268	54%	73%	76%	63%	43%						
2030	Low	17	Wanchese	Internal	1,622	483	581	145	1,365	1,618	1,626	1,453	1,006	108,272	2,306	125,497	178	0	0	na	na	na	na	na	8	54%	73%	76%	63%	43%						
2030	Low	18	Bodie Island	Internal	567	4,130	4,971	1,237	235	279	281	250	233	253,369	520	3,200	74	912	3,930	32%	79%	97%	55%	9%	187	54%	73%	76%	63%	43%						
2030	Low	19	Lower Currituck Peninsula - South	Internal	4,005	672	809	201	3,019	3,548	3,609	3,212	1,662	189,741	3,817	209,712	188	0	0	na	na	na	na	na	12	54%	73%	76%	63%	43%						
2030	Low	20	Elizabeth City	External																											23,919	14,009	10,010	$146,775	$146,775	19,614
2030	Low	21	Moyock Township	Internal	10,370	501	603	150	2,333	2,742	2,790	2,483	4,299	156,668	9,873	476,827	128	0	0	na	na	na	na	na	104	54%	73%	76%	63%	43%						
2030	Low	22	Dare County Mainland	External																											996	1,388	462	$103,602	$103,602	1,064
2030	Low	23	Hatteras Island	External																											5,610	5,936	2,602	$193,090	$193,090	5,934
2030	Low	24	Pasquotank County (Excl. Elizabeth City), NC	External																											25,212	14,766	10,551	$146,775	$146,775	20,667
2030	Low	25	Crawford Township	Internal	10,351	843	1,014	252	3,199	3,760	3,824	3,404	4,291	163,445	9,854	181,230	232	0	0	na	na	na	na	na	8	54%	73%	76%	63%	43%						
2030	Low	26	Lower Currituck Peninsula - North	Internal	2,128	332	399	99	770	905	921	820	885	169,209	2,031	33,448	96	0	0	na	na	na	na	na	0	na	na	na	na	na						
2030	Low	27	Lower Currituck Peninsula - Central	Internal	5,169	777	936	233	1,838	2,160	2,197	1,956	2,144	129,018	4,925	186,214	233	0	0	na	na	na	na	na	12	54%	73%	76%	63%	43%						
2030	Low	28	Camden County, NC	External																											14,085	4,876	6,164	$153,322	$153,322	14,482
2030	Low	29	Balance of Massachusetts	External																											2,488,250	1,490,101	1,061,547	$245,194	$245,194	1,686,415
2030	Low	30	Balance of Connecticut	External																											2,629,552	1,818,357	1,092,968	$284,698	$284,698	1,840,621
2030	Low	31	Albemarle Peninsula, NC	External																											21,532	11,450	9,351	$158,093	$158,093	15,051
2030	Low	32	Knotts Island	External																											2,073	587	846	$135,859	$135,859	1,942
2030	Low	33	Balance of Maryland	External																											754,550	445,407	319,217	$201,883	$201,883	535,561
2030	Low	34	Balance of Delaware	External																											465,066	235,183	199,858	$184,650	$184,650	356,767
2030	Low	35	Balance of New Jersey	External																											944,775	679,698	362,866	$333,850	$333,850	563,516
2030	Low	36	Balance of Virginia	External																											2,390,899	1,426,854	1,032,998	$172,382	$172,382	1,816,789
2030	Low	37	Balance of North Carolina	External																											6,730,301	3,793,021	2,838,380	$184,599	$184,599	5,137,755
2030	Low	38	Balance of South Carolina	External																											4,965,277	2,846,962	2,073,585	$188,008	$188,008	3,575,234
2030	Low	39	Georgia	External																											11,780,269	6,605,568	4,531,215	$213,440	$213,440	8,087,868
2030	Low	40	Balance of West Virginia	External																											1,700,439	983,047	744,719	$182,844	$182,844	1,205,121
2030	Low	41	Balance of Ohio	External																											4,956,551	3,013,432	2,069,417	$188,013	$188,013	3,716,231
2030	Low	42	Michigan	External																											9,950,611	5,643,469	4,132,705	$214,338	$214,338	7,279,551
2030	Low	43	Balance of Pennsylvania	External																											3,531,753	2,178,656	1,463,109	$187,082	$187,082	2,326,925
2030	Low	44	Balance of New York State	External																											5,688,038	3,517,749	2,312,162	$215,322	$215,322	3,738,936
2030	Low	45	Balance of New Hampshire	External																											1,038,012	707,871	442,564	$242,846	$242,846	797,784
2030	Low	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	558	661	665	594	0	0	0	364,834	na	na	0	na	na	na	na	na	na	na	na	na	na	na						
2030	Low	47	Washington, DC-VA-MD-WV MSA	External																											6,702,774	4,754,591	2,692,556	$345,204	$377,593	4,538,413
2030	Low	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											5,973,855	3,954,776	2,428,269	$299,839	$328,990	3,679,126
2030	Low	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											19,535,757	11,842,255	7,443,947	$355,786	$414,717	8,846,126
2030	Low	50	Baltimore-Towson, MD MSA	External																											3,097,410	1,960,242	1,302,546	$285,226	$304,613	2,081,878
2030	Low	51	Richmond, VA MSA	External																											1,579,429	950,188	661,742	$232,836	$240,592	1,198,575
2030	Low	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											1,927,811	1,247,471	787,951	$231,155	$235,246	1,369,191
2030	Low	53	Pittsburgh, PA MSA	External																											2,232,956	1,592,512	960,284	$264,609	$270,545	1,492,669
2030	Low	54	Raleigh-Cary, NC MSA	External																											1,494,141	870,980	603,227	$228,926	$239,865	1,109,030
2030	Low	55	Cleveland-Elyria-Mentor, OH MSA	External																											1,930,941	1,383,643	829,652	$246,863	$247,299	1,350,628
2030	Low	56	Harrisburg-Carlisle, PA MSA	External																											569,133	441,952	247,305	$217,554	$218,003	422,468
2030	Low	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											952,330	504,582	385,721	$232,544	$228,995	673,451
2030	Low	58	Columbus, OH MSA	External																											2,024,253	1,381,343	880,360	$218,472	$223,693	1,542,541
2030	Low	59	Lancaster, PA MSA	External																											568,760	367,301	229,117	$223,029	$223,029	398,947
2030	Low	60	Charlottesville, VA MSA	External																											227,869	164,305	100,098	$235,487	$242,261	186,130
2030	Low	61	York-Hanover, PA MSA	External																											494,824	266,199	209,060	$199,152	$199,152	388,989
2030	Low	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											887,331	687,056	340,142	$585,667	$585,667	601,352
2030	Low	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											4,632,558	3,410,240	1,925,791	$330,983	$338,170	2,982,126
2030	Low	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,329,800	1,483,327	993,984	$257,882	$255,976	1,745,621
2030	Low	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											2,227,841	1,370,603	914,617	$224,907	$227,249	1,631,027
2030	Low	66	Akron, OH MSA	External																											662,895	470,528	288,190	$238,979	$238,235	514,213
2030	Low	67	Rochester, NY MSA	External																											971,466	676,893	386,495	$244,299	$252,236	635,595
2030	Low	68	Reading, PA MSA	External																											420,338	256,131	166,340	$223,499	$223,499	289,256
2030	Low	69	Durham-Chapel Hill, NC MSA	External																											631,641	484,686	270,048	$223,586	$233,354	473,439
2030	Low	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											99,402	49,123	43,643	$170,042	$170,042	74,423
2030	**Low**		**Total/Average**		**67,214**	**92,732**	**111,610**	**27,779**	**41,091**	**48,565**	**48,994**	**43,722**	**29,519**	**$187,521**	**67,866**	**4,932,245**	**2,671**	**19,934**	**82,039**	**32%**	**79%**	**97%**	**55%**	**9%**	**3,733**	**54%**	**73%**	**76%**	**63%**	**43%**	**122,283,283**	**76,009,314**	**49,808,381**	**$256,563**	**$269,945**	**80,969,041**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-23

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - LOW CASI
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental							Hotels							Households		
					Permanent	Seasonal			Annual Avg.	Seasonal								Annual Occ	Seasonal Occupancy						Annual Occ	Seasonal Occupancy								
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2035	Low	1	Southern Shores	Internal	4,811	6,465	7,781	1,937	652	773	776	694	2,081	409,053	4,843	84,462	121	1,492	6,201	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2035	Low	2	Duck	Internal	655	5,715	6,879	1,712	1,333	1,580	1,587	1,419	290	341,002	651	164,873	101	1,248	5,781	32%	79%	97%	55%	9%	10	54%	73%	76%	63%	43%						
2035	Low	3	Sanderling South	Internal	439	3,940	4,742	1,180	338	401	404	361	188	521,900	438	49,065	68	839	3,930	32%	79%	97%	55%	9%	93	54%	73%	76%	63%	43%						
2035	Low	4	Sanderling North	Internal	0	582	701	174	32	37	38	34	0	0	0	1,888	5	60	368	32%	79%	97%	55%	9%	123	54%	73%	76%	63%	43%						
2035	Low	5	Corolla South	Internal	397	9,415	11,332	2,820	186	219	223	198	165	608,869	378	0	122	1,506	8,423	32%	79%	97%	55%	9%	100	na	na	na	na	na						
2035	Low	6	Corolla South Central	Internal	200	2,484	2,990	744	450	529	538	479	83	653,995	190	148,497	35	429	2,172	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2035	Low	7	Corolla North Central	Internal	381	6,589	7,931	1,974	1,093	1,285	1,307	1,163	158	680,847	363	300,048	81	1,005	5,924	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2035	Low	8	Corolla North	Internal	371	6,120	7,365	1,833	469	551	560	499	144	702,293	331	31,427	76	940	4,921	32%	79%	97%	55%	9%	43	54%	73%	76%	63%	43%						
2035	Low	9	Carova, 4wd area	Internal	416	4,008	4,824	1,201	211	248	253	225	173	362,927	396	0	61	749	3,424	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2035	Low	10	Kitty Hawk	Internal	4,155	7,185	8,648	2,152	4,219	4,999	5,022	4,487	1,933	242,972	4,414	330,488	155	1,917	7,754	32%	79%	97%	55%	9%	572	54%	73%	76%	63%	43%						
2035	Low	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	5,714	10,018	12,057	3,001	2,114	2,505	2,517	2,249	2,400	194,244	5,545	419,479	223	2,750	9,220	32%	79%	97%	55%	9%	736	54%	73%	76%	63%	43%						
2035	Low	12	Collington	Internal	4,282	3,751	4,515	1,124	704	835	839	750	1,992	203,215	4,641	17,188	92	1,140	3,477	32%	79%	97%	55%	9%	4	54%	73%	76%	63%	43%						
2035	Low	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,414	6,113	7,358	1,831	5,132	6,082	6,111	5,460	1,025	215,390	2,324	553,273	121	1,488	5,341	32%	79%	97%	55%	9%	655	54%	73%	76%	63%	43%						
2035	Low	14	Nags Head	Internal	1,888	5,101	6,140	1,528	3,133	3,713	3,732	3,334	825	282,451	1,892	394,765	95	1,174	4,709	32%	79%	97%	55%	9%	260	54%	73%	76%	63%	43%						
2035	Low	15	Nags Head / Whalebone	Internal	1,518	6,847	8,240	2,051	4,224	5,007	5,030	4,494	632	285,122	1,429	680,425	117	1,448	5,974	32%	79%	97%	55%	9%	688	54%	73%	76%	63%	43%						
2035	Low	16	Manteo	Internal	6,123	4,687	5,641	1,404	4,765	5,645	5,671	5,068	3,203	215,481	7,382	325,405	105	1,296	4,601	32%	79%	97%	55%	9%	268	54%	73%	76%	63%	43%						
2035	Low	17	Wanchese	Internal	1,657	519	624	155	1,408	1,669	1,677	1,499	1,126	135,441	2,579	125,497	189	0	0	na	na	na	na	na	8	54%	73%	76%	63%	43%						
2035	Low	18	Bodie Island	Internal	579	4,319	5,198	1,294	243	288	289	258	233	316,948	520	3,200	74	912	4,137	32%	79%	97%	55%	9%	187	54%	73%	76%	63%	43%						
2035	Low	19	Lower Currituck Peninsula - South	Internal	4,222	721	868	216	3,226	3,792	3,857	3,433	1,765	236,203	4,054	209,712	199	0	0	na	na	na	na	na	12	54%	73%	76%	63%	43%						
2035	Low	20	Elizabeth City	External																											24,434	14,418	10,262	$182,549	$182,549	20,108
2035	Low	21	Moyock Township	Internal	10,931	538	647	161	2,493	2,931	2,981	2,653	4,548	195,031	10,445	476,827	136	0	0	na	na	na	na	na	104	54%	73%	76%	63%	43%						
2035	Low	22	Dare County Mainland	External																											1,017	1,431	473	$129,599	$129,599	1,090
2035	Low	23	Hatteras Island	External																											5,731	6,122	2,666	$241,542	$241,542	6,080
2035	Low	24	Pasquotank County (Excl. Elizabeth City), NC	External																											25,755	15,197	10,817	$182,549	$182,549	21,187
2035	Low	25	Crawford Township	Internal	10,911	905	1,089	271	3,418	4,018	4,087	3,638	4,540	203,467	10,426	181,230	246	0	0	na	na	na	na	na	8	54%	73%	76%	63%	43%						
2035	Low	26	Lower Currituck Peninsula - North	Internal	2,243	356	429	107	823	968	984	876	945	210,644	2,169	33,448	102	0	0	na	na	na	na	na	0	na	na	na	na	na						
2035	Low	27	Lower Currituck Peninsula - Central	Internal	5,449	835	1,005	250	1,964	2,308	2,348	2,090	2,274	160,610	5,223	186,214	247	0	0	na	na	na	na	na	12	54%	73%	76%	63%	43%						
2035	Low	28	Camden County, NC	External																											14,814	5,214	6,530	$189,865	$189,865	15,340
2035	Low	29	Balance of Massachusetts	External																											2,478,759	1,519,609	1,059,110	$308,857	$308,857	1,677,817
2035	Low	30	Balance of Connecticut	External																											2,604,203	1,838,188	1,079,985	$359,321	$359,321	1,818,934
2035	Low	31	Albemarle Peninsula, NC	External																											21,146	11,733	9,256	$198,816	$198,816	14,898
2035	Low	32	Knotts Island	External																											2,185	628	846	$169,126	$169,126	1,942
2035	Low	33	Balance of Maryland	External																											769,061	458,036	325,758	$254,576	$254,576	542,526
2035	Low	34	Balance of Delaware	External																											484,288	247,833	208,798	$235,543	$235,543	372,713
2035	Low	35	Balance of New Jersey	External																											945,395	694,779	360,363	$428,776	$428,776	559,434
2035	Low	36	Balance of Virginia	External																											2,396,635	1,456,404	1,034,695	$216,529	$216,529	1,803,366
2035	Low	37	Balance of North Carolina	External																											6,798,990	3,904,161	2,861,749	$232,485	$232,485	5,179,632
2035	Low	38	Balance of South Carolina	External																											5,050,357	2,939,575	2,108,588	$237,067	$237,067	3,635,392
2035	Low	39	Georgia	External																											12,068,423	6,848,150	4,610,946	$269,875	$269,875	8,230,182
2035	Low	40	Balance of West Virginia	External																											1,668,410	995,815	728,438	$230,775	$230,775	1,178,085
2035	Low	41	Balance of Ohio	External																											4,837,248	3,032,182	2,013,163	$237,724	$237,724	3,608,818
2035	Low	42	Michigan	External																											9,826,222	5,707,502	4,082,173	$269,816	$269,816	7,190,541
2035	Low	43	Balance of Pennsylvania	External																											3,480,596	2,213,728	1,434,431	$236,732	$236,732	2,255,750
2035	Low	44	Balance of New York State	External																											5,584,938	3,545,290	2,254,131	$273,214	$273,214	3,644,519
2035	Low	45	Balance of New Hampshire	External																											1,054,723	730,522	450,392	$305,725	$305,725	811,809
2035	Low	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	575	682	685	612	0	0	0	364,834	na	na	0	na	na	na	na	na	na	na	na	na	na	na						
2035	Low	47	Washington, DC-VA-MD-WV MSA	External																											6,897,510	4,932,196	2,763,429	$434,120	$477,562	4,657,872
2035	Low	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											5,932,883	4,024,830	2,408,350	$379,210	$414,811	3,648,946
2035	Low	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											19,419,131	11,919,936	7,347,071	$449,123	$526,746	8,731,002
2035	Low	50	Baltimore-Towson, MD MSA	External																											3,148,781	2,008,235	1,325,169	$359,130	$382,177	2,118,037
2035	Low	51	Richmond, VA MSA	External																											1,632,787	991,912	683,548	$293,683	$303,020	1,238,071
2035	Low	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											1,960,166	1,287,143	803,725	$290,140	$294,026	1,396,601
2035	Low	53	Pittsburgh, PA MSA	External																											2,183,578	1,609,132	931,606	$338,110	$345,834	1,448,093
2035	Low	54	Raleigh-Cary, NC MSA	External																											1,558,818	918,868	625,647	$288,681	$302,802	1,150,248
2035	Low	55	Cleveland-Elyria-Mentor, OH MSA	External																											1,877,122	1,391,781	806,457	$312,933	$313,812	1,312,868
2035	Low	56	Harrisburg-Carlisle, PA MSA	External																											570,298	446,551	247,864	$270,791	$271,179	423,422
2035	Low	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											970,561	519,084	390,172	$295,793	$293,055	681,222
2035	Low	58	Columbus, OH MSA	External																											2,051,790	1,417,011	895,011	$273,588	$280,124	1,568,212
2035	Low	59	Lancaster, PA MSA	External																											575,656	379,122	232,378	$280,922	$280,922	404,624
2035	Low	60	Charlottesville, VA MSA	External																											232,012	169,079	102,405	$294,766	$303,933	190,419
2035	Low	61	York-Hanover, PA MSA	External																											503,345	272,499	212,720	$248,487	$248,487	395,798
2035	Low	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											875,622	696,429	333,324	$754,149	$754,149	589,299
2035	Low	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											4,601,703	3,441,711	1,912,011	$415,491	$425,272	2,960,787
2035	Low	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,338,413	1,516,316	1,000,782	$325,891	$324,493	1,757,559
2035	Low	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											2,308,485	1,442,105	945,460	$282,284	$285,160	1,686,029
2035	Low	66	Akron, OH MSA	External																											648,134	478,821	282,570	$306,385	$305,501	504,185
2035	Low	67	Rochester, NY MSA	External																											947,730	680,207	372,757	$310,339	$321,075	613,002
2035	Low	68	Reading, PA MSA	External																											418,914	261,233	164,367	$283,034	$283,034	285,824
2035	Low	69	Durham-Chapel Hill, NC MSA	External																											653,042	509,799	278,764	$279,798	$292,684	488,719
2035	Low	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											97,698	49,945	43,051	$214,564	$214,564	73,474
2035	**Low**		**Total/Average**		**69,756**	**97,213**	**117,004**	**29,121**	**43,207**	**51,064**	**51,518**	**45,973**	**30,722**	**$232,964**	**70,632**	**5,082,245**	**2,772**	**20,393**	**86,358**	**32%**	**79%**	**97%**	**55%**	**9%**	**3,883**	**54%**	**73%**	**76%**	**63%**	**43%**	**122,547,510**	**77,550,462**	**49,762,206**	**$323,649**	**$341,053**	**80,914,479**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-24

MID CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC ANALYSIS - LOW CASE
FORECASTED YEAR
INTERNAL AND EXTERNAL ZONES

					Population				At-Place Employment				Households					Rental							Hotels							Households			
					Permanent	Seasonal			Annual Avg.	Seasonal								Annual Occ	Seasonal Occupancy					Annual Occ	Seasonal Occupancy									
Year	Scenario	Arup Zone #	Arup Zone Description	Arup Zone Type	#	Average Daily Peak Season	Average Daily Peak of Peak Season	Average Daily Spring/Fall Shoulder Season	#	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	#	Average Income	Vehicle Ownership	Retail (sq.ft.)	# of 2nd Homes	# of Rental Units	# of Bedrooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	# of Rooms	%	Peak Season	Peak of Peak Season	Spring/Fall Shoulder Season	Off Season	Population	At-Place Employment	#	Avg Household Income	Weighted Avg. Household Income	Vehicle Ownership
2040	Low	1	Southern Shores	Internal	4,900	6,731	8,102	2,016	670	795	798	713	2,081	513,880	4,843	84,462	121	1,492	6,485	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2040	Low	2	Duck	Internal	668	6,041	7,271	1,810	1,371	1,624	1,632	1,459	290	428,390	651	164,873	101	1,248	6,145	32%	79%	97%	55%	9%	10	54%	73%	76%	63%	43%						
2040	Low	3	Sanderling South	Internal	447	4,243	5,107	1,271	348	412	415	371	188	655,647	438	49,065	68	839	4,273	32%	79%	97%	55%	9%	93	54%	73%	76%	63%	43%						
2040	Low	4	Sanderling North	Internal	0	583	702	175	34	40	40	36	0	0	0	1,888	5	60	369	32%	79%	97%	55%	9%	123	54%	73%	76%	63%	43%						
2040	Low	5	Corolla South	Internal	416	10,103	12,160	3,026	199	234	238	212	172	762,866	395	0	129	1,596	9,280	32%	79%	97%	55%	9%	100	na	na	na	na	na						
2040	Low	6	Corolla South Central	Internal	209	2,665	3,208	798	481	565	575	511	86	819,405	199	148,497	37	455	2,340	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2040	Low	7	Corolla North Central	Internal	398	7,071	8,510	2,118	1,166	1,371	1,394	1,241	165	853,049	378	300,048	86	1,065	6,500	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2040	Low	8	Corolla North	Internal	388	6,263	7,538	1,876	500	588	598	532	144	879,920	331	31,427	76	940	5,050	32%	79%	97%	55%	9%	43	54%	73%	76%	63%	43%						
2040	Low	9	Carova, 4wd area	Internal	436	4,301	5,177	1,288	225	265	270	240	180	454,720	414	0	64	794	3,721	32%	79%	97%	55%	9%	0	na	na	na	na	na						
2040	Low	10	Kitty Hawk	Internal	4,231	7,710	9,279	2,309	4,505	5,337	5,362	4,791	1,966	305,237	4,489	430,488	165	2,032	8,638	32%	79%	97%	55%	9%	572	54%	73%	76%	63%	43%						
2040	Low	11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal	5,819	10,488	12,623	3,142	2,173	2,575	2,588	2,312	2,400	244,023	5,545	419,479	223	2,750	9,735	32%	79%	97%	55%	9%	736	54%	73%	76%	63%	43%						
2040	Low	12	Collington	Internal	4,361	4,025	4,844	1,206	724	859	862	771	2,026	255,292	4,720	17,188	98	1,208	3,614	32%	79%	97%	55%	9%	4	54%	73%	76%	63%	43%						
2040	Low	13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal	2,459	6,464	7,779	1,936	5,339	6,327	6,357	5,680	1,025	270,587	2,324	553,273	121	1,488	5,592	32%	79%	97%	55%	9%	780	54%	73%	76%	63%	43%						
2040	Low	14	Nags Head	Internal	1,923	5,262	6,333	1,576	3,221	3,817	3,837	3,427	825	354,834	1,892	394,765	95	1,174	4,880	32%	79%	97%	55%	9%	260	54%	73%	76%	63%	43%						
2040	Low	15	Nags Head / Whalebone	Internal	1,546	7,027	8,457	2,105	4,343	5,147	5,171	4,620	632	358,190	1,429	680,425	117	1,448	6,164	32%	79%	97%	55%	9%	688	54%	73%	76%	63%	43%						
2040	Low	16	Manteo	Internal	6,236	5,029	6,053	1,507	4,898	5,803	5,830	5,210	3,323	270,702	7,658	325,405	111	1,373	4,983	32%	79%	97%	55%	9%	268	54%	73%	76%	63%	43%						
2040	Low	17	Wanchese	Internal	1,688	556	670	167	1,448	1,715	1,724	1,541	1,210	170,150	2,773	125,497	201	0	0	na	na	na	na	na	8	54%	73%	76%	63%	43%						
2040	Low	18	Bodie Island	Internal	590	4,578	5,510	1,371	250	296	297	265	233	398,171	520	3,200	74	912	4,423	32%	79%	97%	55%	9%	187	54%	73%	76%	63%	43%						
2040	Low	19	Lower Currituck Peninsula - South	Internal	4,420	774	931	232	3,442	4,046	4,115	3,663	1,851	295,944	4,250	209,712	211	0	0	na	na	na	na	na	12	54%	73%	76%	63%	43%						
2040	Low	20	Elizabeth City	External																											24,886	14,806	10,448	$227,844	$227,844	20,472
2040	Low	21	Moyock Township	Internal	11,444	577	695	173	2,661	3,127	3,181	2,832	4,755	244,359	10,920	476,827	144	0	0	na	na	na	na	na	104	54%	73%	76%	63%	43%						
2040	Low	22	Dare County Mainland	External																											1,036	1,471	481	$162,811	$162,811	1,109
2040	Low	23	Hatteras Island	External																											5,836	6,293	2,712	$303,441	$303,441	6,184
2040	Low	24	Pasquotank County (Excl. Elizabeth City), NC	External																											26,231	15,606	11,013	$227,844	$227,844	21,570
2040	Low	25	Crawford Township	Internal	11,423	971	1,168	291	3,648	4,288	4,361	3,882	4,746	254,929	10,900	181,230	260	0	0	na	na	na	na	na	8	54%	73%	76%	63%	43%						
2040	Low	26	Lower Currituck Peninsula - North	Internal	2,348	382	460	114	878	1,033	1,050	935	994	263,920	2,284	33,448	108	0	0	na	na	na	na	na	0	na	na	na	na	na						
2040	Low	27	Lower Currituck Peninsula - Central	Internal	5,705	896	1,078	268	2,096	2,463	2,506	2,230	2,382	201,232	5,471	186,214	262	0	0	na	na	na	na	na	12	54%	73%	76%	63%	43%						
2040	Low	28	Camden County, NC	External																											15,481	5,569	6,842	$236,904	$236,904	16,074
2040	Low	29	Balance of Massachusetts	External																											2,466,500	1,547,841	1,051,086	$390,604	$390,604	1,660,656
2040	Low	30	Balance of Connecticut	External																											2,576,862	1,854,893	1,061,841	$455,177	$455,177	1,788,549
2040	Low	31	Albemarle Peninsula, NC	External																											20,755	12,018	9,119	$250,982	$250,982	14,677
2040	Low	32	Knotts Island	External																											2,287	670	846	$211,902	$211,902	1,942
2040	Low	33	Balance of Maryland	External																											781,669	469,775	330,158	$322,643	$322,643	546,106
2040	Low	34	Balance of Delaware	External																											501,709	260,924	216,065	$302,618	$302,618	385,674
2040	Low	35	Balance of New Jersey	External																											944,709	709,784	355,810	$553,540	$553,540	552,179
2040	Low	36	Balance of Virginia	External																											2,398,804	1,485,377	1,030,474	$273,076	$273,076	1,780,669
2040	Low	37	Balance of North Carolina	External																											6,854,436	4,020,170	2,867,046	$294,398	$294,398	5,188,827
2040	Low	38	Balance of South Carolina	External																											5,123,557	3,034,780	2,129,482	$300,760	$300,760	3,671,229
2040	Low	39	Georgia	External																											12,323,163	7,096,257	4,656,381	$343,201	$343,201	8,311,279
2040	Low	40	Balance of West Virginia	External																											1,636,038	1,007,331	708,982	$292,378	$292,378	1,145,945
2040	Low	41	Balance of Ohio	External																											4,718,557	3,047,240	1,948,583	$301,765	$301,765	3,486,868
2040	Low	42	Michigan	External																											9,696,025	5,767,051	4,011,888	$341,059	$341,059	7,066,738
2040	Low	43	Balance of Pennsylvania	External																											3,427,807	2,247,906	1,399,280	$300,887	$300,887	2,175,892
2040	Low	44	Balance of New York State	External																											5,480,487	3,570,371	2,187,003	$347,974	$347,974	3,535,447
2040	Low	45	Balance of New Hampshire	External																											1,069,024	753,109	455,267	$387,149	$387,149	820,512
2040	Low	46	Marketplace @ Southern Shores / Walmart / Retail	Internal	na	na	na	na	592	701	704	629	0	0	0	364,834	na	na	0	na	na	na	na	na	na	na	na	na	na	na						
2040	Low	47	Washington, DC-VA-MD-WV MSA	External																											7,071,349	5,111,346	2,813,825	$549,597	$608,426	4,742,817
2040	Low	48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External																											5,886,373	4,092,232	2,376,178	$481,585	$525,547	3,600,202
2040	Low	49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External																											19,283,316	11,985,844	7,213,516	$569,218	$672,170	8,572,291
2040	Low	50	Baltimore-Towson, MD MSA	External																											3,192,833	2,052,295	1,338,850	$454,340	$482,240	2,139,904
2040	Low	51	Richmond, VA MSA	External																											1,680,765	1,036,064	700,121	$373,113	$384,463	1,268,089
2040	Low	52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External																											1,987,953	1,327,441	814,371	$366,064	$369,657	1,415,100
2040	Low	53	Pittsburgh, PA MSA	External																											2,134,212	1,623,736	899,170	$433,704	$443,775	1,397,673
2040	Low	54	Raleigh-Cary, NC MSA	External																											1,617,528	968,623	642,734	$366,852	$385,169	1,181,662
2040	Low	55	Cleveland-Elyria-Mentor, OH MSA	External																											1,823,989	1,398,155	780,159	$397,996	$399,815	1,270,057
2040	Low	56	Harrisburg-Carlisle, PA MSA	External																											570,626	450,648	247,049	$338,487	$338,890	422,030
2040	Low	57	Allentown-Bethlehem-Easton, PA-NJ MSA	External																											986,410	533,684	391,900	$378,439	$377,100	684,239
2040	Low	58	Columbus, OH MSA	External																											2,074,924	1,452,717	904,044	$344,434	$352,757	1,584,039
2040	Low	59	Lancaster, PA MSA	External																											581,367	391,028	234,222	$355,688	$355,688	407,836
2040	Low	60	Charlottesville, VA MSA	External																											235,594	173,503	104,057	$370,667	$383,036	193,491
2040	Low	61	York-Hanover, PA MSA	External																											510,680	278,499	214,933	$311,661	$311,661	399,915
2040	Low	62	Bridgeport-Stamford-Norwalk, CT MSA	External																											863,429	704,281	325,015	$974,307	$974,307	574,610
2040	Low	63	Boston-Cambridge-Quincy, MA-NH MSA	External																											4,566,483	3,468,935	1,888,694	$523,753	$537,071	2,924,680
2040	Low	64	Cincinnati-Middletown OH-KY-IN MSA	External																											2,343,367	1,547,696	1,001,822	$412,338	$412,038	1,759,387
2040	Low	65	Charlotte-Gastonia-Concord NC-SC MSA	External																											2,381,198	1,516,632	968,802	$356,873	$360,470	1,727,655
2040	Low	66	Akron, OH MSA	External																											633,385	486,403	275,765	$394,348	$393,334	492,043
2040	Low	67	Rochester, NY MSA	External																											924,137	682,957	357,628	$395,759	$410,296	588,124
2040	Low	68	Reading, PA MSA	External																											417,012	266,292	161,514	$360,128	$360,128	280,864
2040	Low	69	Durham-Chapel Hill, NC MSA	External																											672,282	536,398	285,401	$352,666	$369,882	500,355
2040	Low	70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Co., NC	External																											95,965	50,718	42,269	$271,520	$271,520	72,197
2040	**Low**		**Total/Average**		**72,053**	**102,740**	**123,656**	**30,777**	**45,210**	**53,428**	**53,907**	**48,104**	**31,676**	**$291,306**	**72,823**	**5,182,245**	**2,878**	**20,874**	**92,191**	**32%**	**79%**	**97%**	**55%**	**9%**	**4,008**	**54%**	**73%**	**76%**	**63%**	**43%**	**122,631,035**	**79,065,359**	**49,432,846**	**$410,187**	**$433,040**	**80,397,860**

Source: East Carolina Univ., Woods and Poole, Delta Associates, February 2010.

TABLE C-25

MID-CURRITUCK BRIDGE PROJECT
LAND USE AND DEMOGRAPHIC FORECAST – LOW CASE
NOTES ON DATA INPUTS

Internal Zones

The methodology in the low case is essentially identical to the methodology in the base case, replacing the base case multiplier with the low case multiplier. The following variables slightly differ from the base case and are detailed below.

Seasonal (or Non-Resident) Population — Redevelopment assumes that within 12 years after a home reaches 50 years old, it will be redeveloped with 50% more bedrooms.

Average Household Income — Average (mean) household income forecasts at the county level were estimated based on base case household income and the ratio of low case total income to base case total income. The base case total income is calculated by multiplying base case employment by the ratio of Woods & Poole's total income to Woods & Poole's employment. The low case total income is calculated by multiplying low case employment by the ratio of base case total income to base case employment. The distribution among zones was based on the value of residential properties extracted from the county property tax files. The current relationship between zonal income and county income has been held constant for the forecasted base case years. The total is a weighted average, weighted by the number of households in each zone.

External Zones

The methodology in the low case is essentially identical to the methodology in the base case, replacing the base case multiplier with the low case multiplier. The following variables slightly differ from the base case and are detailed below.

Average Household Income - Forecast data were estimated by multiplying the base case average household income by the ratio of the low case total income to base case total income. The base case total income is calculated by multiplying base case employment by the ratio of Woods & Poole's total income to Woods & Poole's employment. The low case total income is calculated by multiplying low case employment to the ratio of base case total income to base case employment. The total is a weighted average, weighted by the number of households.

Appendix D:

Future Development Assumptions

TABLE D-1

RESIDENTIAL DEVELOPMENT CAPACITY IN THE STUDY AREA
CURRITUCK COUNTY, NC

TAZ	Description	Vacant Lots in Subdivisions	Vacant Land Not In Subdivisions (Acres) [2/]	Potential Lots [3/]	Development Capacity (Lots) [4/]
4	Sanderling North	0	0.7	1	1
5	Corolla South	1,513	77.0	154	1,667
6	Corolla South Central	281	9.5	19	300
7	Corolla North Central	465	7.3	15	480
8	Corolla North	231	21.9	44	275
9	Carova, 4wd area	2,548	1,170.6	390	2,938
19	Lower Currituck Peninsula - South	916	415.2	1,246	2,162
21	Moyock Township	1,510	1,895.8	5,687	7,197
25	Crawford Township	1,140	2,020.8	6,062	7,202
26	Lower Currituck Peninsula - North	259	2,292.6	6,878	7,137
27	Lower Currituck Peninsula - Central	1,652	934.1	2,802	4,454
32	Knotts Island	91	62.4	187	278
TOTAL		**10,606**	**8,907.9**	**23,486**	**34,092**

1/ Excludes land owned by government, utilities, churches, non-profit groups, and property owner associations.
2/ Excluding land in residential subdivision lots.
3/ Residential land not in subdivisions, at two to three units per acre, except Zone 9, which is 1 unit per 3 acres.
4/ Vacant Lots in Subdivisions plus Potential Lots.

Source: Delta Associates, December 2009.

DA29251

TABLE D-2

VESTED RESIDENTIAL SUBDIVISIONS IN THE STUDY AREA
TOTAL LOTS, IMPROVED LOTS, AND VACANT LOTS
CURRITUCK COUNTY, NORTH CAROLINA

TAZ	Arup Zone Description	Total Lots	Improved Lots																			Vacant Lots
			Pre 1992	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	CO's 2004	CO's 2005	CO's 2006	CO's 2007	CO's 2008	Totals	
4	Sanderling North	65	0	0	0	0	0	0	0	15	16	15	5	3	4	3	3	1	0	0	65	0
5	Corolla South	2,968	573	48	50	91	75	77	103	73	70	58	63	47	42	31	25	17	5	7	1,455	1,513
6	Corolla South Central	639	0	0	0	0	0	47	39	32	27	26	12	15	45	45	22	24	15	9	358	281
7	Corolla North Central	1,571	400	55	43	78	42	42	55	46	49	46	43	87	32	26	24	26	6	6	1,106	465
8	Corolla North	988	283	48	47	68	45	28	24	18	20	13	12	31	31	32	25	24	5	3	757	231
9	Carova, 4wd area	3,150	277	5	7	10	17	12	16	23	19	17	19	29	18	24	34	37	19	19	602	2,548
19	Lower Currituck Peninsula - South	1,487	268	8	13	11	32	19	18	26	32	12	17	18	14	9	10	36	18	10	571	916
21	Moyock Township	3,042	548	79	50	62	31	33	31	38	33	78	75	158	116	50	16	54	44	36	1,532	1,510
25	Crawford Township	2,513	748	25	43	52	23	34	36	18	27	25	28	49	63	27	26	75	44	30	1,373	1,140
26	Lower Currituck Peninsula - North	392	48	1	4	6	2	2	7	4	5	1	4	16	16	4	3	7	1	2	133	259
27	Lower Currituck Peninsula - Central	2,565	465	19	13	15	9	26	25	20	26	24	34	39	58	33	17	36	40	14	913	1,652
32	Knotts Island	228	56	3	10	15	2	2	6	8	3	2	4	4	2	1	2	10	4	3	137	91
TOTAL		**19,608**	**3,666**	**291**	**280**	**408**	**278**	**322**	**360**	**321**	**327**	**317**	**316**	**496**	**441**	**285**	**207**	**347**	**201**	**139**	**9,002**	**10,606**

Note: CO = Certificate of Occupancy.

Source: Delta Associates, December 2009.

TABLE D-3

COMMERCIAL/RETAIL DEVELOPMENT CAPACITY
CURRITUCK COUNTY, NC

TAZ	Description	Vacant Commercial Land (Acres) [1/]	Development Capacity (SF) [2/]
4	Sanderling North	2.4	20,909
5	Corolla South	0.0	0
6	Corolla South Central	8.6	74,749
7	Corolla North Central	8.5	74,313
8	Corolla North	15.5	135,297
9	Carova, 4wd area	0.0	0
19	Lower Currituck Peninsula - South	1,127.3	9,821,212
21	Moyock Township	503.6	4,387,363
25	Crawford Township	379.6	3,307,424
26	Lower Currituck Peninsula - North	219.9	1,915,682
27	Lower Currituck Peninsula - Central	581.1	5,062,282
32	Knotts Island	2.2	18,992
Total		**2,848.7**	**24,818,223**

1/ Excludes land owned by government, utilities, churches, non-profit organizations, and property owner associations. Also excludes land zoned for industrial, recreational, hotel, and other non-retail uses.
2/ Based on 0.2 floor-area-ratio for retail/commercial.

Source: Delta Associates, December 2009.

TABLE D-4

RESIDENTIAL AND COMMERCIAL DEVELOPMENT CAPACITY IN THE STUDY AREA
DARE COUNTY, NC

TAZ	Description	Total Vacant Land (Acres)[1/]			Residential Lots in Subdivisions	Residential Land Not in Subdivisions (Acres) [2/]	Potential Lots [3/]	Future Development Capacity	
		Residential	Commercial	Total				Total Lots [4/]	Commercial (Sq. Ft.) [5/]
1	Southern Shores	337.6	16.7	354.3	594	0.0	0	594	145,316
2	Duck	55.8	1.2	57.0	152	0.0	0	152	10,367
3	Sanderling South	35.4	--	35.4	96	0.0	0	96	0
10	Kitty Hawk	872.7	44.0	916.7	598	562.4	1,125	1,723	383,328
11	Kill Devil Hills North	151.2	18.6	169.8	629	24.7	74	703	162,305
12	Collington	425.9	--	425.9	633	170.8	342	975	0
13	Kill Devil Hills South	130.3	20.7	151.0	330	15.8	47	377	179,903
14	Nags Head	154.9	21.3	176.2	250	45.5	114	364	185,304
15	Nags Head / Whalebone	98.6	31.5	130.1	218	14.7	37	255	274,602
16	Manteo	1,007.0	76.7	1,083.7	802	615.9	1,232	2,034	668,559
17	Wanchese	1,571.7	47.2	1,618.9	97	1,272.0	2,544	2,641	411,206
18	Bodie Island	36.6	0.5	37.1	76	7.9	20	96	4,617
46	Marketplace @ So. Shores / Walmart	--	1.3	1.3	0	0.0	0	0	11,500
TOTAL		**4,877.7**	**279.7**	**5,157.4**	**4,475**	**2,729.6**	**5,534**	**10,009**	**2,437,008**

1/ Excludes land owned by government, utilities, churches, non-profit organizations, and property owner associations.
Also excludes land classified as marshland.
2/ Excluding land in residential subdivision lots.
3/ Residential land not in subdivisions, at two to three units per acre, depending on zone.
4/ Residential Lots in Subdivisions plus Potential Lots.
5/ Based on 0.2 floor-area-ratio for retail/commercial use.

Source: Delta Associates, December 2009.

TABLE D-5

NEW HOTEL AND RETAIL DEVELOPMENT ASSUMPTIONS FOR THE STUDY AREA
BASE CASE FORECASTS

Type	2009-2015 [1/]	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040	Total 2009-2040
Hotel Rooms	100 - Zone 5 150 - Zone 10	100 - Zone 21 125 - Zone 11	150 - Zone 15	125 - Zone 11 125 - Zone 13	150 - Zone 10 150 - Zone 14	125 - Zone 13	
Total	**250**	**225**	**150**	**250**	**300**	**125**	**1,300**
Retail SF [2/]	70,000 - Zone 7 50,000 - Zone 13 75,000 - Zone 14	45,000 - Zone 1 125,000 - Zone 8 150,000 - Zone 21 100,000 - Zone 11 100,000 - Zone 15	50,000 - Zone 11 70,000 - Zone 6 100,000 - Zone 25 100,000 - Zone 1 75,000 - Zone 14	100,000 - Zone 19 125,000 - Zone 13 100,000 - Zone 17	125,000 - Zone 21 100,000 - Zone 10	100,000 - Zone 21 100,000 - Zone 15	
Total	**195,000**	**520,000**	**395,000**	**325,000**	**225,000**	**200,000**	**1,860,000**

1/ Includes a 100-room hotel currently planned in Zone 5. No other hotels are firmly planned.

2/ Assumes that 2,000 to 3,000 new households are required to support a 100,000 to 150,000 SF retail center. Retail centers will contain a variety of uses including services, small offices, and medical tenants, in addition to retail establishments.

Source: Delta Associates, December 2009.

TABLE D-6

NEW HOTEL AND RETAIL DEVELOPMENT ASSUMPTIONS FOR THE STUDY AREA
HIGH FORECASTS

Type	2009-2015 [1/]	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040	Total 2009-2040
Hotel Rooms	100 - Zone 5 150 - Zone 10	100 - Zone 21 125 - Zone 11	100 - Zone 25 150 - Zone 15 100 - Zone 13 150 - Zone 10 100 - Zone 16	125 - Zone 11 125 - Zone 13 100 - Zone 21	300 - Zone 9 150 - Zone 10 150 - Zone 14	125 - Zone 13	
Total	**250**	**225**	**600**	**350**	**600**	**125**	**2,150**
Retail SF [2/]	125,000 - Zone 8 70,000 - Zone 7 75,000 - Zone 14 50,000 - Zone 13 100,000 - Zone 15	45,000 - Zone 1 70,000 - Zone 6 150,000 - Zone 21 100,000 - Zone 11 100,000 - Zone 15 100,000 - Zone 19 150,000 - Zone 16	125,000 - Zone 13 100,000 - Zone 19 150,000 - Zone 25 100,000 - Zone 1 75,000 - Zone 14 100,000 - Zone 17 50,000 - Zone 11	100,000 - Zone 10 75,000 - Zone 15 40,000 - Zone 9 100,000 - Zone 25 150,000 - Zone 16	100,000 - Zone 25 125,000 - Zone 21 100,000 - Zone 9	100,000 - Zone 9 100,000 - Zone 17	
Total	**420,000**	**715,000**	**700,000**	**465,000**	**325,000**	**200,000**	**2,825,000**

1/ Includes a 100-room hotel currently planned in Zone 5. No other hotels are firmly planned.

2/ Assumes that 2,000 to 3,000 new households are required to support a 100,000 to 150,000 SF retail center. Retail centers will contain a variety of uses including services, small offices, and medical tenants, in addition to retail establishments.

Source: Delta Associates, December 2009.

TABLE D-7

NEW HOTEL AND RETAIL DEVELOPMENT ASSUMPTIONS FOR THE STUDY AREA
LOW FORECASTS

Type	2009-2015 [1/]	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040	Total 2009-2040
Hotel Rooms	100 - Zone 5 150 - Zone 10	100 - Zone 21	150 - Zone 15	125 - Zone 11	150 - Zone 14	125 - Zone 13	
Total	**250**	**100**	**150**	**125**	**150**	**125**	**900**
Retail SF [2/]	75,000 - Zone 14 70,000 - Zone 7	45,000 - Zone 1 70,000 - Zone 6 150,000 - Zone 21 100,000 - Zone 15	50,000 - Zone 11 100,000 - Zone 17 100,000 - Zone 19 100,000 - Zone 25	100,000 - Zone 15 125,000 - Zone 21	150,000 - Zone 13	100,000 - Zone 10	
Total	**145,000**	**365,000**	**350,000**	**225,000**	**150,000**	**100,000**	**1,335,000**

1/ Includes a 100-room hotel currently planned in Zone 5. No other hotels are firmly planned.

2/ Assumes that 2,000 to 3,000 new households are required to support a 100,000 to 150,000 SF retail center. Retail centers will contain a variety of uses including services, small offices, and medical tenants, in addition to retail establishments.

Source: Delta Associates, December 2009.

TABLE D-8

LODGING PROPERTIES IN THE STUDY AREA
(HOTELS, MOTELS, COTTAGE COURTS, AND B&B'S)
CURRITUCK AND DARE COUNTIES

		Address					Number of
Property Name	Zone	Street	Town	State	Zip	Type	Rooms
Advice 5 Cents	2	111 Scarborough Lane	Duck	NC	27949	B&B	4
The Duck Inn	2	1158 Duck Road	Duck	NC	27949	B&B	3
The Sleeping Duck	2	1152 Duck Road	Duck	NC	27949	B&B	3
The Sanderling Resort & Spa	3	1461 Duck Road	Duck	NC	27949	Hotel	93
Hampton Inn & Suites	4	333 Audubon Drive	Corolla	NC	27927	Hotel	123
Midway Marina Motel	25	157 Coinjock Development Road	Coinjock	NC	27923	Hotel	4
Sea Oats Motel	19	112 N. River Road	Jarvisburg	NC	27947	Hotel	12
Walnut Island Lodge	27	169 Walnut Island Boulevard	Grandy	NC	27939	Hotel	12
Palmer Inn Bed and Breakfast	25	3861 Caratoke Highway	Barco	NC	27917	B&B	4
Trish's Bed And Breakfast	21	192 Caratoke Highway	Moyock	NC	27958	B&B	4
Barnes Hunting Lodge	32	108 Barnes Lane	Knotts Island	NC	27950	Hotel	5
The Inn at Corolla Light	8	1066 Ocean Trail	Corolla	NC	27927	Hotel	43
3 Seasons Bed & Breakfast	10	4628 Seascape Drive	Kitty Hawk	NC	27949	B&B	5
Bald View B&B	10	3805 Elijah Baum Road	Kitty Hawk	NC	27949	B&B	4
Cypress Moon Inn	10	1206 Harbor Court	Kitty Hawk	NC	27949	B&B	3
Outer Banks Intl Hostel	10	1004 W Kitty Hawk Road	Kitty Hawk	NC	27950	B&B	54
Ramona's Cottage	10	1205 Harbor Court	Kitty Hawk	NC	27949	B&B	1
Saltaire Cottage Court	10	Milepost 2.5	Kitty Hawk	NC	27949	CC	22
Beach Haven Motel	10	4104 N. Virginia Dare Trail	Kitty Hawk	NC	27949	Hotel	6
Buccaneer Motel & Beach Suites	10	3512 N. Virginia Dare Trail	Kitty Hawk	NC	27949	Hotel	27
Hilton Garden Inn	10	5353 N. Virgina Dare Trail	Kitty Hawk	NC	27949	Hotel	180
Holiday Inn Express Kittyhawk	10	3919 N. Croaton Hwy	Kitty Hawk	NC	27949	Hotel	98
Sea Kove Motel	10	4600 Lindbergh Avenue	Kitty Hawk	NC	27949	Hotel	22
Cypress House Inn	11	500 N. Virginia Dare Trail	Kill Devil Hills	NC	27948	B&B	10
Best Western Ocean Reef Suites	11	107 N. Virginia Dare Trail	Kill Devil Hills	NC	27948	Hotel	71
Cavalier Motel	11	601 N. Virginia Dare Trail	Kill Devil Hills	NC	27948	Hotel	66
Days Inn & Suites Mariner	11	1801 N. Virginia Dare Trail	Kill Devil Hills	NC	27948	Hotel	77
Days Inn Oceanfront Wright Brothers	11	101 N. Virginia Dare Trail	Kill Devil Hills	NC	27948	Hotel	54
Driftin' Sands Motel	11	1906 N. Virginia Dare Trail	Kill Devil Hills	NC	27948	Hotel	10
Nettlewood Motel	11	1718 N Virginia Dare Trl	Kill Devil Hills	NC	27948	Hotel	38
Sea Ranch Hotel	11	1731 N. Virginia Dare Trail	Kill Devil Hills	NC	27948	Hotel	50
See Sea Motel	11	1234 N. Virginia Dare Trail	Kill Devil Hills	NC	27948	Hotel	20
The Carolina Oceanfront	11	401 N. Virgina Dare Trail	Kill Devil Hills	NC	27948	Hotel	119
Travelodge Nags Head Beach Hotel	11	804 N. Virginia Dare Trial	Kill Devil Hills	NC	27948	Hotel	96
Colington Creek Inn	12	1293 Colington Road	Kill Devil Hills	NC	27948	B&B	4
Atlantic Street Inn	13	205 E. Atlantic Street	Kill Devil Hills	NC	27948	B&B	6
Wright Cottage Court / Wright House	13	Beach Road	Kill Devil Hills	NC	27948	CC	19
Colony IV by the Sea	13	405 S. Virginia Dare Trail	Kill Devil Hills	NC	27948	Hotel	95
Comfort Inn On the Ocean	13	1601 S. Virginia Dare Trail	Kill Devil Hills	NC	27948	Hotel	105
Ebb Tide Motel	13	2028 S. Virginia Dare Trail	Kill Devil Hills	NC	27948	Hotel	45
John Yancy Quality Inn	13	2009 S. Virginia Dare Trail	Kill Devil Hills	NC	27948	Hotel	108
Ocean House Oceanfront Motel	13	1901 S. Virginia Dare Trail	Kill Devil Hills	NC	27948	Hotel	43
Outer Banks Motor Lodge	13	1509 S. Virginia Dare Trail	Kill Devil Hills	NC	27948	Hotel	63
Ramada Plaza Nags Head Beach	13	1701 S. Virginia Dare Trail	Kill Devil Hills	NC	27948	Hotel	171
Nags Head Beach Inn	14	303 E. Admiral Street	Nags Head	NC	27959	B&B	8
Sandbar Bed and Breakfast	14	2508 S. Virginia Dare Trail	Nags Head	NC	27959	B&B	3
Nags Head Fishing Pier Cottages	14	3335 S. Virginia Dare Trail	Nags Head	NC	27959	CC	6
Pelican Cottages	14	3513 S Virginia Dare Trail	Nags Head	NC	27960	CC	3
Beacon Motor Lodge	14	2617 S. Virginia Dare Trail	Nags Head	NC	27959	Hotel	51
Colonial Inn Motel	14	3329 S. Virginia Dare Trail	Nags Head	NC	27959	Hotel	39
Cahoon's Cottages	15	7213 S. Virginia Dare Trail	Nags Head	NC	27959	CC	11
My Lagoon	15	7000 S. Virginia Dare Trail	Nags Head	NC	27959	CC	3
Ocean Side Court	15	6401 S. Virginia Dare Trail	Nags Head	NC	27959	CC	11
Blue Heron Motel	15	6811 S. Virginia Dare Trail	Nags Head	NC	27959	Hotel	30
Fin 'n Feather Waterside Inn	15	7740 S. Virginia Dare Trail	Nags Head	NC	27959	Hotel	10
First Colony Inn	15	6720 S. Virginia Date Trail	Nags Head	NC	27959	Hotel	30
Islander Motel	15	7001 S. Virginia Dare Trail	Nags Head	NC	27959	Hotel	25
Manor Motel	15	6321 S. Virginia Dare Trail	Nags Head	NC	27959	Hotel	16
Nags Head Inn	15	4701 S. Virginia Dare Trail	Nags Head	NC	27959	Hotel	100
Oasis Suites	15	7721 S. Virginia Dare Trail	Nags Head	NC	27959	Hotel	17
Owens' Motel	15	7115 S. Virginia Dare Trail	Nags Head	NC	27959	Hotel	65
Sandspur Motel & Cottage Court	15	6607 S. Virginia Dare Trail	Nags Head	NC	27959	Hotel	19
Sea Foam Motel	15	7111 S. Virginia Dare Trail	Nags Head	NC	27959	Hotel	53
Surf Side Hotel	15	6701 S. Virginia Dare Trail	Nags Head	NC	27959	Hotel	82
Tar Heel Motel	15	7010 S. Virginia Dare Trail	Nags Head	NC	27959	Hotel	37
Travelers Oceanside Inn	15	7218 S. Virginia Dare Trail	Nags Head	NC	27959	Hotel	29
Burrus House Inn Water Front	16	509 US 64/264	Manteo	NC	27954	B&B	9
Cameron House Inn	16	300 Budleigh Street	Manteo	NC	27954	B&B	7
Roanoke Island Inn	16	305 Fernando Street	Manteo	NC	27954	B&B	9
Scarborough House	16	323 Fernando Street	Manteo	NC	27954	B&B	6
The Booth House	16	135 Morrison Grove Road	Manteo	NC	27954	B&B	9
The Outdoors Inn	16	406 Uppowoc Street	Manteo	NC	27954	B&B	2
Tranquil House Inn	16	405 Queen Elizabeth Ave	Manteo	NC	27954	B&B	25
White Doe Inn	16	319 Sir Walter Raleigh Street	Manteo	NC	27954	B&B	8
Island Guest House and Cottages	16	706 US 64/264	Manteo	NC	27954	CC	15
Dare Haven Motel	16	Rt. 64/264	Manteo	NC	27954	Hotel	28
Duke Of Dare Motor Lodge	16	100 South Virginia Dare Rd.	Manteo	NC	27954	Hotel	57
Elizabethan Inn	16	814 N Main Highway	Manteo	NC	27954	Hotel	79
Scarborough Inn	16	524 US 64	Manteo	NC	27954	Hotel	14
Island House of Wanchese B&B	17	Old Wharf Rd.	Wanchese	NC	27981	B&B	4
Wanchese Inn B&B	17	85 Jovers Lane	Wanchese	NC	27981	B&B	4
Relaxinn	18	8008 S. Old Oregon Inlet Road	Nags Head	NC	27959	B&B	3
Geri's Place	18	10321 S. Old Oregon Inlet Road	Nags Head	NC	27959	CC	14
High Tide Cottages	18	8228 S. Old Oregon Inlet Road	Nags Head	NC	27959	CC	2
JP Cottages	18	9023 S. Old Oregon Inlet Road	Nags Head	NC	27959	CC	6
Comfort Inn South	18	8031 S. Old Oregon Inlet Road	Nags Head	NC	27959	Hotel	105
Dolphin Oceanfront Hotel	18	8017 S. Old Oregon Inlet Road	Nags Head	NC	27959	Hotel	45
Whalebone Motel	18	8201 S. Old Oregon Inlet Road	Nags Head	NC	27959	Hotel	12
TOTAL ROOMS							**3,108**

Source: Outer Banks Visitors Bureau, Currituck Co. Travel and Tourism, Delta Associates, February 2010.

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TABLE D-9

RV/CAMPGROUND FACILITIES IN THE STUDY AREA
CURRITUCK AND DARE COUNTIES

Property Name	Zone	Address				Type	Number of Spaces
		Street	Town	State	Zip		
Adventure Bound Campground	10	1004 W. Ktty Hawk Road	Kitty Hawk	NC	27949	RV/C	20
Joe & Kay's Campground	12	1193 Colington Road	Kill Devil Hills	NC	27948	RV/C	20
Kitty Hawk RV Park, Inc.	10	3945 Croatan Parkway	Kitty Hawk	NC	27949	RV/C	18
Refuge on Roanoke Island Campground	16	2881 NC Hwy. 345	Wanchese	NC	27954	RV/C	59
TOTAL SPACES							**117**

SOURCE: Outer Banks Visitors Bureau, Currituck Co. Travel and Tourism, Delta Associates, February 2009.

DA29251
Appdx D - Devel AssumD9 RV-Camp

Appendix E:

GDP and GRP Forecasts

GROSS DOMESTIC PRODUCT AND GROSS REGIONAL PRODUCT TRENDS AND FORECASTS
UNITED STATES AND CURRITUCK AND DARE COUNTIES
2000-2040

BASE CASE

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
USGDP (millions)	$10,567,249	$10,678,640	$10,885,474	$11,174,313	$11,607,042	$11,986,355	$12,373,537	$12,635,469	$12,628,460	$12,425,892	
USGDP % Growth		1.05%	1.94%	2.65%	3.87%	3.27%	3.23%	2.12%	-0.06%	-1.60%	
GRP (millions) 1/	$1,266	$1,345	$1,477	$1,608	$1,674	$1,724	$1,777	$1,753	$1,656	$1,609	
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	
USGDP (millions)	$12,823,520	$13,195,403	$13,564,874	$13,917,696	$14,197,720	$14,027,306	$14,476,179	$14,895,989	$15,313,076	$15,711,369	
USGDP % Growth	3.20%	2.90%	2.80%	2.60%	2.01%	-1.20%	3.20%	2.90%	2.80%	2.60%	
GRP (millions) 1/	$1,672	$1,731	$1,790	$1,847	$1,895	$1,882	$1,952	$2,019	$2,086	$2,150	
	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	
USGDP (millions)	$16,027,482	$15,835,105	$16,341,829	$16,815,742	$17,286,582	$17,736,206	$18,093,059	$17,875,889	$18,447,917	$18,982,907	
USGDP % Growth	2.01%	-1.20%	3.20%	2.90%	2.80%	2.60%	2.01%	-1.20%	3.20%	2.90%	
GRP (millions) 1/	$2,204	$2,188	$2,268	$2,344	$2,420	$2,493	$2,553	$2,533	$2,624	$2,709	
	2030	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
USGDP (millions)	$19,514,428	$20,021,998	$20,424,841	$20,179,683	$20,825,433	$21,429,370	$22,029,392	$22,602,377	$23,057,137	$22,780,383	$23,509,355
USGDP % Growth	2.80%	2.60%	2.01%	-1.20%	3.20%	2.90%	2.80%	2.60%	2.01%	-1.20%	3.20%
GRP (millions) 1/	$2,795	$2,878	$2,945	$2,919	$3,022	$3,119	$3,216	$3,308	$3,384	$3,352	$3,468

1/ Currituck County and Dare County.

HIGH CASE

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
USGDP (millions)	$10,567,249	$10,678,640	$10,885,474	$11,174,313	$11,607,042	$11,986,355	$12,373,537	$12,635,469	$12,628,460	$12,425,892	
USGDP % Growth		1.05%	1.94%	2.65%	3.87%	3.27%	3.23%	2.12%	-0.06%	-1.60%	
GRP (millions) 1/	$1,266	$1,345	$1,477	$1,608	$1,674	$1,724	$1,777	$1,753	$1,656	$1,609	
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	
USGDP (millions)	$13,007,041	$13,576,148	$14,145,671	$14,695,260	$15,136,071	$14,865,571	$15,560,822	$16,241,666	$16,923,008	$17,580,503	
USGDP % Growth	4.68%	4.38%	4.20%	3.89%	3.00%	-1.79%	4.68%	4.38%	4.20%	3.89%	
GRP (millions) 1/	$1,696	$1,781	$1,867	$1,950	$2,020	$1,994	$2,098	$2,201	$2,305	$2,406	
	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	
USGDP (millions)	$18,107,863	$17,784,252	$18,616,008	$19,430,528	$20,245,644	$21,032,230	$21,663,130	$21,275,983	$22,271,044	$23,245,486	
USGDP % Growth	3.00%	-1.79%	4.68%	4.38%	4.20%	3.89%	3.00%	-1.79%	4.68%	4.38%	
GRP (millions) 1/	$2,490	$2,457	$2,584	$2,709	$2,834	$2,956	$3,057	$3,014	$3,167	$3,318	
	2030	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
USGDP (millions)	$24,220,640	$25,161,663	$25,916,433	$25,453,274	$26,643,704	$27,809,466	$28,976,080	$30,101,862	$31,004,823	$30,450,728	$31,874,884
USGDP % Growth	4.20%	3.89%	3.00%	-1.79%	4.68%	4.38%	4.20%	3.89%	3.00%	-1.79%	4.68%
GRP (millions) 1/	$3,469	$3,616	$3,737	$3,682	$3,866	$4,047	$4,230	$4,406	$4,551	$4,481	$4,702

1/ Currituck County and Dare County.

LOW CASE

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
USGDP (millions)	$10,567,249	$10,678,640	$10,885,474	$11,174,313	$11,607,042	$11,986,355	$12,373,537	$12,635,469	$12,628,460	$12,425,892	
USGDP % Growth		1.05%	1.94%	2.65%	3.87%	3.27%	3.23%	2.12%	-0.06%	-1.60%	
GRP (millions) 1/	$1,266	$1,345	$1,477	$1,608	$1,674	$1,724	$1,777	$1,753	$1,656	$1,609	
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	
USGDP (millions)	$12,731,789	$13,007,033	$13,280,401	$13,540,604	$13,746,166	$13,621,560	$13,956,891	$14,258,620	$14,558,294	$14,843,534	
USGDP % Growth	2.46%	2.16%	2.10%	1.96%	1.52%	-0.91%	2.46%	2.16%	2.10%	1.96%	
GRP (millions) 1/	$1,660	$1,706	$1,752	$1,797	$1,834	$1,827	$1,882	$1,933	$1,983	$2,032	
	2020	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	
USGDP (millions)	$15,068,876	$14,932,280	$15,299,878	$15,630,641	$15,959,150	$16,271,837	$16,518,862	$16,369,122	$16,772,092	$17,134,682	
USGDP % Growth	1.52%	-0.91%	2.46%	2.16%	2.10%	1.96%	1.52%	-0.91%	2.46%	2.16%	
GRP (millions) 1/	$2,072	$2,063	$2,124	$2,179	$2,234	$2,287	$2,331	$2,319	$2,385	$2,446	
	2030	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
USGDP (millions)	$17,494,801	$17,837,577	$18,108,371	$17,944,223	$18,385,968	$18,783,448	$19,178,220	$19,553,978	$19,850,830	$19,670,886	$20,155,138
USGDP % Growth	2.10%	1.96%	1.52%	-0.91%	2.46%	2.16%	2.10%	1.96%	1.52%	-0.91%	2.46%
GRP (millions) 1/	$2,506	$2,564	$2,611	$2,596	$2,668	$2,734	$2,799	$2,862	$2,913	$2,894	$2,973

1/ Currituck County and Dare County.

Source: ECU Bureau of Business Research, Woods and Poole Economics, Delta Associates, December 2009.

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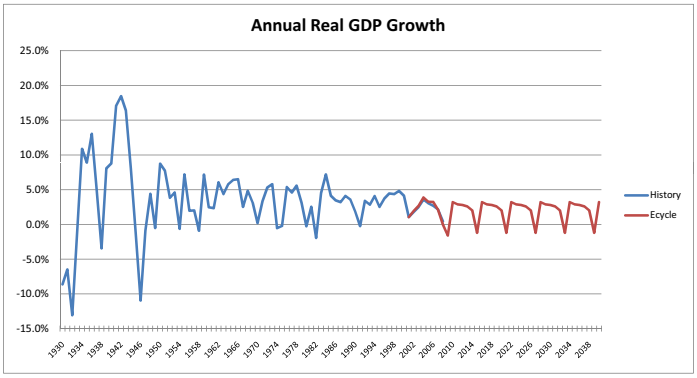
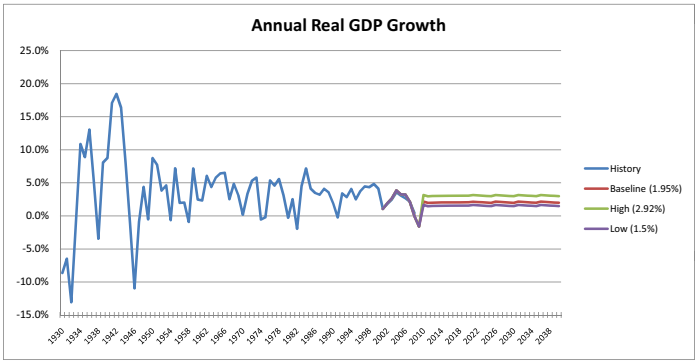
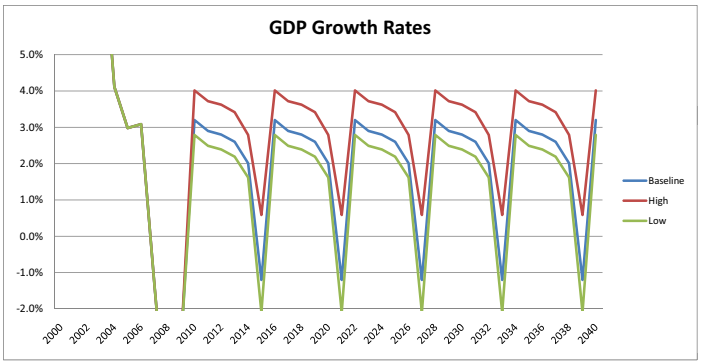
GROSS DOMESTIC PRODUCT AND GROSS REGIONAL PRODUCT TRENDS AND FORECASTS
UNITED STATES AND CURRITUCK AND DARE COUNTIES
2000-2040







Source: ECU Bureau of Business Research, Woods and Poole Economics, Delta Associates, December 2009.

DA29251
Appdx E - GDP GRP Forecast revData

Appendix F:

Documents Relied Upon

EXHIBIT F-1

DOCUMENTS RELIED UPON IN THE COURSE OF OUR WORK

1. Indirect and Cumulative Effects Technical Report
2. Administrative Action Draft Environmental Impact Report
3. Proposed Mid-Currituck Bridge Preliminary Traffic and Revenue Study
4. Proposed Mid-Currituck Bridge Preliminary Traffic and Revenue Study – 2008 Update
5. Mid-Currituck Sound Bridge Phase 2 Research Study
6. Economic Development Strategy "Vision Plan" for Currituck County, North Carolina
7. 2006 Land Use Plan – Currituck County
    A. Currituck County Zoning Map
    B. Map of Currituck County
    C. Map of Areas of Environment Concern (AEC)
    D. Map of Soil Suitability for Septic Systems
    E. Map of Quality Classes and Sub-basins
    F. Map of Flood Hazard Areas (100 year only)
    G. Map of Fragile Areas
    H. Map of N. Sanderling to S. Corolla – Shoreline Change Study and Setback Factors
    I. Map of S Corolla – Shoreline Change Study and Setback Factors
    J. Map of N Corolla – Shoreline Change Study and Setback Factors
    K. Map of N of Corolla to VA – Shoreline Change Study and Setback Factors
    L. Map of Existing Land Use
    M. Map of Water and Sewer Systems
    N. Map of Transportation
    O. Future Land Use Plan Map
8. Currituck County Unified Development Ordinance
9. Currituck County Major/Minor Residential Dwelling Counts
10. Currituck County Tax Parcel Files
11. Carova Undeveloped Lots (Currituck County)
12. Commercial Site Plans (Currituck County)
13. Dare County Draft Land Use Plan (January 2009)
14. Dare County Tax Parcel Files
15. Town of Duck Land Use Plan
16. Town of Duck Zoning Map
17. Town of Kill Devil Hills Land Use Plan
18. Town of Kill Devil Hills Zoning Map
19. Town of Manteo 20-Year Plan Update
20. Town of Manteo Core CAMA Land Use Plan Update 2007
21. Town of Manteo Zoning Map
22. Town of Nag's Head Land and Water Use Plan 2000
23. Town of Nag's Head 2006 Draft Land Use Plan
24. Town of Nag's Head Land Suitability Analysis Map
25. Town of Nag's Head Existing Land Use Map
26. Town of Nag's Head Future Land Use Map
27. 2010 Complete Economic and Demographic Data Source (CEDDS), Woods & Poole Economics, Inc. 2009.

Appendix J

Technical Memo #8 - Base Year Model Validation Report

Currituck Development Group

Mid Currituck Bridge

Technical Memo #8 - Base Year Model Validation Report

209783

Final | October 2010

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 209783

ARUP

Document Verification

ARUP

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		Signature			
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MCTM Zone List

Appendix C

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Appendix D

Journey Time Validation

Appendix E

Turning Movement Validation

Executive Summary

This technical note details the development and validation of the Base Year Mid-Currituck Transport Models (MCTM) according to the methodology agreed with CDG, Cambridge Systematics, NCTA and their advisors. This method was outlined in Technical Memo #15 Model Revision Note, dated May 2010.

In order for the impact of the Mid-Currituck Bridge (MCB) to be assessed, 15 base year models were developed to reflect existing (2009 and 2010) travel patterns and volumes in the Outer Banks using a methodology agreed with CDG, Cambridge Systematics, NCTA and their advisors during meetings in the Outer Banks during April 27-28th , 2010. The models developed incorporated detailed segmentation due to the varied characteristics of both the traffic volumes and the characteristics of those people making trips. Differentiation by season, day of week, time of day, the residency status of the trip maker and journey purpose was incorporated within the model to ensure a variety of responses could be modeled within the forecasting process.

The following models were developed:

Table A: Base Year Models

2010 Peak Weekday AM	2009 Shoulder-Peak Weekday AM
2010 Peak Weekday Midday	2009 Shoulder-Peak Weekday Midday
2010 Peak Weekday PM	2009 Shoulder-Peak Weekday PM
2010 Peak Saturday AM	2009 Shoulder-Peak Weekend AM
2010 Peak Saturday Midday	2009 Shoulder-Peak Weekend Midday
2010 Peak Saturday PM	2009 Shoulder-Peak Weekend PM
2010 Peak Sunday AM	
2010 Peak Sunday Midday	
2010 Peak Sunday PM	

The model development process incorporated extensive observed data collected in 2009 and 2010 including the project specific travel surveys undertaken in the Outer Banks. These included surveys of traffic volumes, vehicle category, turning movements and journey times as well as the Realtors contracts databases and the demographic datasets. All data was extensively logic checked against independent NCDOT data and was deemed suitable for use within the model development and validation process.

The MCTM models incorporate a four-stage model which includes trip generation, trip distribution and assignment and toll choice. The trip generation model utilized an intercept survey conducted in 2006 by Wilbur Smith Associates to ensure an observed trip distribution was incorporated, while out-of-scope traffic (which was not observed within the intercept survey) was generated using the demographic datasets and locally derived trip rates. Out-of-scope traffic was distributed at a 12 hour level using a gravity model before being disaggregated to the average hour model. All trips were then assigned, whereby the model allocates the trips between each pair of zones using the appropriate route. Although not applied in the base year, the MCTM also includes a toll choice model, which

apportions the trips between each pair of zones to those who will utilize the toll road, and those who will not.

Due to a lack of observed data, the Peak Sunday models were developed using an entirely synthetic approach. Inputs were drawn from the validated Peak Weekday and Saturday models, and a limited matrix estimation process was conducted.

The validation results highlight that the MCTM replicates base year conditions to a high standard. Model validation criteria was taken from the FSUTMS Cube Framework Phase II Model Calibration and Validation Standards Final Report (2008), developed by Cambridge Systematics.

In terms of link volume validation, all models are within the acceptability criteria (of 30%) for RMSE on an individual Peak hour basis with the exception of the Peak Weekday PM model which was only slightly outside the accepted criteria at 31%. When aggregating the model results to represent average daily traffic within each season and grouping sites based on average daily traffic, all models and groups met the required criteria. In terms of Percentage Error (the difference between observed and modeled flow taking into account the relative traffic volume based on average daily traffic), 86% of all validation sites were within the compliant standard.

93% of journey time routes (28 out of a total of 30) were within +/- 15%. This indicates that the base year models reproduced the current observed journey times in the study area to a high degree of accuracy. This is very important given that the main benefit of the MCB is the potential time savings compared with the existing route using the Wright Memorial Bridge.

In terms of the GEH statistic (a comparison of observed and modeled volumes taking into account the relative traffic volume at the time period level) for link flows, between 68% and 93% of validation locations meet the preferred GEH criteria (less than 5) across the 15 models, while over 91% of count locations meet the acceptable GEH standard (less than 10). The turning movement validation (at the US158 /NC12 intersection) highlighted that the models were generally representative of the observed data, with 14 out of 15 models showing 50% or more movements with a GEH less than 5. The key movements (Wright Memorial Bridge to NC-12 northbound and vice versa) are acceptable (GEH less than 10) in all models. Most models showed a GEH less than 5 for these movements.

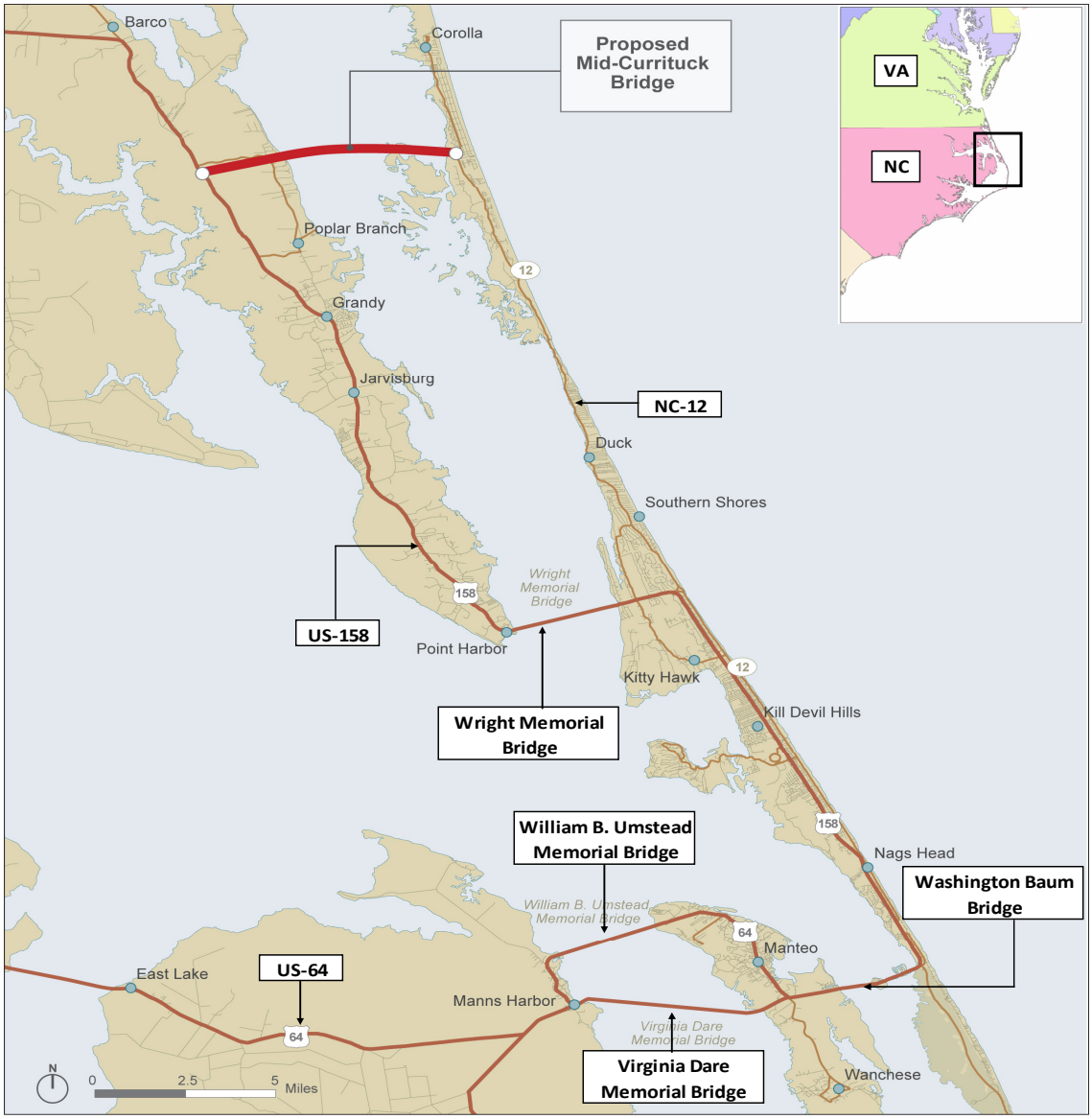
In conclusion, the methodology adopted is robust for the purpose of an investment grade study. It is consistent with the proposed methodology which was agreed with the wider traffic and revenue study team, NCTA and their advisors. The MCTM has been validated to a high standard and replicates the unique characteristics of the Outer Banks. It is therefore suitable as a base from which to forecast future year traffic flows to informing funding decisions regarding the proposed bridge.

1 Introduction

1.1 Project Background

The North Carolina Turnpike Authority (NCTA) is authorized to study, plan, develop and undertake preliminary design work on the Mid-Currituck Bridge, a proposed toll facility in the Outer Banks. The Mid-Currituck Bridge is located in northeastern NC and would connect the Currituck County mainland, to Currituck County on the Outer Banks (see Figure 1).

Figure 1: Study Area



The Outer Banks is a 200-mile (320-km) long string of narrow barrier islands off the coast of North Carolina. They cover approximately half the northern North Carolina coastline, separating the Albemarle Sound and Pamlico Sound from the Atlantic Ocean. The majority of the Outer Banks island communities, from

Corolla to Nags Head, are prime summer vacation destinations. At the moment there are two crossings south of the Virginia border; the Wright Memorial Bridge (around 32 miles south of the Virginia border) and the Washington Baum Bridge further south. Both crossings are untolled facilities.

1.2 The Project and Wider Area of Influence

The proposed Mid-Currituck Bridge involves the construction of approximately seven miles of new road from US-158 on mainland Currituck County, to NC-12 on the Outer Banks (Figure 1).

This area currently has very limited road access. US-158 and NC-12 are the only means of north-south travel to the Outer Banks. According to preliminary analysis, the new bridge will save approximately 35 miles and significant time for some journeys. It will also improve the evacuation time of the outer banks in the event of emergencies.

In the summer, the Outer Banks become heavily congested and the proposed bridge will significantly ease this congestion whilst facilitating continued growth within the area.

The Outer Banks attracts millions of vacationers throughout the year and significant growth has been observed in recent years. Traffic within the area is highly seasonal, with peak weekend flows between June and August about 125 percent higher on the existing Wright Memorial Bridge and the Outer Banks than traffic observed during the rest of the season. Similarly, weekend traffic is about seventy percent higher than weekday traffic.

The existing road infrastructure operates near or at capacity on NC-12 between US-158/NC-12 and Corolla during summer weekends. The new bridge will substantially improve traffic flow conditions on NC-12 and US-158 and, at the same time, reduce travel time between the mainland and the Outer Banks and improve the overall system efficiency with additional linkage. As a result, it will provide opportunities for sustainable additional development of the northern part of the Outer Banks and the mainland.

In this respect, the Project presents a unique marketing opportunity to leverage the existing Outer Banks travel/tourism industry with tailored marketing strategies to highlight substantial travel time savings, cost savings, and increased accessibility to this beautiful and unique destination.

1.3 Purpose of this Report

To forecast the impact of the Mid-Currituck Bridge, 15 base year models were developed to reflect existing (2009 and 2010) travel patterns in the Outer Banks. The existing or ‘base year’ Mid-Currituck Traffic Model (MCTM) was developed based on travel surveys undertaken in the Outer Banks in 2006, 2009 and 2010.

This report summarizes the development of the base year models and the validation of the MCTM against the observed project specific survey data collected during the peak and shoulder-peak seasons during 2009 and 2010. The report includes:

- Data utilized within the model development;

- Trip table, zone system and network development methodology;
- Traffic assignment; and
- Validation results.

Cambridge Systematics (CS), an internal auditor contracted to CDG, have reviewed the methodology and results documented within this report. CS have confirmed the approach and validation results are robust, and that the base year models are suitable as a base from which to forecast future traffic and revenue throughout the concession period.

2 Data Sources and Surveys

2.1 Overview

A detailed review of the publically available data highlighted the need for additional project specific data in order to construct the base year models. In terms of existing data, two key sources were identified:

- Data collected as part of the "Proposed Mid-Currituck Bridge Preliminary Traffic and Revenue Study, January 2007", developed by Wilbur Smith Associates (WSA).
- North Carolina Department of Transport (NCDOT) permanent traffic count data from site A2703, Wright Memorial Bridge (US-158).

These sources provided valuable information on certain elements of the traffic profile within the study area, including:

- Historical traffic growth.
- Hourly, daily, monthly and seasonal traffic profile.
- Detailed trip distribution details.

In order to enhance and validate existing information, Arup commissioned a range of project specific surveys:

- Traffic and journey time survey.
- Willingness to pay survey.
- Demographic and land-use survey.
- Realtors survey

Overall, there was sufficient data available for the purposes of the study. The extensive data collection program was undertaken to ensure that the study area and its unique characteristics could be modeled in detail. All survey data was subjected to sensibility and logic checks to ensure it was reliable and robust for use in the traffic model development. Details regarding these surveys and their outputs were detailed in Technical Memos #2 to 6, as agreed with CDG and NCTA.

2.2 Existing Traffic Data

2.2.1 NCDOT Traffic Data

Arup obtained historical traffic data for the permanent count site on US-158, (east of Wright Memorial Bridge, including hourly traffic flows by direction and day. This data was utilized in assessing historical traffic growth within the study area, and in the definition of the base year models developed.

2.2.2 Proposed Mid-Currituck Bridge Preliminary Traffic and Revenue Study, WSA Data

Preliminary forecasting work was conducted by Wilbur Smith Associates (WSA). This was originally reported in January 2007. The model was validated to a 2006 base year. An update was subsequently reported in October 2008.

Existing data collected as part of this demand forecasting project was made available to Arup, including:

- Detailed mail-back intercept survey data (conducted during summer 2006).
- Traffic and journey time surveys (conducted during 2006).
- Existing model zone system.
- Base year trip tables (2006).
- Forecast year trip tables (2010, 2015, 2020, 2025).

Arup reviewed the information that was made available and concluded that the data formed a good basis to build upon with additional project specific surveys.

The zone system was retained as a base in developing the model. The 2006 zone system was revised and significantly enhanced to better represent the unique characteristics of both the study area and travel patterns within it. This is detailed below in Section 4.

2.3 Project Specific Traffic Surveys

To validate and supplement the existing data, Arup commissioned four surveys/studies. Of specific relevance to the base year model development and calibration are the traffic surveys, conducted during August, September and October 2009. Additional traffic surveys were also undertaken during July 2010 (peak season only) as weather related issues affected the ATC data collection during the 2009 surveys. The 2010 counts were conducted during July, providing a greater understanding of the entire peak season (the 2009 counts incorporated August and September), and also provided a longer data series for subsequent analysis.

Classified automatic traffic counts (ATC), turning movement manual classification counts (MCC) and journey time surveys were conducted to establish the existing traffic profile within the study area, the nature of traffic growth and the current level of service on the existing untolled facilities. The ATC counts provided information regarding hourly, daily and seasonal traffic variations, while the MCC counts were used to break the traffic flows down by vehicle type, and also provide information on the key intersection of US-158 and NC-12. The results of the traffic surveys were presented in Technical Memos #5 and #6.

3 Model Structure

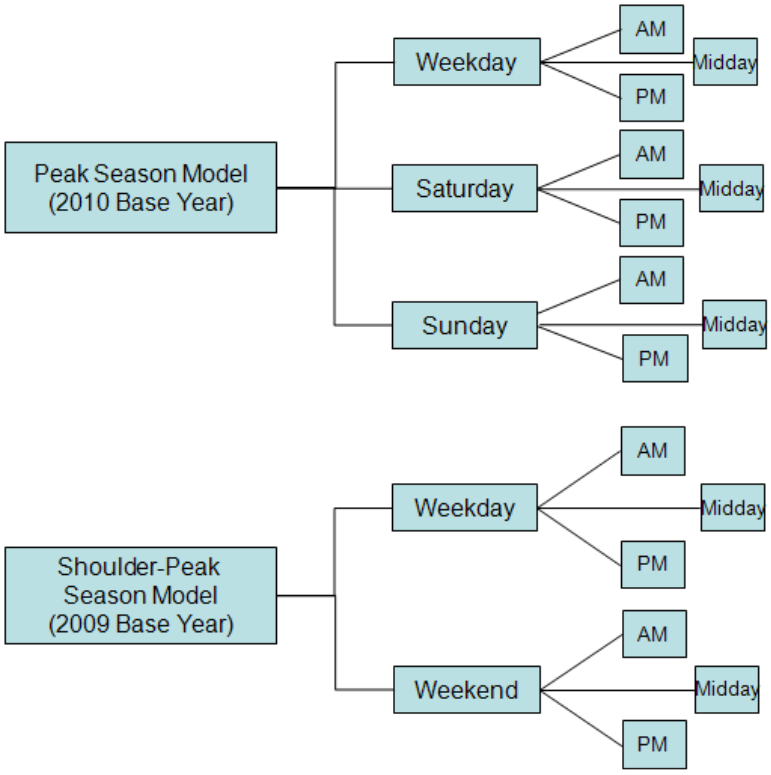
3.1 Overview

The MCTM is a four-stage model, including the following key elements:

1. Trip generation – the study area is sub-divided into zones and the number of trips that begin and end in each zone was identified based on the 2006 mail-back survey.
2. Trip distribution – the number of trips between each pair of zones within the study area is estimated.
3. Trip assignment – allocates the trips between each pair of zones using the appropriate route.
4. Toll choice model – apportions the trips between each pair of zones to those who will utilize the toll road, and those who will not.

The model follows an iterative process between stages 3 and 4 until an equilibrium state is found. A total of fifteen base year models were developed, as outlined below in Figure 2. The Peak Season models were validated to Peak 2010 traffic volumes (July), while the Shoulder-Peak models were validated to Shoulder-Peak 2009 volumes (September / October 2009).

Figure 2: Base Year Models



Significantly higher traffic volumes were observed on Saturdays during the Peak Season associated with vacationer traffic heading to and from the Outer Banks. Sunday traffic volumes and journey times, in comparison, were considerably lower. The Realtors Survey highlighted that the majority of rental property check-

ins/outs were on Saturday. In order to accurately model the differences between Saturday and Sunday during the peak season, two sets of models were developed for peak weekends – Saturday models and Sunday models.

The origin / destination data collected during the intercept survey undertaken by WSA in 2006 was used to develop the 'in-scope' traffic, i.e. those movements between the mainland (to/ from the Wright Memorial Bridge) to the northern Outer Banks (north of the US158/NC12 intersection. Trips making these movements were considered to be the main market for the MCB. Those trips between the mainland (to / from the Wright Memorial Bridge) to the southern Outer Banks (south of the US158/NC12 intersection) were not observed as part of the origin / destination surveys and were considered 'out-of-scope' as it is unlikely these trips would be attracted to the MCB. These trips were included in the trip tables in the model, and developed using a synthetic approach, as they were not observed during the origin / destination surveys.

As the origin / destination data collected during the intercept survey undertaken by WSA in 2006 was only collected on a weekday and Saturday, synthetic models were developed for Peak Sundays using a combination of the weekday and Saturday observed data from the intercept survey, and matrix estimation of the out-of-scope traffic. Average weekend models were developed for the shoulder peak.

3.2 Market Segments

Based on analysis of the 2006 mail-back intercept survey data, four trip purposes have been modeled in detail:

- To or from work (commute)
- Company business
- Other (personal business, school, shopping, social/ recreational)
- Begin or end vacation stay

In addition, two residency categories have been modeled independently in order to incorporate a variety of behavioral responses to the toll facility. Residents are defined as those who live in Pasquotank, Camden, Currituck and Dare Counties, while visitors are all other people who are not residents of the above named counties. The observed journey purpose and residency split in the 2006 mail-back survey can be found in Appendix A.

Overall, a very detailed segmentation was applied. The level of detail ensured that each modeled time period and its dominant journey purpose (vacation trips in the weekend models and other trips in the weekday models) is replicated, and the unique characteristics that accompany each journey purpose within the study area are represented in the fifteen base year models.

3.3 Model Time Periods

As outlined above in Figure 2, fifteen base year models have been developed. Each model represents an average hour representing the AM peak (07:00 to 10:00), the midday inter-peak (10:00 to 16:00), and the PM peak period (16:00 to 19:00). These were developed for an average weekday and weekend for the

shoulder-peak season, and an average weekday, Saturday and Sunday for the peak season.

This approach was adopted for several key reasons. The realtors highlighted that the majority of rentals either begin/end on Saturday/Sunday, meaning that vacation traffic on the Outer Banks peaks during these days. The observed traffic volumes and levels of congestion were of a different magnitude on Saturdays during the peak season. In contrast, weekday traffic profiles within the study area were observed as generally flat throughout the day.

Arup aggregated the survey data by weekend (shoulder-peak only) and weekday to make best use of the available survey data. In the absence of data collected on a peak Sunday, the peak Sunday models were developed using observed trip data from both the weekday and Saturday survey data. This approach was adopted as the Sunday model was expected to share characteristics with both the weekday and Saturday traffic, with some long-distance visitor vacation traffic still arriving/departing the study area (in line with the Saturday observations), but also a greater proportion of local traffic (in line with the weekday observations).

3.4 Vehicle Types

Analysis of the 2006 intercept survey data and the 2009 turning movement counts highlighted that the only significant vehicle category in the study area are cars/pickup vans, with the majority of count sites showing in excess of 95%.

In the absence of any detailed origin-destination survey data regarding heavy vehicles, only cars/pickup vans were modeled. Potential truck traffic utilizing the tolled facility and associated revenue will be assessed outside of the traffic model based on analysis conducted on the 2009 and 2010 traffic survey data.

3.5 Software

The MCTM was built within Cube Voyager. Cube Voyager is a powerful traffic modeling software package recognized internationally, with a number of assignment algorithms and the ability to model tolls robustly. Cube Voyager also includes integration with geographic information systems (GIS). Arup has used Cube Voyager successfully on a number of patronage/investment grade studies in the U.S.

4 Zone System Development

4.1 Introduction

The zoning system is an important part of the traffic model, since it provides the basis for defining the origins and destinations of trips. The Mid-Currituck model area is subdivided into internal zones, which cover the immediate study area, and external zones, which cover the area of influence.

The objective of the external zoning system is to enable traffic flows at the study area boundary to be estimated within acceptable levels of accuracy. This involves the appreciation of the catchment areas of main roads crossing the study area boundary.

All trips associated with the internal zones are included so that the model can provide realistic estimates of travel characteristics in the study area. In the external area, only trips associated with the study area itself were included. The sizes of the internal zones are, therefore, smaller and more refined compared with the external zones.

Internal zones are generally demarcated by:

- Natural barriers (rivers, railways, motorways or other major roads).
- Areas of similar land use that have clearly identifiable and unambiguous points of access onto the road network included in the model.
- Administrative and planning data boundaries.

The size of traffic zones is a critical factor in determining the realism and accuracy of the traffic model. If zones are too large, the model will be unable to estimate traffic flows to the required level of precision, however good the quality of the trip table data. On the other hand, if the zones are too small, the sample sizes in the cells of the trip table will be small also, affecting the accuracy of the trip and flow estimates.

Each zone contains a relatively homogenous geographical unit, with common characteristics including:

- Land-use.
- Development constraints.
- Environmental constraints.
- Specific growth forecasts.

4.2 Zone System Development

4.2.1 Introduction

This section discusses the process adopted to define the internal and external zones for the purposes of this study. As outlined above, the 2006 zone system was utilized as a base. Extensive analysis was expended by Arup and, based on advice

from our demographic sub-consultants, Delta Associates, the zone system was developed further to ensure the required level of detail for the study was captured. This included significant analysis and logic checking to ensure accurate representation of the traffic loading points.

The zone system development can be separated into two groups – internal and external zones. The methodologies for refining these two sub-groups are outlined below.

4.2.2 External Zones

The external zones were defined based on survey data collected as part of the Realtors Survey. A database of home zip codes based on signed rental contracts, comprising of approximately 160,000 records (rental contracts), was organized by ZIP code to determine the areas with the greatest frequency of rental contracts. The goal of this process was to identify clusters of ZIP codes defined by metropolitan areas or sub-metropolitan areas that have a high frequency of rental contracts. The most prolific 'sending areas' were defined as external zones within the MCTM. A total of 46 external zones are included in the model. These are listed in Appendix B.

4.2.3 Internal Zones

The internal zone system was based on the previous study conducted in 2006. Based on analysis of the 2006 zone system, the original zone system was deemed appropriate to be used as a base for the MCTM. It included sufficient detail on the Outer Banks for the study, with at least one zone associated with each major settlement. There are 24 internal zones in the MCTM.

A series of enhancements were made to the internal zone system where deemed appropriate. It was necessary to introduce a finer zoning system on the mainland to differentiate between local counties and external zones. These were previously grouped together based upon the road used to access the local study area. In order to adequately represent trips associated with key trip generators/attractors within the local counties, and in order to take differing demographic projections by area into account, the following changes were made to the 2006 zone system:

- Specific zones were introduced to correspond to Pasquotank, Camden and Dare counties.
- The Currituck Peninsula was disaggregated into multiple zones to better represent trips originating/destined for the peninsula, and their propensity to use the tolled facility.
- Two new zones were introduced to correspond to Elizabeth City, a major source of business and commuting trips as identified in the mail-back intercept survey, and the Marketplace / Walmart shopping complex at Southern Shores.

The zone system will be enhanced further within the forecasting models if major new developments are identified that are not currently well represented. This will be determined in accordance with future land-use projections provided by the sub-consultants. Details of this will be included in Technical Memo #9 – Forecasting Methodology Growth Models.

4.3 Study Area and Model Coverage

The zone system is outlined overleaf in Figure 3 and Figure 4. A full list of MCTM zones is included in Appendix B.

Figure 3: Zone System - Outer Banks

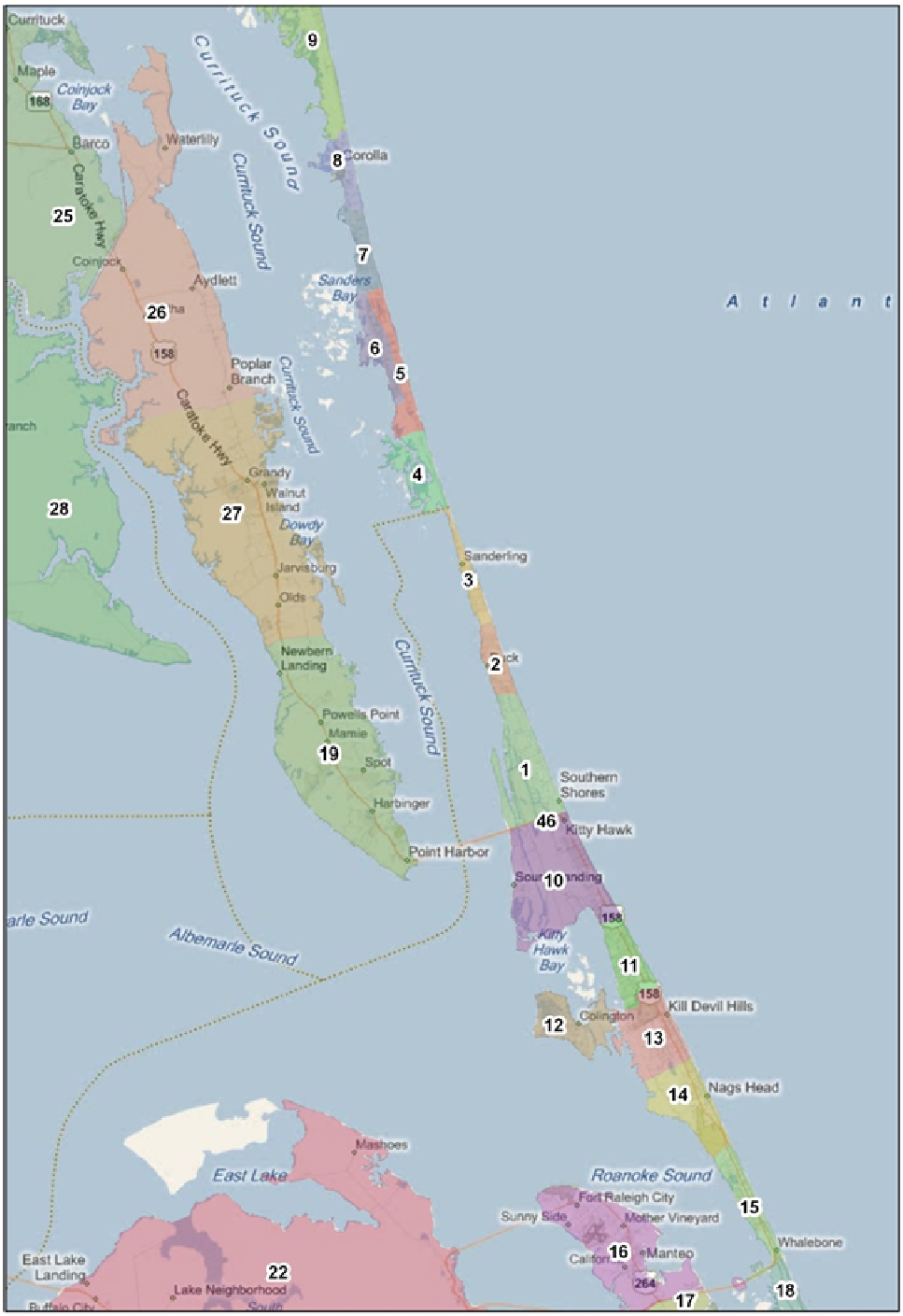
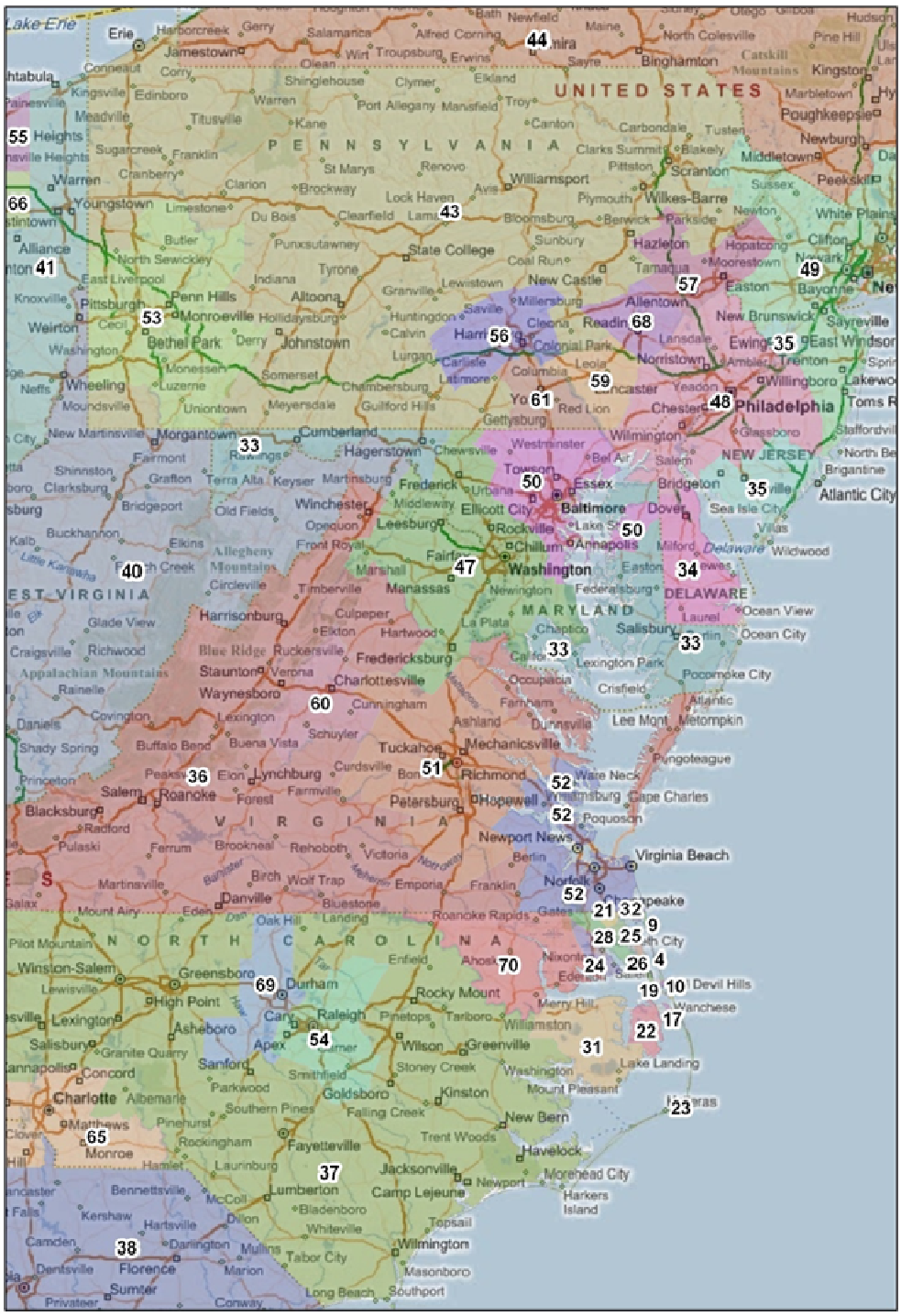


Figure 4: Zone System – External Zones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NORTH CAROLINA
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Washington
Richmond
Virginia Beach
Norfolk
Charlotte
Raleigh
Durham
Greensboro
Winston-Salem
High Point
Asheboro
Fayetteville
Wilmington
Jacksonville
New Bern
Greenville
Rocky Mount
Wilson
Goldsboro
Kinston
Havelock
Morehead City
Camp Lejeune
Lumberton
Sanford
Concord
Salisbury
Lexington
Statesville
Hickory
Gastonia
Monroe
Rockingham
Laurinburg
Florence
Sumter
Myrtle Beach
Conway
Southport
Long Beach
Masonboro
Topsail
Whiteville
Dillon
Bennettsville
Hartsville
Darlington
Camden
Kershaw
Albemarle
Pinehurst
Southern Pines
Carthage
Sanford
Apex
Cary
Pittsboro
Siler City
Asheboro
Lexington
Salisbury
Mooresville
Statesville
Hickory
Lenoir
Morganton
Marion
Rutherfordton
Forest City
Shelby
Gastonia
Kings Mountain
Lincolnton
Newton
Conover
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Chester
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Seneca
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5 Trip Table Development

5.1 Introduction

The following section outlines the proposed process for developing the 2009 trip tables. As outlined in Section 2.2 the trip tables were developed by utilizing the 2006 WSA origin-destination data as a base.

5.2 Data Sources

5.2.1 Existing Data

As outlined in Section 2.2, preliminary forecasting work was conducted by Wilbur Smith Associates (WSA). This was originally reported in January 2007. The model was validated to a 2006 base year. An update was subsequently reported in October 2008.

The detailed mail-back intercept survey data (conducted during summer 2006) was utilized as the primary data source for observed in-scope traffic. The existing intercept survey data was deemed appropriate for use in the Arup study because:

- The survey included 1,800 valid survey returns, and a high response rate of 15%.
- The data includes important information regarding trip distribution, frequency, purpose and origin/destination.
- The survey includes all critical movements, defined as those which are both contributing to the level of congestion within the study area, and also most affected by the scheme.
- The data is relatively recent (conducted in 2006), and we believe that the trip distributions in the study area have not changed since 2006.

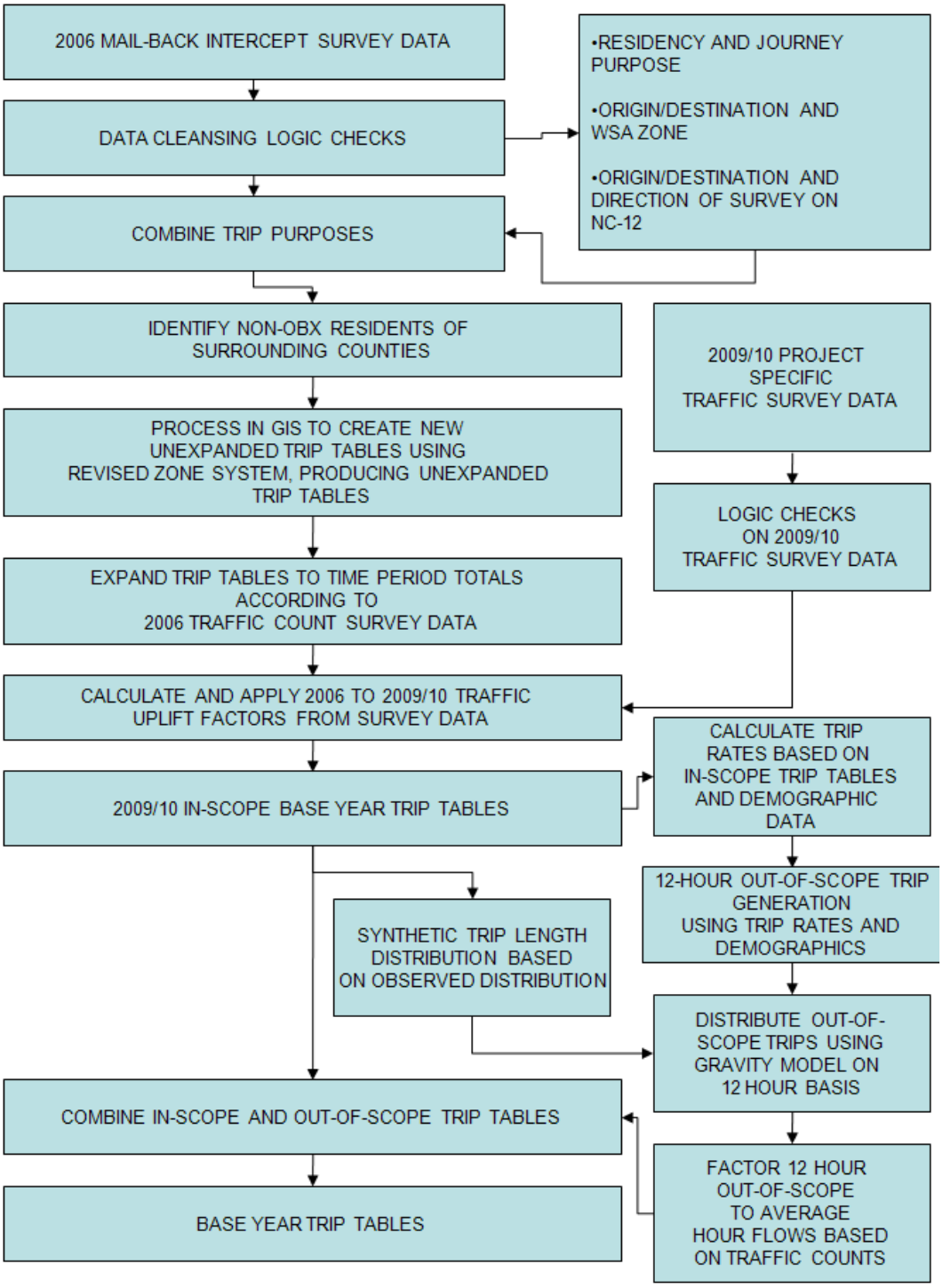
This data was supplemented with the project specific data collected during 2009 and 2010 as outlined in Section 2.2.

5.3 Trip Table Development Process

5.3.1 Overview

This overall process followed to develop the 2009 base year trip matrices is outlined graphically below in Figure 5.

Figure 5: Trip Table Development (Average Weekday, Peak Saturday and Shoulder-Peak Weekend)



5.3.2 Mail-Back Survey Data Cleansing and Logic Checking

The mail-back intercept data was first logic checked to ensure that the dataset is robust. A series of cross-checks were conducted to ensure that the residency status and journey purposes corresponded, the origin and destination locations were correctly attributed to the previous zone system, and that the origin and destination locations matched the direction of survey on NC-12. A series of

multiple regressions were also conducted, comparing the number of observed trips in the 2006 mail-back survey against a wide variety of demographic variables. This process was conducted within each season and weekday / weekend on a trip-purpose basis to ensure that the number of trips was when logical compared with zonal population, employment, quantities of rental units and retail. Strong regressions were observed for all key journey purposes and time periods. For example, visitor vacation trips were compared to available hotel and rental units bedrooms. R-squared statistics between 0.70 and0.92 were observed across all models. T-statistics highlighted all coefficients were statistically significant at the 95% confidence interval.

5.3.3 Trip Purpose Reclassification

A number of trip purposes were combined as outlined in Table 1. This gave a maximum of eight segments (four trip purposes, and two residency types).

Table 1: Journey Purpose Remapping

Intercept Survey Trip Purpose Classification (Mail-back Survey, 2006)	**Trip Purpose Classification (MCTM, 2009/2010)**
Commute	Commute
Company Business	Business
Personal Business	Other
School	
Shopping	
Social / Recreational	
Begin / End Vacation	Begin / End Vacation

5.3.4 Residency Type Reclassification

An important element of the trip table development was the identification of residency type. The intercept survey data used a different residency classification to that proposed for the Arup model. Residents were defined as permanent residents of the Outer Banks, whilst we wanted to include those living in the mainland counties of Dare, Camden, Currituck and Pasquotank in the classification.

In order to identify those local residents on the mainland, a process was developed using origin and destination location, and the original journey purpose from the 2006 intercept survey. Survey records which have both an origin or destination within the four mainland ‘resident’ counties and a trip purpose which was determined as home-based (either at the origin or destination – for example, commute, school, shopping etc.), then these were re-coded as a resident for the new Mid-Currituck model.

The distribution of residency types in the 2006 mail-back survey data are outlined below in Table 2.

Table 2: Residency Types

Season	Day	Residency	% of Trips
Shoulder -Peak	WD	Resident (Non-Outer Banks Areas)	3.4%
		Resident (Outer Banks Areas)	7.5%
		Visitor	7.1%
	SAT	Resident (Non-Outer Banks Areas)	1.5%
		Resident (Outer Banks Areas)	3.4%
		Visitor	8.8%
Peak	WD	Resident (Non-Outer Banks Areas)	8.6%
		Resident (Outer Banks Areas)	11.6%
		Visitor	17.6%
	SAT	Resident (Non-Outer Banks Areas)	3.0%
		Resident (Outer Banks Areas)	2.8%
		Visitor	24.7%

5.3.5 Re-Zoning

As outlined above in Section 4, the MCTM consists of 70 zones. This is considerably more detailed than previous studies conducted on the Mid-Currituck Bridge. Due to the extensive revisions to the zone system, it was necessary to remap the 2006 mail-back survey data to the new zone system.

The survey data included the latitude and longitude of each trip origin and destination, so building segmented trip matrices directly from the survey data was straightforward. The data was imported into a GIS package, and the trips were remapped to the revised zone system spatially. Using the detailed latitude and longitude coordinate information for each record, the corresponding origin and destination zone was updated within the GIS package. A series of detailed logic checks were then conducted to ensure that the output was correct.

5.3.6 2006 Trip Table Expansion

Traffic count data was collected at the same time and location as the mail-back intercept surveys were distributed. As the mail-back intercept survey collected only a sample of all drivers passing the survey site, the traffic count data was used to expand the survey interview records to match the total traffic volumes for each time period in each direction in 3 time bands for expansion (AM Peak – 07:00-10:00, Inter Peak- 10:00-16:00, PM Peak – 16:00-19:00).

These expansion factors were appended directly to the survey records, ensuring that the detail in each survey record was retained for future data manipulation. This ensured that the journey purpose mix was retained and a variety of behavioral responses to tolling could be modeled.

5.3.7 2006 – 2009 / 2010 Trip Table Uplifting

In addition to the expansion of the survey sample to 2006 total traffic volumes, it was necessary to apply a further set of factors to account for traffic growth between 2006, when the surveys were undertaken, and the model base year. These were calculated based on a comparison of observed data from traffic counts undertaken in 2006, and the project specific counts collected in 2009 and 2010 for counts conducted between Southern Shores and Duck on NC-12. From this comparison, a series of growth factors were derived.

These factors were applied by season, day of week, time of day and directional basis, and were applied to the 2006 traffic volumes. A similar process was adopted to that outlined in Section 5.3.6, whereby the expansion factor was appended to the raw survey data. The impact of this was that all journey purpose data was retained, enabling the modeling of each journey purpose individually.

It is important to recognize that the counts were conducted during different times of the year and for different lengths of time. The purpose of this process was to ensure that the observed traffic from the intercept survey data replicates the base year traffic counts. It was not to compare the 2006 and 2009 / 2010 counts as these are not directly comparable as they were conducted at different times of the year and for different durations.

5.3.8 Observed Traffic Trip Tables

A total of 90 trip tables were produced for the base year models. These are outlined below in Table 3. Resident vacation trips and visitor commute trips were not modeled due to an insignificant number of observed trips in the mail back survey. All other segments were assigned to the network individually.

Table 3: Trip Table Summary

Season	Residency	Trip Purpose	Time Period			Days Modeled*	Number of Trip Tables
			AM	MD	PM		
Peak	Resident	Begin / End Vacation	N/A	N/A	N/A	-	-
		Commute	Yes	Yes	Yes	3	9
		Business	Yes	Yes	Yes	3	9
		Other	Yes	Yes	Yes	3	9
	Visitor	Begin / End Vacation	Yes	Yes	Yes	3	9
		Commute	N/A	N/A	N/A	-	-
		Business	Yes	Yes	Yes	3	9
		Other	Yes	Yes	Yes	3	9
Shoulder-Peak	Resident	Begin / End Vacation	N/A	N/A	N/A	-	-
		Commute	Yes	Yes	Yes	2	6
		Business	Yes	Yes	Yes	2	6
		Other	Yes	Yes	Yes	2	6
	Visitor	Begin / End Vacation	Yes	Yes	Yes	2	6
		Commute	N/A	N/A	N/A	-	-
		Business	Yes	Yes	Yes	2	6
		Other	Yes	Yes	Yes	2	6

Total Number of Trip Tables = 90

*Peak (Weekday / Saturday / Sunday) Shoulder Peak (Weekday and Average Weekend Day)

5.4 Out-of-Scope Traffic

5.4.1 Overview

The 2006 survey demand includes those movements passing thorough the single survey site at Southern Shores on NC-12. It includes in detail all movements in scope for potential use of the Mid-Currituck Bridge. Traffic between the mainland and the southern part of the Outer Banks and short distance traffic on the Outer Banks that do not pass through the survey site are not included in the mail-back survey, and it was important to include estimates of this traffic as this contributes to congestion on US-158 on the mainland, on the Wright Memorial Bridge, and on the northern part of the Outer Banks.

This section outlines the trip generation and distribution process for those trips considered as ‘out-of-scope’. To clarify, the term ‘out-of-scope’ means those trips that cross the existing Wright Memorial and have origins/destination to the south (i.e. in Kitty Hawk, Kill Devil Hills, Nags Head and beyond). Consequently, these trips were not observed in the WSA intercept survey used to develop the trip table for ‘in-scope’ trips. Table 4 summarizes those trips that are in/out-of-scope in terms of this process (based on whether they were fully, partially, or not observed in the WSA intercept survey), identifying those trips that were synthesized as part of this process.

Table 4: Definition of In-Scope and Out-of-Scope Trips

Origins / Destinations	Northern Outer Banks	Southern Outer Banks	Mainland
Northern Outer Banks	'In-Scope' Partially observed	'In-Scope'; Fully observed	'In-Scope ' Fully observed'
Southern Outer Banks	'In-Scope ' Fully observed'	'Out-of-Scope' Not observed	'Out-of-Scope' Not observed
Mainland	'In-Scope ' Fully observed'	'Out-of-Scope' Not observed	'Out-of-Scope' Not observed

While out-of-scope traffic is important in terms of modeling the correct level of congestion on the WMB, the 'out-of-scope' trips are not likely to use the new Mid-Currituck Bridge given the bridge would not provide significant time savings due to their origins / destination to the southern section of the Outer Banks. Therefore, the key issue was to ensure the correct journey times and congestion experienced by in-scope trips which are likely to use the new tolled facility.

5.4.2 Out-of-Scope Trip Generation and Distribution

Two inputs were incorporated into the out-of-scope trip table generation and distribution as follow:

- Observed trip movement data, from which the trip length distribution (TLD) can be extracted and against which the synthetic trip tables will be validated. The WSA survey data was used to this effect; and
- Zonal planning data from which trip ends were estimated (as developed by Delta Associates).

Total trip ends were calculated on a 12-hour basis for each journey purpose, model season an day of the week utilizing the demographic data and locally derived trip rates. The trips rates were calculated using the following approach:

1. The number of in-scope trips (as generated above in Section 5.3.8) was calculated for each zone in each model and combined to represent a 12-hour total.
2. Regressions were run for the number of trip origins and destinations in each zone against each demographic variable, highlighting relationships between each journey purpose and the demographic characteristics of the area.

Based on the initial regressions, further multiple regressions were run for combinations of demographic variables to explore additional explanatory relationships. This process was conducted by season, day of week, residency type and journey purpose. The resulting coefficients represent the number of trips generated per unit of each demographic variable (i.e. the trip rates). These trip rates were applied to all zones within the model to generate 12 hour totals for trip generation and attraction. These 12 hour zonal trip totals were imported into the gravity models.

The 12 hour trip rates are detailed below in Table 5.

Table 5: 12-Hour Trip Rates

Year	Season	Day of Week	Resident Type	Trip Purpose	Input Variable 1	Origin	Destination	Input Variable 2	Origin	Destination
2010	Peak	Weekday	Resident / Visitor	Business	Peak of Peak Season Employment	0.147	0.232			
2010	Peak	Saturday	Resident / Visitor	Business	Peak of Peak Season Employment	0.030	0.065			
2009	Shoulder-Peak	Weekday	Resident / Visitor	Business	Spring/Fall Shoulder Season Employment	0.222	0.116			
2009	Shoulder-Peak	Weekend	Resident / Visitor	Business	Spring/Fall Shoulder Season Employment	0.130	0.115			
2010	Peak	Weekday	Resident	Commute	Permanent Population	0.659	0.327	Permanent Employment	0.193	0.453
2010	Peak	Saturday	Resident	Commute	Permanent Population	0.378	0.329	Permanent Employment	0.050	0.102
2009	Shoulder-Peak	Weekday	Resident	Commute	Permanent Population	0.484	0.353	Permanent Employment	0.158	0.188
2009	Shoulder-Peak	Weekend	Resident	Commute	Permanent Population	0.123	0.443	Permanent Employment	0.292	0.030
2010	Peak	Weekday	Resident	Other	Permanent Population	1.083	1.303			
2010	Peak	Saturday	Resident	Other	Permanent Population	0.700	0.244			
2009	Shoulder-Peak	Weekday	Resident	Other	Permanent Population	1.029	0.825			
2009	Shoulder-Peak	Weekend	Resident	Other	Permanent Population	0.851	0.956			
2010	Peak	Weekday	Visitor	Other	Total Bedrooms (Rental & Hotel)	0.103	0.113			
2010	Peak	Saturday	Visitor	Other	Total Bedrooms (Rental & Hotel)	0.039	0.028			
2009	Shoulder-Peak	Weekday	Visitor	Other	Total Bedrooms (Rental & Hotel)	0.046	0.039			
2009	Shoulder-Peak	Weekend	Visitor	Other	Total Bedrooms (Rental & Hotel)	0.062	0.038			
2010	Peak	Weekday	Visitor	Vacation	Total Bedrooms (Rental & Hotel)	0.058	0.043			
2010	Peak	Saturday	Visitor	Vacation	Total Bedrooms (Rental & Hotel)	0.233	0.198			
2009	Shoulder-Peak	Weekday	Visitor	Vacation	Total Bedrooms (Rental & Hotel)	0.027	0.029			
2009	Shoulder-Peak	Weekend	Visitor	Vacation	Total Bedrooms (Rental & Hotel)	0.072	0.080			
2010	Peak	Weekday	Resident / Visitor	Business	Peak of Peak Season Employment	0.147	0.232			
2010	Peak	Saturday	Resident / Visitor	Business	Peak of Peak Season Employment	0.030	0.065			
2009	Shoulder-Peak	Weekday	Resident / Visitor	Business	Spring/Fall Shoulder Season Employment	0.222	0.116			
2009	Shoulder-Peak	Weekend	Resident / Visitor	Business	Spring/Fall Shoulder Season Employment	0.130	0.115			

The out-of-scope trip generation was supplemented using a retail trip rate from the ITE Trip Generation Handbook (8th Edition) to ensure the trip making properties of all zones was accurately represented. This was applied to the retail floorspace as detailed in the Delta Associates demographic dataset.

5.4.3 Gravity Model

A Tanner function was fitted to the observed trip length distributions for each journey purpose and season and day of week, an example of which is:

Equation 1: Tanner Function

$$f(c_{ij}) = c_{ij}^{\alpha}.\exp(-\beta c_{ij})$$

where,

$f(c_{ij})$ = generalized function of travel costs

α and β = parameters for calibration

The model was calibrated using observed average trip lengths taken from the WSA intercept survey and the Realtors survey database, and 12-hour out-of-scope trip tables were generated for each season and day of the week. Logic checking was undertaken to ensure that the gravity model produced a sensible representation of the observed trip length distribution. The output 12-hour trip tables were then factored to represent each average hourly model (AM, Midday and PM Peak) using factors output from analysis of the available traffic survey data.

The out-of-scope trip tables were then incorporated with the 'in-scope' trip tables to produce the final base year trip tables. These were assigned in the base year model and a model validation process was undertaken using the new traffic survey data collected (see Section 8 for details).

5.5 Peak Sunday Model Development

The methodology detailed above was utilized in developing all models with the exception of the Peak Sunday model. As the origin / destination data collected during the intercept survey undertaken by WSA in 2006 was only collected on a Saturday, synthetic models were required for the peak Sunday period.

The Peak Sunday models were developed using the following approach:

- The Peak Saturday models and Peak Weekday models using all observed data were developed and validated.
- Comparative analysis was conducted on the Saturday and Weekday models, focusing on trip rates, journey purpose split at each count location and trip distribution to highlight the differences between the Weekday and Saturday models. The Sunday model was predicted to exhibit aspects of both these models (i.e. some vacationer trips still arriving in the area as highlighted in the Realtors Survey, but a greater proportion of short distance trips as people have arrived for their vacations.)
- The in-scope matrices were developed using both the weekday and Saturday observed data from the WSA intercept survey.

- The expected number of visitor vacation trips was predicted by regression analysis. The observed check-in and check-out data (from the Realtors Survey) was regressed against the number of observed weekday and Saturday visitor vacation trips over 12 hours.
- The resulting relationship between the observed check-in/out percentages and observed visitor vacation trip totals was used to predict the number of Sunday visitor vacation trips using the Sunday check-in/out data from the Realtors Survey.
- The remaining shortfall between the Site 3 (see Figure 8) count data and the predicted number of visitor vacation trips was filled using the other trip purposes. All non-visitor vacation data was incorporated from both the peak weekday and peak Saturday.
- The in-scope traffic was assigned to the network, and the shortfall at the count sites 2, 4, 9 and 11 (see Figure 8) and the counts undertaken at the US158 / NC12 intersection (Sites A-D) was calculated. A Sunday out-of-scope trip table was generated by estimating the out-of-scope matrix at these locations to the calculated shortfall between the assigned in-scope traffic and the observed traffic count.
- The Saturday out-of-scope trip table was used as a prior matrix.

6 Network Development

6.1 Introduction

The highway network is represented in the model by links, each of which has a variety of attributes associated with it. Link attributes in the MCTM include:

- the reference numbers at the ends of the link (i.e. 'nodes');
- the link length;
- the base year travel speed on the link (during the time period being modeled);
- the speed-flow relationship appropriate for the link;
- the link capacity;
- whether the link operates in both directions or in one direction only; and
- any restrictions to particular vehicle types using the link.

6.2 Network Construction

6.2.1 Existing Data

The network has been developed based on GIS information available from NCDOT. The available GIS layer included link distance and the number of lanes. Additional information regarding other road characteristics was appended to the network for use within the assignment process including link classification, the number of lanes, free flow travel times and volume delay functions.

6.2.2 Network Development Methodology

The NCDOT GIS information was imported into CUBE and, before any link information was appended to the network, a network inventory was carried out to ensure that all required routes and network details were included in the network. This process highlighted that all key routes were included within the network. The original data source included all routes throughout the state of North Carolina, so the network inventory was followed by a cleansing process, whereby all highways not relevant to the Mid-Currituck area were cleaned from the network.

Following this process, a range of additional logic checks were conducted on the network before zonal information was appended to the network. This process is outlined below:

- Logic checking of existing link-based information (speed, number of lanes, classification etc.).
- The coding of the zone system, including the coding of both internal and external centroid connectors.
- Logic checking of centroid locations and centroid connector characteristics (network connection locations).

Finally, capacities and speeds were appended to the network based on the Highway Capacity Manual (2000) and observations made during site visits to the Outer Banks. The base year model consists entirely of buffer networks with no detailed junction simulation. This was deemed appropriate given the strategic nature of the model.

6.3 Base Year Network

The MCTM base year network can be seen below in Figure 6.

Figure 6: Base Year Network

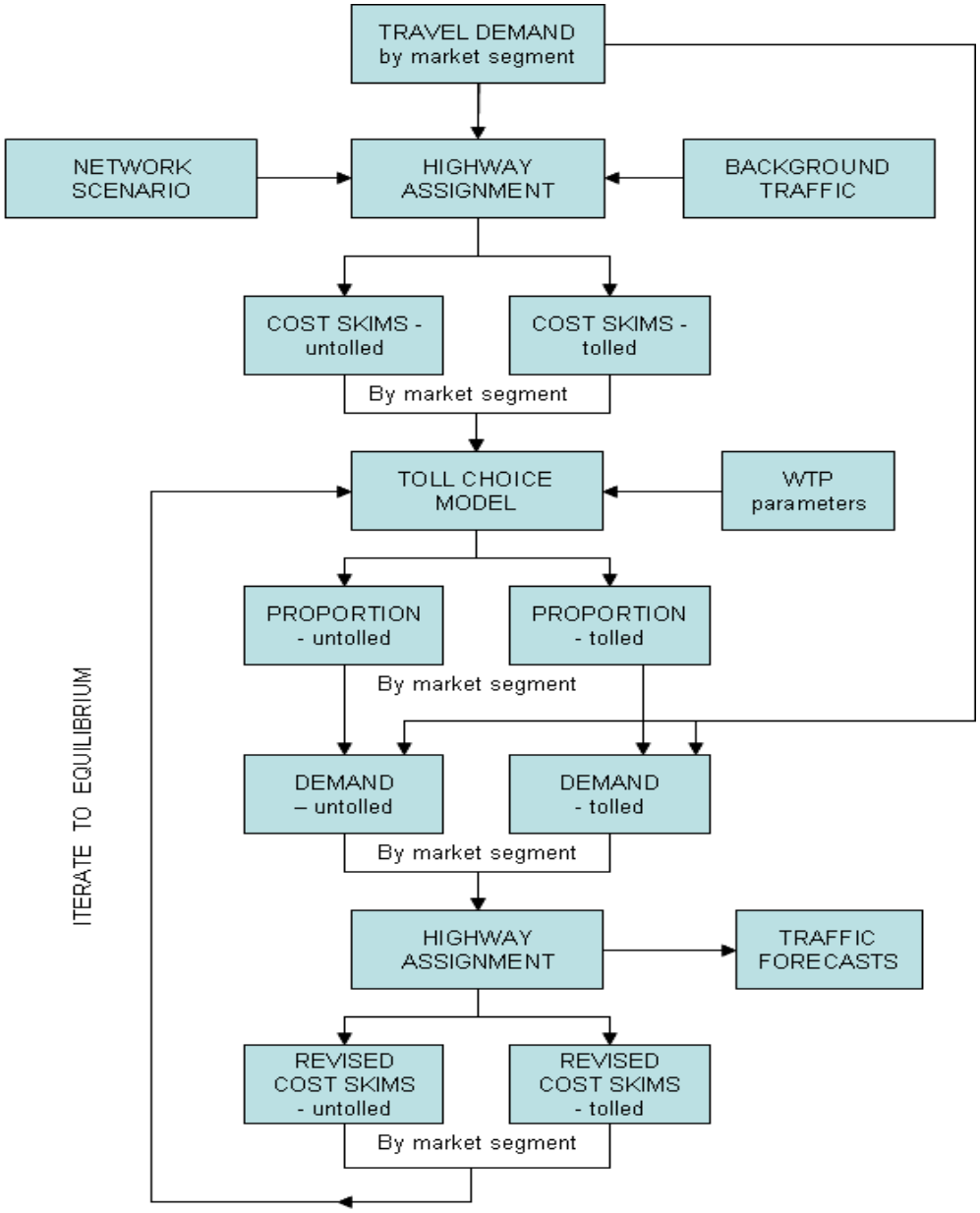
7 Assignment

7.1 Assignment and Toll-Choice Model

The assignment process is outlined below in Figure 11. Whilst there are no toll facilities within the MCTM base year model, the base year demand will be utilized in a series of toll optimization runs to aid in establishing optimal toll rates for different toll products. The assignment algorithm transfers the congested network highway travel times from the highway assignment models into the toll-choice model. This process compares tolled and untolled generalized costs, allowing the proportions of traffic which use the tolled and free facilities to be calculated. All out-of-scope traffic will be restricted from using the tolled facility.

The subsequent proportions were then applied to the input matrices and the model re-runs the assignment based on the revised tolled and untolled input matrices. This is an iterative procedure which continues until equilibrium is established.

Figure 7: Assignment and Toll Choice Model Structure



7.2 Representation of Delays

7.2.1 Volume Delay Functions

Volume delay functions were applied throughout the study area to ensure that delays and congestion were modeled robustly where they may have a significant impact on drivers' route choice. Capacities were applied based on Highway Capacity Manual 2000 guidance, and were appended to the network with continuity and consistency to ensure that the model is representative of actual traffic conditions. The Bureau of Public Roads (BPR) volume delay function was utilized in the model, which is standard practice for studies of this nature. This is shown below in Equation 1, where TC is the congested travel time for each link, T0 is the free-flow travel time, V is the volume on the link, while C represents the

capacity of each link. α adjusts each link's response to increased volumes whilst the link is within capacity, while β represents the power function, which dictates how quickly each modeled link responds to increased congestion above the defined link capacity.

Equation 2: BPR Volume-Delay Function

$$TC = T0 * (1 + \alpha * (V / C)\hat{} \beta)$$

The standard BPR speed flow was applied to all non-essential links in the model (i.e. those outside the core study area). Within the core study area, specifically on the approaches to the Wright Memorial Bridge and US-158 / NC-12 intersection, and US-168 and NC-12 throughout the Outer Banks, new volume-delay relationships were developed. These links constitute key activity areas where congestion is known to accumulate quickly and, as such, quicker responses to increased traffic volumes were required in these locations to replicate the observed journey times within the model.

Different volume-delay parameters were applied to the Saturday midday and PM models to highlight the different constitution of traffic during these periods, specifically the increased vacationer traffic during the weekend models. As detailed in Technical Memo #5: Peak Season Traffic Survey Report, inbound traffic in the Saturday midday and PM periods experienced significant delays, with journey times in excess of 3 hours. This compares to journey times of approximately 1.5 hours during weekdays and Sundays. As such, different parameters were required in order to accurately model these journey times. The volume delay functions were consistent between all other peak and shoulder-peak models.

Supplemental speed flow curves were defined, each with a different value of α and β. This was necessary to ensure that responses to congestion were accurately represented on different link types within the model. Specific values for α and β were developed as part of the calibration process.

7.2.2 Logic Checks

The integrity and representativeness of the network was ensured by running a series of checks on the assignment. These included:

- Checking the routes through the network between select origin-destination pairs.
- Comparison of modeled and observed journey times and distances under both congested and uncongested conditions.

8 Model Validation

8.1 Introduction

Model validation is a check that ensures the model reproduces observed trip patterns and journey times on the main routes in the study area. To ensure the model is robust, the data utilized in the validation process is independent. This data was not utilized within the model development. Model validation serves several purposes:

- To provide a level of comfort to decision makers that the model reproduces observed data.
- To provide evidence that the model results are accurate enough to be used for the desired analysis.
- To account for the errors in observed data used for comparisons.

The following was undertaken as part of the approach to the model validation:

- Validation of modeled traffic volumes;
- Validation of modeled turning movements at the NC-158/NC-12 intersection; and
- Validation of modeled journey times between Barco and the end of NC-12, north of Corolla.

8.2 Validation Standards

In Technical Memo #15 Model Revisions, it was proposed that the validation process would use the following criteria in accordance with appropriate U.S. guidance. CS, on behalf of the Federal Highway Administration (FHWA), assisted with the development of the *Model Validation and Reasonableness Checking Manual*. This manual often serves as default standards if no state-specific model validation guidelines are in place. No such standards exist in North Carolina, as with many southeastern states. CS has also developed standards for Florida (FSUTMS – Florida State Urban Transportation Model Structure) based on national research that has resulted in more comprehensive, and in many cases, more stringent standards than the national standards. Acceptability guidelines for each validation criteria were developed as part of this. A summary of the relevant FSUTMS standards are outlined in Table 6 below.

Table 6: Model Validation Acceptability Criteria*

Model Statistic to Evaluate	Road Type / Typical Volume	Accuracy Standard
Volume over Count	Freeway	+/-7%
	Divided / Principal Arterial	+/-10%
	Minor / Undivided	+/-15%
	Collector	+/-20%
	Frontage Road	+/-25%
Root Mean Squared Error (RMSE)	< 5k ADT	+/-45% to +/- 100%
	5k to 10k ADT	+/-35% to +/- 45%
	10k to 15k ADT	+/-27% to +/- 35%
	15k to 20k ADT	+/-25% to +/- 30%
	20k to 30k ADT	+/-15% to +/- 27%
	30k to 50k ADT	+/-15% to +/- 25%
	50k to 60k ADT	+/-10% to +/- 20%
	> 60k ADT	+/-10% to +/- 19%
	Areawide	+/-30% to +/- 50%
Percentage Error	<10k Volume	+/-25% to +/- 50%
	10k to 30k Volume	+/-20% to +/- 30%
	30k to 50k Volume	+/-15% to +/- 25%
	50k to 65k Volume	+/-10% to +/- 20%
	65k to 75k Volume	+/-5% to +/- 15%

* Florida Department of Transportation, Systems Planning Office, *Model Validation & Calibration Standards*

In addition, we included the GEH (Geoffrey E. Hayes' goodness of fit) statistic. Standard practice dictates that a GEH value below 5 highlights that the model at that location is a very good representation of observed conditions. A GEH statistic between 5 and 10 is acceptable, while a value greater than 10 indicates that a specific location within the model needs additional attention. GEH statistics are reported for each count site in each direction. The GEH statistic takes into account the magnitude of the traffic volume in question in its calculation. Therefore, the higher the volume, the lower the accepted tolerance.

Equation 3: GEH Statistic

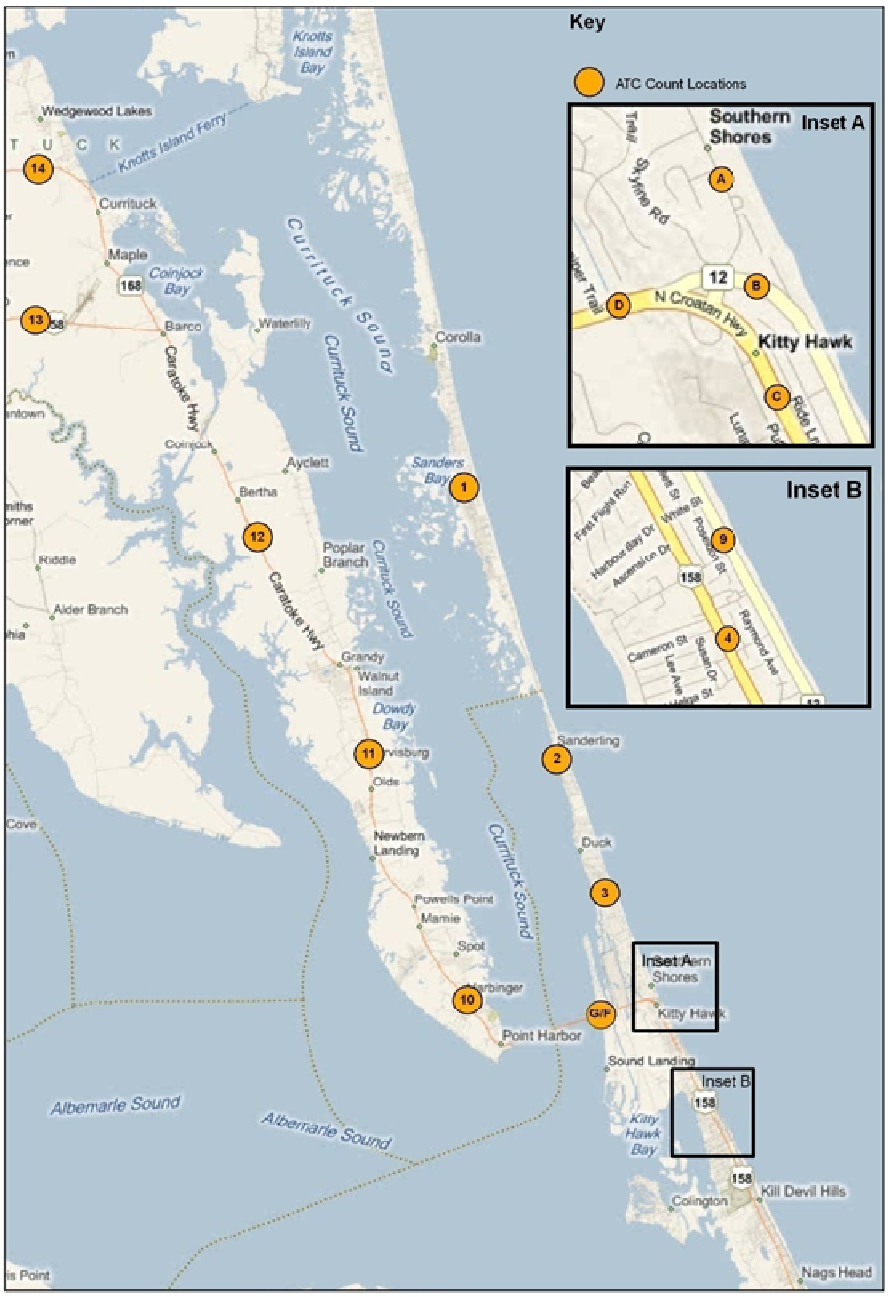
$$GEH = \sqrt{\frac{(V_2 - V_1)^2}{(V_1 + V_2)/2}}$$

8.3 Link Validation Traffic Count Data

The Automated Traffic Counts were continuous, 24-hour volume counts for a full 2 weeks. The counts were collected in 15-minute intervals and were classified according to the standard Federal Highway Administration (FHWA) classification chart. The validation count locations are numbered 1-14 and are shown in Figure

8 below. Site G/F corresponds to data collected on the Wright Memorial Bridge to verify the robustness of the NCDOT permanent count data, and is presented within the validation results as a check on volumes crossing the existing bridge.

Figure 8: ATC Count Locations

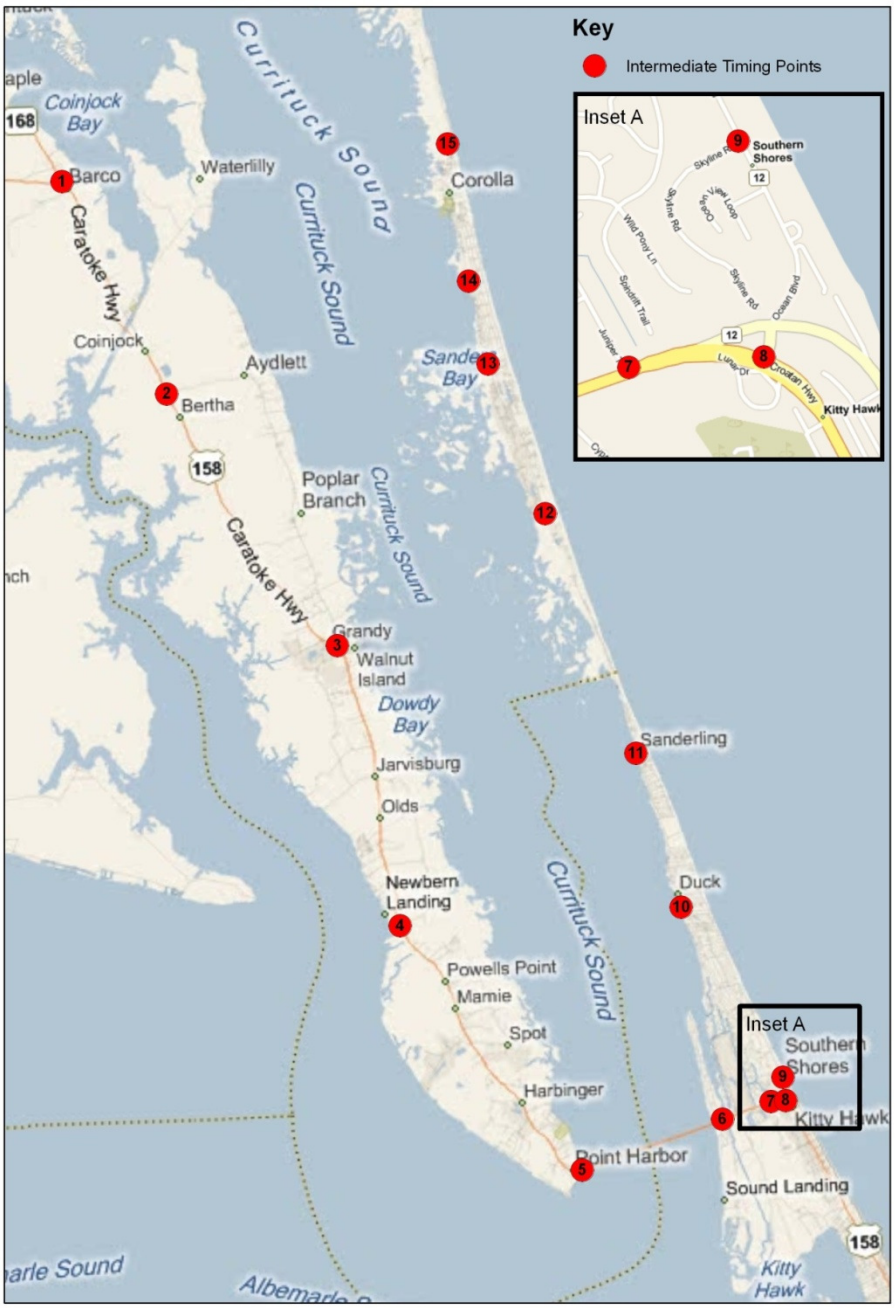


8.4 Journey Time Survey Validation Data

Journey time surveys during 2009 were conducted along some of the major routes throughout the Outer Banks. During 2010, the key market route between Barco and Corolla was surveyed (Figure 9). Validation was conducted against this route.

All journey time survey data was utilized within the validation process. The observed journey times and variability were deemed as appropriate for the study area and validation process as reported in Technical Memos #5 and #6.

Figure 9: Journey Time Survey Route & Intermediate Timing Points



The modeled journey times were extracted along each route and compared to the average of the observed runs for each modeled time period. It is standard practice that the modeled journey times should be within 15% of the observed journey times. This criterion has been used in validating the MCTM. Intermediate timing points were not collected as part of the shoulder-peak journey time surveys and, as such, validation is only presented for the total journey duration.

8.5 Turning Movement Manual Classification Count Validation

The MCC counts conducted at the intersection of US-158 and NC-12 were used to validate the level of observed and background traffic passing through the intersection. This junction has a significant impact on journey times and delays, and will be significant in route choice once the new bridge has been opened to traffic. As such, it was important to ascertain how well the MCTM replicated flows through this key area.

8.6 Validation Results

Table 7 details a summary of the validation results and the acceptability criteria for each measure. A complete breakdown of the results can be found in Appendix C (link flow validation), Appendix D (journey time validation) and Appendix E (turning movement validation). The Peak Sunday results exclude those sites where estimation was conducted on the out-of-scope trip tables.

It can be seen that:

RMSE:

- All models are within the acceptability criteria (of 30%) for RMSE on an individual Peak hour basis with the exception of the Peak Weekday PM model (31%).
- When aggregating the model results to represent average daily traffic within each season and grouping sites based on average daily traffic, all models and groups meet the required criteria as set out in Table 6.
- Areawide RMSE varies between 5% and 26%, within the acceptable standard of +/-30%.

Journey Time Validation:

- 93% of journey time routes (30 in total) were within the +/- 15% acceptability criteria.
- The shoulder-peak weekday MD model was the only model not to fully achieve the criteria, with a variance just outside the tolerance of 16% and 20% from the observed journey times.
- The modeled and observed speeds on WMB were compared for each base year model. The results of this comparison are shown in Table 8. These results show that the modeled speeds match the observed speeds strongly in each time period.

Percentage Error:

- Over 86% of all sites are within the compliant standards in terms of percentage error (as set out in Table 6).
- 100% of sites meet these criteria within the Peak Sunday model.

GEH Statistic:

- Between 68% and 93% of count locations meet the preferred GEH criteria (less than 5) across the 15 models. The strongest validation in terms of GEH is found in the Sunday model.
- Over 91% of count locations meet the acceptable GEH standard (less than 10).

Turning Movements:

- The turning movement validation highlighted that the models were generally representative of the observed data, with 14 out of 15 models showing 50% or more movements with a GEH less than 5.
- The key movements (Wright Memorial Bridge to NC-12 northbound and vice versa) are acceptable (GEH less than 10) in all models. Most models showed a GEH less than 5 for these movements.

Volume over Count Ratio:

- The volume over count ratio statistics were lower compared to the other validation criteria, with 50% to 95% of count sites meeting the compliant criteria.

In summary the validation results show that the models that have been developed are robust in terms of reproducing observed traffic volumes and journey times. The validation results show that in terms of the RMSE, Percentages Error and GEH statistics, link flows meet the acceptability criteria as set in the FSTUMS standards for link flow validation (shown in Table 6). This is also shown in terms of the turning movements and the journey times. One area where se criteria are not quite achieved is the Volume over Count Validation. However, it should be noted that this type of validation analysis does not take into account the magnitude of the traffic volume being considered, unlike the other link flow validation calculations (RMSE, Percentage Error and GEH). Therefore, whilst it is a useful guide, the Volume over Count analysis could be considered to be too coarse for this type of validation.

Table 7: Base Year Validation Summary

Model Statistic to Evaluate	Road Type / Typical Volume	Accuracy Standard	PK WD AM	PK WD MD	PK WD PM	PK SA AM	PK SA MD	PK SA PM	PK SU AM	PK SU MD	PK SU PM	SPK WD AM	SPK WD MD	SPK WD PM	SPK WE AM	SPK WE MD	SPK WE PM
Root Mean Squared Error (RMSE) (Time Period)	Average Hour	+/-30%	23%	27%	31%	12%	15%	22%	13%	11%	12%	19%	18%	17%	17%	17%	17%
Root Mean Squared Error (RMSE) (Average Daily Traffic)	< 5k ADT	+/-45% to +/-100%	12%			71%						26%			40%		
	5k to 10k ADT	+/-35% to +/-45%	10%			11%						20%					
	10k to 15k ADT	+/-27% to +/-35%	15%												10%		
	15k to 20k ADT	+/-25% to +/-30%							6%								
	20k to 30k ADT	+/-15% to +/-27%				8%											
	30k to 50k ADT	+/-15% to +/-25%															
	50k to 60k ADT	+/-10% to +/-20%															
	> 60k ADT	+/-10% to +/-19%															
	Areawide	+/-30% to +/-50%	26%			12%			5%			16%			11%		
Percentage Error (Average Daily Traffic)	All	Compliant %	86%			91%			100%			86%			86%		
Volume over Count (Time Period)	All Links	Compliant %	55%	68%	64%	73%	77%	73%	77%	95%	77%	50%	55%	73%	55%	82%	64%
GEH (Time Period)	All Links	<5 (Preferred)	77%	82%	68%	82%	73%	82%	86%	93%	93%	86%	86%	86%	77%	82%	77%
GEH (Time Period)	All Links	<10 (Acceptable)	95%	91%	91%	95%	100%	91%	100%	100%	100%	100%	100%	100%	100%	95%	100%
Journey Time - Inbound		+/-15%	-7%	9%	2%	2%	4%	1%	-9%	15%	3%	8%	20%	11%	7%	15%	-11%
Journey Time - Outbound		+/-15%	-7%	12%	7%	9%	2%	-11%	4%	12%	2%	10%	16%	11%	3%	14%	8%
Turning Movements (GEH) (Time Period)		<5	67%	50%	50%	50%	67%	50%	83%	100%	67%	50%	100%	67%	67%	83%	83%
Turning Movements (GEH) (Time Period)		<10	100%	100%	100%	83%	83%	67%	100%	100%	83%	100%	100%	100%	67%	100%	100%

Table 8: Comparison of Modeled and Observed (2010) Wright Memorial Bridge Speeds (mph)

Time of Day	Direction	Peak Weekday		Peak Saturday		Peak Sunday	
		Modelled	Observed	Modelled	Observed	Modelled	Observed
AM	EB	52	45	48	45	51	46
	WB	51	52	36	44	45	49
MD	EB	51	45	18	13	42	33
	WB	49	49	44	38	45	48
PM	EB	50	44	12	9	49	46
	WB	49	48	48	37	46	46

9 Summary

The following key points should be noted:

- The methodology adopted is robust for the purpose of an investment grade study. It is consistent with the proposed methodology which was outlined in Technical Memo #7 – Proposed Methodology for Developing the Base Year Model and Technical Memo #15 Model Revisions Note.
- The MCTM includes all competing infrastructure and the existing network in detail.
- The MCTM zone system is appropriate for the study, having been extensively refined to add considerable detail to key areas of the Outer Banks and its area of influence.
- The MCTM has been validated to a high standard against independent observed links flows, turning movements and journey time data.
- Link flows validate against the FSUTMS validation criteria in terms of Route Mean Square Error, Percentage Error and the GEH statistic.
- 93% of the modeled journey times across the 15 models are within 15% of the observed journey times,
- The key movements (Wright Memorial Bridge to NC-12 northbound and vice versa) are acceptable (GEH less than 10) in all models. Most models showed a GEH less than 5 for these movements

The calibration and validation results conclude that the MCTM is highly representative of traffic conditions as observed in 2009 and 2010. The model is a suitable base from which to forecast traffic and revenue with a view to informing funding decisions regarding the proposed bridge.

Appendix A

Mail-Back Intercept Survey
Journey Purpose Split

A1 Mail-Back Intercept Survey Journey Purpose Split

Table 8: Observed Journey Purpose Split

Season	Day	Purpose	% of Trips
Shoulder -Peak	Weekday	Begin / End Vacation	13.6%
		Business	11.4%
		Commute	21.1%
		Other	53.9%
	Saturday	Begin / End Vacation	45.2%
		Business	4.4%
		Commute	11.5%
		Other	38.9%
Peak	Weekday	Begin / End Vacation	15.9%
		Business	7.4%
		Commute	24.6%
		Other	52.0%
	Saturday	Begin / End Vacation	70.3%
		Business	2.7%
		Commute	9.1%
		Other	17.9%

Appendix B

MCTM Zone List

B1 MCTM Zone List

Table 9: Zone List

TAZ	Description	Zone Type
1	Southern Shores	Internal
2	Duck	Internal
3	Sanderling South	Internal
4	Sanderling North	Internal
5	Corolla South	Internal
6	Corolla South Central	Internal
7	Corolla North Central	Internal
8	Corolla North	Internal
9	Carova, 4wd area	Internal
10	Kitty Hawk	Internal
11	Kill Devil Hills (N. of Wright Brothers Memorial)	Internal
12	Collington	Internal
13	Kill Devil Hills (S. of Wright Brothers Memorial)	Internal
14	Nags Head	Internal
15	Nags Head / Whalebone	Internal
16	Manteo	Internal
17	Wanchese	Internal
18	Bodie Island	Internal
19	Lower Currituck Peninsula - South	Internal
20	Elizabeth City	External
21	Moyock Township	Internal
22	Dare County Mainland	External
23	Hatteras Island	External
24	Pasquotank County (Excl. Elizabeth City), NC	External
25	Crawford Township	Internal
26	Lower Currituck Peninsula - North	Internal
27	Lower Currituck Peninsula - Central	Internal
28	Camden County, NC	External
29	Balance of Massachusetts	External
30	Balance of Connecticut	External
31	Albemarle Peninsula, NC	External
32	Knotts Island	External
33	Balance of Maryland	External
34	Balance of Delaware	External
35	Balance of New Jersey	External

36	Balance of Virginia	External
37	Balance of North Carolina	External
38	Balance of South Carolina	External
39	Georgia	External
40	Balance of West Virginia	External
41	Balance of Ohio	External
42	Michigan	External
43	Balance of Pennsylvania	External
44	Balance of New York State	External
45	Balance of New Hampshire	External
46	Marketplace @ Southern Shores / Walmart / Retail	Internal
47	Washington, DC-VA-MD-WV MSA	External
48	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD MSA	External
49	New York-Northern New Jersey-Long Island, NY-NJ-PA MSA	External
50	Baltimore-Towson, MD MSA	External
51	Richmond, VA MSA	External
52	Virginia Beach-Norfolk-Newport News VA-NC MSA	External
53	Pittsburgh, PA MSA	External
54	Raleigh-Cary, NC MSA	External
55	Cleveland-Elyria-Mentor, OH MSA	External
56	Harrisburg-Carlisle, PA MSA	External
57	Allentown-Bethlehem-Easton, PA-NJ MSA	External
58	Columbus, OH MSA	External
59	Lancaster, PA MSA	External
60	Charlottesville, VA MSA	External
61	York-Hanover, PA MSA	External
62	Bridgeport-Stamford-Norwalk, CT MSA	External
63	Boston-Cambridge-Quincy, MA-NH MSA	External
64	Cincinnati-Middletown OH-KY-IN MSA	External
65	Charlotte-Gastonia-Concord NC-SC MSA	External
66	Akron, OH MSA	External
67	Rochester, NY MSA	External
68	Reading, PA MSA	External
69	Durham-Chapel Hill, NC MSA	External
70	Bertie, Hertford, Gales, Chowan, Perquimans & Northampton Counties, NC	External

Appendix C

Link Volume Validation

C1 Link Volume Validation

Table 10: Peak Weekday AM Link Validation

Direction	Count Site	Observed Flow (Veh/hr)	Modeled Flow (Veh/hr)	Difference	GEH	% Difference
NB/WB	1	314	349	35	1.9	11%
	2	306	396	90	4.8	29%
	3	552	555	3	0.1	1%
	4	1143	823	-320	10.2	-28%
	9	138	233	95	7.0	69%
	10	660	757	97	3.6	15%
	11	574	627	53	2.2	9%
	12	566	553	-13	0.6	-2%
	13	183	175	-8	0.6	-4%
	14	518	432	-86	4.0	-17%
	F/G	660	757	97	3.6	15%
SB/EB	1	268	326	58	3.4	22%
	2	258	389	131	7.3	51%
	3	517	503	-14	0.6	-3%
	4	1042	825	-217	7.1	-21%
	9	132	160	28	2.3	21%
	10	718	614	-104	4.0	-15%
	11	572	631	59	2.4	10%
	12	448	515	67	3.0	15%
	13	212	146	-66	4.9	-31%
	14	317	428	111	5.8	35%
	F/G	726	614	-112	4.3	-15%

Table 11: Peak Weekday MD Link Validation

Direction	Count Site	Observed Flow (Veh/hr)	Modeled Flow (Veh/hr)	Difference	GEH	% Difference
NB/WB	1	441	334	-107	5.4	-24%
	2	416	372	-44	2.2	-11%
	3	717	716	-1	0.0	0%
	4	1479	985	-494	14.1	-33%
	9	281	266	-15	0.9	-5%
	10	819	966	147	4.9	18%
	11	706	789	83	3.0	12%
	12	664	696	32	1.2	5%
	13	196	235	39	2.6	20%
	14	578	527	-51	2.2	-9%
	F/G	817	966	149	5.0	18%
SB/EB	1	580	450	-130	5.7	-22%
	2	486	594	108	4.7	22%
	3	761	738	-23	0.8	-3%
	4	1573	1033	-540	15.0	-34%
	9	272	215	-57	3.6	-21%
	10	817	711	-106	3.8	-13%
	11	717	749	32	1.2	4%
	12	664	628	-36	1.4	-5%
	13	209	169	-40	2.9	-19%
	14	590	531	-59	2.5	-10%
	F/G	820	711	-109	3.9	-13%

Table 12: Peak Weekday PM Link Validation

Direction	Count Site	Observed Flow (Veh/hr)	Modeled Flow (Veh/hr)	Difference	GEH	% Difference
NB/WB	1	408	365	-43	2.2	-10%
	2	321	457	136	6.9	42%
	3	636	636	0	0.0	0%
	4	1412	934	-478	14.0	-34%
	9	298	293	-5	0.3	-2%
	10	851	956	105	3.5	12%
	11	759	790	31	1.1	4%
	12	658	674	16	0.6	2%
	13	240	255	15	1.0	6%
	14	495	483	-12	0.6	-3%
	F/G	839	956	117	3.9	14%
SB/EB	1	622	567	-55	2.2	-9%
	2	533	638	105	4.3	20%
	3	825	813	-13	0.4	-2%
	4	1618	939	-679	19.0	-42%
	9	298	251	-47	2.9	-16%
	10	723	870	147	5.2	20%
	11	653	910	257	9.2	39%
	12	639	784	145	5.4	23%
	13	205	194	-11	0.8	-5%
	14	649	659	10	0.4	2%
	F/G	718	870	152	5.4	21%

Table 13: Peak Saturday AM Link Validation

Direction	Count Site	Observed Flow (Veh/hr)	Modeled Flow (Veh/hr)	Difference	GEH	% Difference
NB/WB	1	433	543	110	5.0	25%
	2	521	627	106	4.4	20%
	3	805	805	0	0.0	0%
	4	1812	1661	-151	3.6	-8%
	9	177	576	399	20.6	225%
	10	2175	2172	-3	0.1	0%
	11	2134	2113	-21	0.4	-1%
	12	2114	2107	-7	0.1	0%
	13	167	233	66	4.7	40%
	14	2030	1894	-136	3.1	-7%
	F/G	2169	2172	3	0.1	0%
SB/EB	1	606	660	54	2.1	9%
	2	836	933	97	3.3	12%
	3	1006	1005	-1	0.0	0%
	4	1206	1146	-60	1.8	-5%
	9	183	162	-21	1.6	-12%
	10	1343	1190	-153	4.3	-11%
	11	1373	1197	-176	4.9	-13%
	12	1337	1153	-184	5.2	-14%
	13	376	273	-103	5.7	-27%
	14	1132	892	-240	7.5	-21%
	F/G	1338	1190	-148	4.2	-11%

Table 14: Peak Saturday MD Link Validation

Direction	Count Site	Observed Flow (Veh/hr)	Modeled Flow (Veh/hr)	Difference	GEH	% Difference
NB/WB	1	627	566	-61	2.5	-10%
	2	642	697	55	2.1	9%
	3	628	628	0	0.0	0%
	4	1602	1385	-217	5.6	-14%
	9	325	459	134	6.8	41%
	10	1288	1370	82	2.3	6%
	11	1246	1279	33	0.9	3%
	12	1334	1268	-66	1.8	-5%
	13	223	196	-27	1.9	-12%
	14	1258	1096	-162	4.7	-13%
	F/G	1260	1370	110	3.0	9%
SB/EB	1	588	480	-108	4.7	-18%
	2	457	603	146	6.4	32%
	3	642	642	0	0.0	0%
	4	1772	1434	-338	8.4	-19%
	9	375	393	18	0.9	5%
	10	1814	1895	81	1.9	4%
	11	2014	1971	-43	1.0	-2%
	12	2173	1897	-276	6.1	-13%
	13	251	279	28	1.7	11%
	14	2007	1626	-381	8.9	-19%
	F/G	1707	1895	188	4.4	11%

Table 15: Peak Saturday PM Link Validation

Direction	Count Site	Observed Flow (Veh/hr)	Modeled Flow (Veh/hr)	Difference	GEH	% Difference
NB/WB	1	637	541	-96	3.9	-15%
	2	597	610	13	0.5	2%
	3	512	512	0	0.0	0%
	4	1306	982	-324	9.6	-25%
	9	260	312	52	3.1	20%
	10	971	1028	57	1.8	6%
	11	933	936	3	0.1	0%
	12	929	941	12	0.4	1%
	13	381	182	-199	11.8	-52%
	14	661	775	114	4.2	17%
	F/G	962	1028	66	2.1	7%
SB/EB	1	556	447	-109	4.9	-20%
	2	474	583	109	4.7	23%
	3	713	713	0	0.0	0%
	4	1736	1055	-681	18.2	-39%
	9	321	281	-40	2.3	-12%
	10	1450	1425	-25	0.6	-2%
	11	1405	1484	79	2.1	6%
	12	1079	958	-121	3.8	-11%
	13	162	210	48	3.5	30%
	14	1021	1230	209	6.2	20%
	F/G	1552	1425	-127	3.3	-8%

Table 16: Peak Sunday AM Link Validation

Direction	Count Site	Observed Flow (Veh/hr)	Modeled Flow (Veh/hr)	Difference	GEH	% Difference
NB/WB	1	310	352	42	2.3	14%
	3	634	597	-37	1.5	-6%
	10	1413	1430	17	0.4	1%
	12	1329	1393	64	1.7	5%
	13	96	132	36	3.4	37%
	14	1157	1301	144	4.1	12%
	F/G	1413	1430	17	0.4	1%
SB/EB	1	425	602	177	7.8	14%
	3	885	909	24	0.8	-6%
	10	756	763	7	0.3	1%
	12	701	742	41	1.5	5%
	13	261	159	-102	7.0	37%
	14	514	608	94	4.0	12%
	F/G	761	763	2	0.1	1%

Table 17: Peak Sunday MD Link Validation

Direction	Count Site	Observed Flow (Veh/hr)	Modeled Flow (Veh/hr)	Difference	GEH	% Difference
NB/WB	1	452	513	61	2.8	14%
	3	857	794	-63	2.2	-7%
	10	1230	1294	64	1.8	5%
	12	1177	1131	-46	1.3	-4%
	13	220	203	-17	1.1	-8%
	14	1128	953	-175	5.4	-16%
	F/G	1183	1294	111	3.1	9%
SB/EB	1	468	378	-90	4.4	14%
	3	631	668	37	1.4	-7%
	10	1615	1541	-74	1.9	5%
	12	1492	1513	21	0.5	-4%
	13	203	223	20	1.4	-8%
	14	1436	1299	-138	3.7	-16%
	F/G	1578	1541	-37	0.9	9%

Table 18: Peak Sunday PM Link Validation

Direction	Count Site	Observed Flow (Veh/hr)	Modeled Flow (Veh/hr)	Difference	GEH	% Difference
NB/WB	1	340	405	65	3.4	19%
	3	603	603	0	0.0	0%
	10	1047	1165	118	3.5	11%
	12	1027	974	-53	1.7	-5%
	13	323	221	-102	6.2	-32%
	14	753	773	20	0.7	3%
	F/G	1052	1165	113	3.4	11%
SB/EB	1	502	491	-11	0.5	19%
	3	680	679	-1	0.0	0%
	10	859	870	11	0.4	11%
	12	739	808	69	2.5	-5%
	13	135	102	-33	3.0	-32%
	14	663	712	49	1.9	3%
	F/G	867	870	3	0.1	11%

Table 19: Shoulder-Peak Weekday AM Link Validation

Direction	Count Site	Observed Flow (Veh/hr)	Modeled Flow (Veh/hr)	Difference	GEH	% Difference
NB/WB	1	169	187	18	1.3	11%
	2	211	230	19	1.3	9%
	3	371	371	0	0.0	0%
	4	871	898	28	0.9	3%
	9	96	210	113	9.2	117%
	10	532	623	91	3.8	17%
	11	445	590	145	6.4	33%
	12	481	503	22	1.0	5%
	13	223	253	30	1.9	13%
	14	420	292	-128	6.8	-30%
SB/EB	1	98	134	36	3.3	36%
	2	120	147	27	2.3	22%
	3	309	308	-1	0.0	0%
	4	836	807	-29	1.0	-3%
	9	94	138	44	4.1	47%
	10	589	489	-100	4.3	-17%
	11	554	449	-105	4.7	-19%
	12	355	391	36	1.9	10%
	13	209	188	-21	1.5	-10%
	14	314	249	-65	3.9	-21%

Table 20: Shoulder-Peak Weekday MD Link Validation

Direction	Count Site	Observed Flow (Veh/hr)	Modeled Flow (Veh/hr)	Difference	GEH	% Difference
NB/WB	1	246	187	-59	4.0	-24%
	2	239	271	32	2.0	13%
	3	411	410	-1	0.0	0%
	4	1066	959	-107	3.3	-10%
	9	201	224	23	1.6	11%
	10	637	734	97	3.7	15%
	11	514	689	175	7.2	34%
	12	475	600	125	5.4	26%
	13	203	265	62	4.1	31%
	14	424	382	-42	2.1	-10%
SB/EB	1	253	151	-102	7.2	-40%
	2	268	224	-44	2.8	-17%
	3	478	478	0	0.0	0%
	4	1009	880	-130	4.2	-13%
	9	195	164	-31	2.3	-16%
	10	571	660	89	3.6	16%
	11	583	608	25	1.0	4%
	12	452	543	91	4.1	20%
	13	172	225	53	3.8	31%
	14	412	369	-43	2.2	-10%

Table 21: Shoulder-Peak Weekday PM Link Validation

Direction	Count Site	Observed Flow (Veh/hr)	Modeled Flow (Veh/hr)	Difference	GEH	% Difference
NB/WB	1	169	120	-49	4.1	-29%
	2	176	167	-9	0.6	-5%
	3	368	368	0	0.0	0%
	4	1018	870	-148	4.8	-15%
	9	211	296	85	5.3	40%
	10	657	709	52	2.0	8%
	11	550	663	113	4.6	20%
	12	446	557	111	5.0	25%
	13	279	267	-12	0.7	-4%
	14	354	336	-18	1.0	-5%
SB/EB	1	234	184	-50	3.5	-21%
	2	252	287	35	2.2	14%
	3	453	453	0	0.0	0%
	4	1037	859	-178	5.8	-17%
	9	197	207	11	0.7	5%
	10	595	590	-5	0.2	-1%
	11	607	567	-40	1.6	-7%
	12	516	494	-22	1.0	-4%
	13	196	196	0	0.0	0%
	14	532	347	-185	8.8	-35%

Table 22: Shoulder-Peak Weekend AM Link Validation

Direction	Count Site	Observed Flow (Veh/hr)	Modeled Flow (Veh/hr)	Difference	GEH	% Difference
NB/WB	1	184	156	-28	2.1	-15%
	2	205	200	-5	0.4	-2%
	3	329	329	0	0.0	0%
	4	1057	1042	-15	0.5	-1%
	9	112	218	106	8.2	94%
	10	1028	959	-69	2.2	-7%
	11	903	906	3	0.1	0%
	12	874	843	-31	1.1	-4%
	13	199	195	-4	0.3	-2%
	14	736	674	-62	2.3	-8%
SB/EB	1	194	241	47	3.2	24%
	2	257	347	90	5.2	35%
	3	448	443	-5	0.2	-1%
	4	601	798	196	7.4	33%
	9	123	178	56	4.6	46%
	10	502	619	117	4.9	23%
	11	448	548	100	4.5	22%
	12	388	500	112	5.3	29%
	13	237	181	-56	3.9	-24%
	14	249	340	91	5.3	37%

Table 23: Shoulder-Peak Weekend MD Link Validation

Direction	Count Site	Observed Flow (Veh/hr)	Modeled Flow (Veh/hr)	Difference	GEH	% Difference
NB/WB	1	310	214	-96	6.0	-31%
	2	322	275	-47	2.7	-15%
	3	509	509	0	0.0	0%
	4	1167	1281	114	3.2	10%
	9	214	364	151	8.9	71%
	10	1103	1037	-66	2.0	-6%
	11	931	958	27	0.9	3%
	12	1030	893	-137	4.4	-13%
	13	268	288	20	1.2	8%
	14	959	639	-320	11.3	-33%
SB/EB	1	305	270	-35	2.1	-12%
	2	332	295	-37	2.1	-11%
	3	551	551	-1	0.0	0%
	4	1033	1099	67	2.0	6%
	9	240	294	55	3.3	23%
	10	872	870	-2	0.1	0%
	11	888	797	-91	3.1	-10%
	12	855	736	-119	4.2	-14%
	13	194	193	-1	0.1	-1%
	14	818	570	-248	9.4	-30%

Table 24: Shoulder-Peak Weekend PM Link Validation

Direction	Count Site	Observed Flow (Veh/hr)	Modeled Flow (Veh/hr)	Difference	GEH	% Difference
NB/WB	1	234	197	-37	2.5	-16%
	2	243	338	95	5.6	39%
	3	408	439	31	1.5	8%
	4	911	826	-85	2.9	-9%
	9	189	220	32	2.2	17%
	10	683	798	115	4.2	17%
	11	559	749	190	7.4	34%
	12	570	704	134	5.3	23%
	13	313	210	-103	6.4	-33%
	14	467	518	51	2.3	11%
SB/EB	1	258	273	15	0.9	6%
	2	278	395	117	6.4	42%
	3	500	500	0	0.0	0%
	4	893	822	-72	2.4	-8%
	9	189	194	5	0.4	3%
	10	667	723	56	2.1	8%
	11	632	671	39	1.5	6%
	12	567	628	61	2.5	11%
	13	155	130	-25	2.1	-16%
	14	505	518	13	0.6	3%

Appendix D

Journey Time Validation

D1 Journey Time Validation Results

Table 25 : Peak Weekday Journey Time Validation

Route	Modeled (min)		Observed (min)		% Difference	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Peak Weekday AM	67	65	72	70	-7%	-7%
Peak Weekday MD	81	86	75	77	9%	12%
Peak Weekday PM	75	80	73	75	2%	7%

Table 26 : Peak Saturday Journey Time Validation

Route	Modeled (min)		Observed (min)		% Difference	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Peak Saturday AM	74	90	72	82	2%	9%
Peak Saturday MD	137	86	132	84	4%	2%
Peak Saturday PM	222	74	219	84	1%	-11%

Table 27 : Peak Sunday Journey Time Validation

Route	Modeled (min)		Observed (min)		% Difference	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Peak Sunday AM	67	76	74	73	-9%	4%
Peak Sunday MD	96	80	83	72	15%	12%
Peak Sunday PM	73	73	71	71	3%	2%

Table 28 : Shoulder-Peak Weekday Journey Time Validation

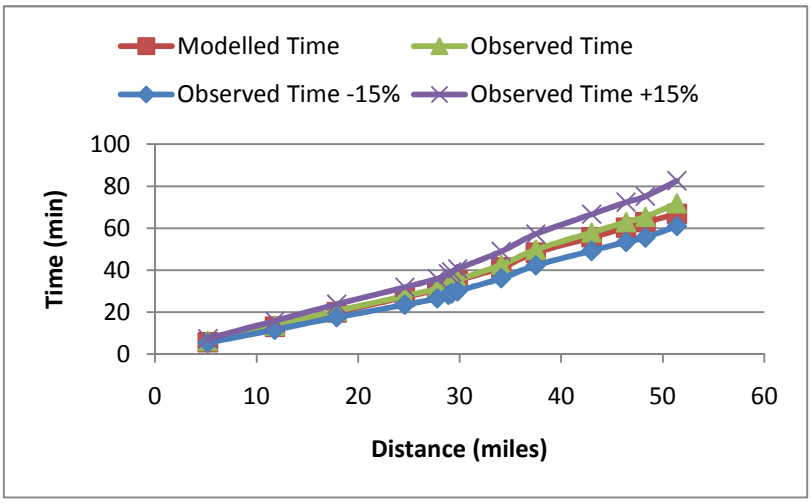
Route	Modeled (min)		Observed (min)		% Difference	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Shoulder-Peak Weekday AM	61	60	56	54	8%	10%
Shoulder-Peak Weekday MD	68	65	57	56	20%	16%
Shoulder-Peak Weekday PM	62	62	56	56	11%	11%

Table 29 : Shoulder-Peak Weekend Journey Time Validation

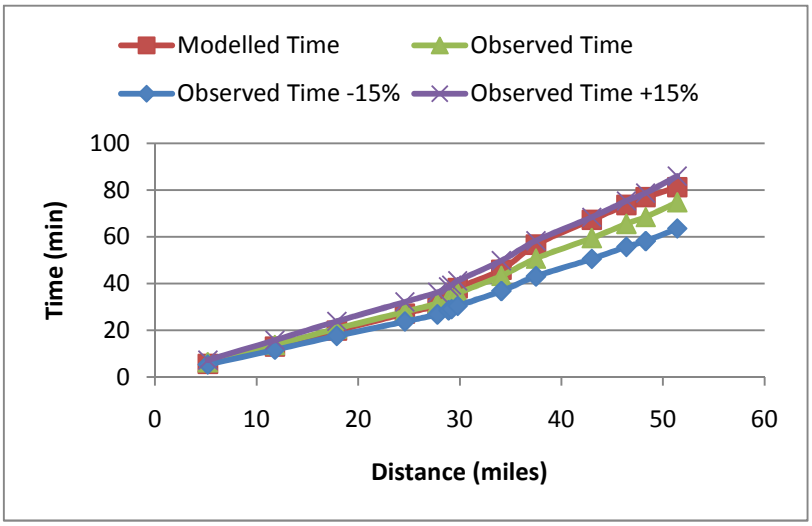
Route	Modeled (min)		Observed (min)		% Difference	
	Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
Shoulder-Peak Weekend AM	61	60	57	58	7%	3%
Shoulder-Peak Weekend MD	70	68	61	60	15%	14%
Shoulder-Peak Weekend PM	65	63	73	58	-11%	8%

Figure 10: Peak Weekday Journey Time Graphs

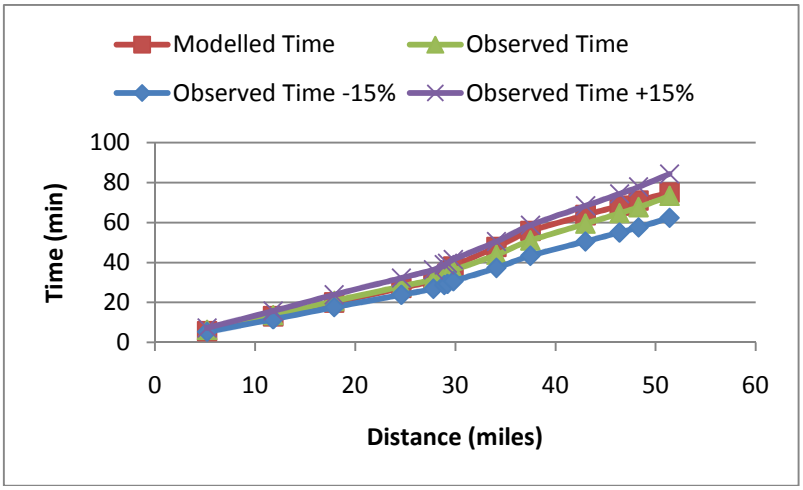
Inbound AM



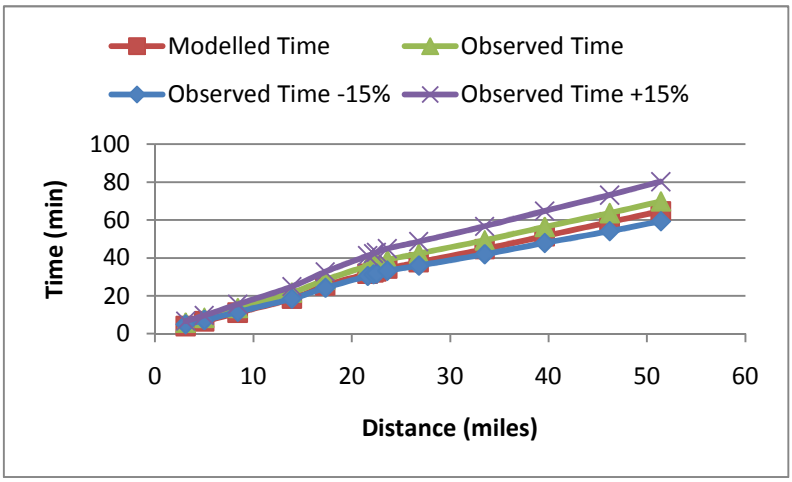
Inbound MD



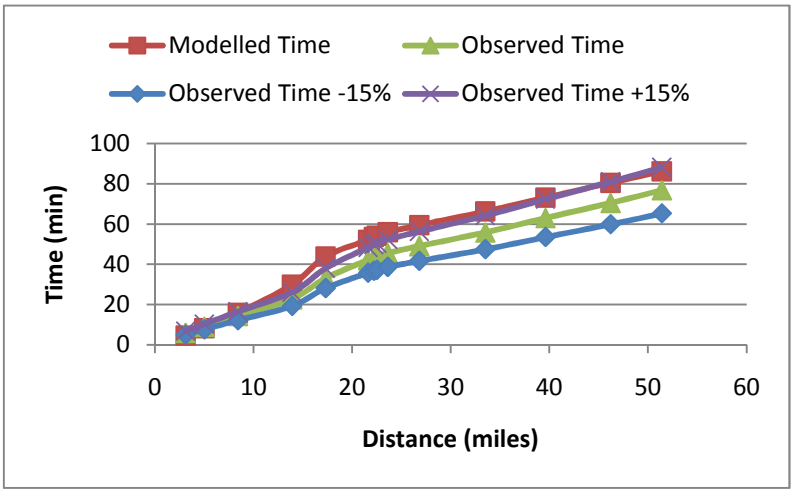
Inbound PM



Outbound AM



Outbound MD



Outbound PM

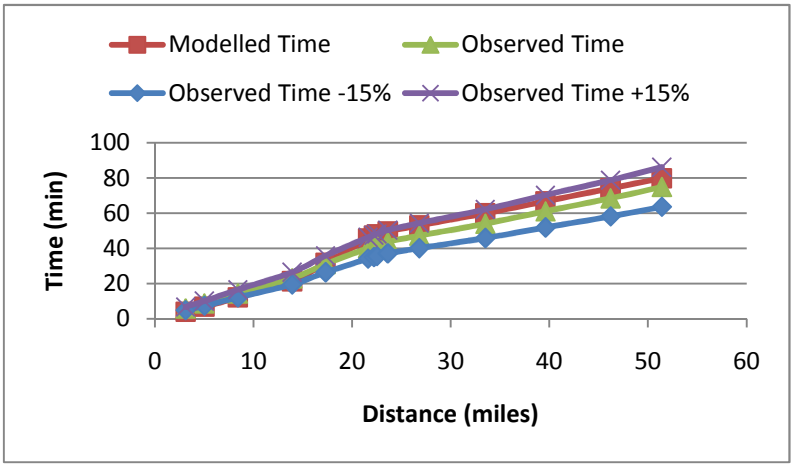
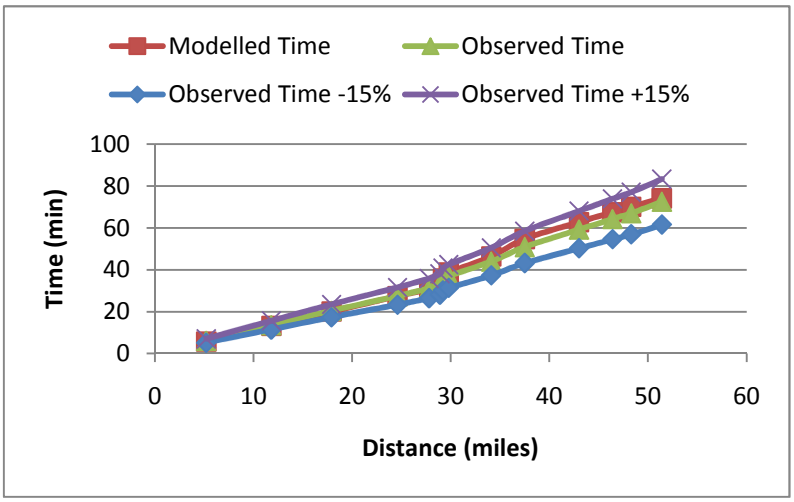
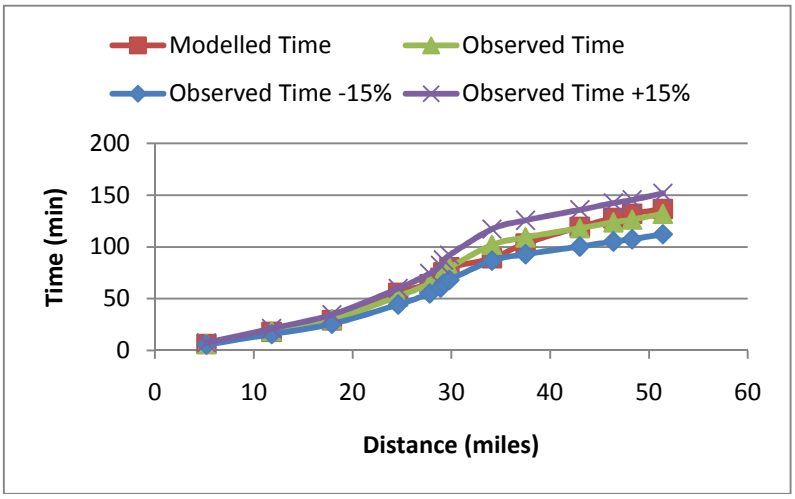


Figure 11: Peak Saturday Journey Time Graphs

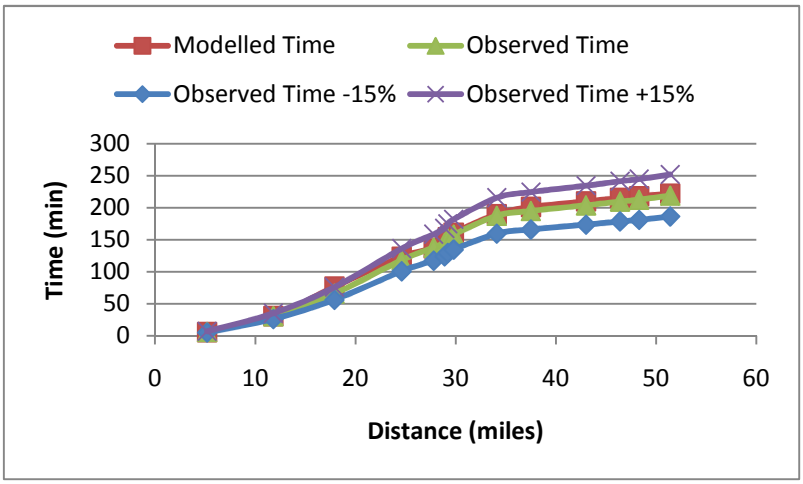
Inbound AM



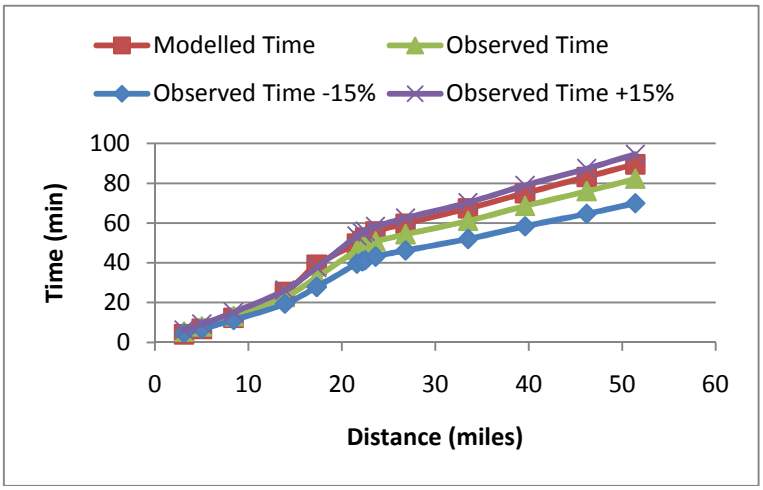
Inbound MD



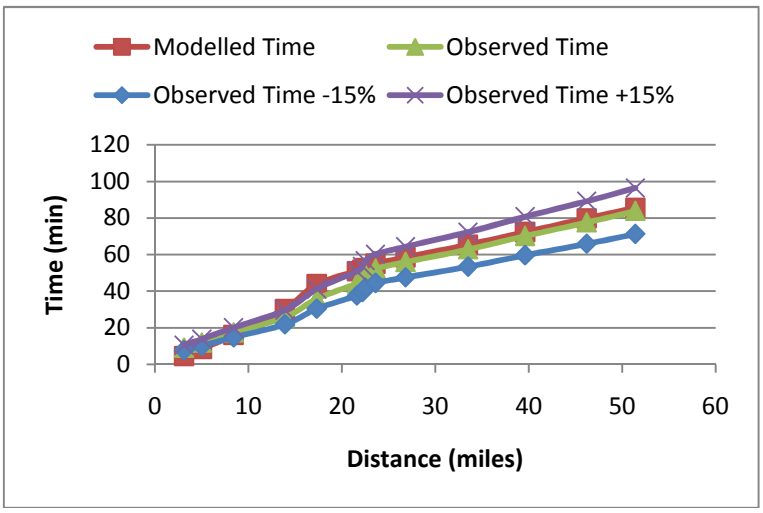
Inbound PM



Outbound AM



Outbound MD



Outbound PM

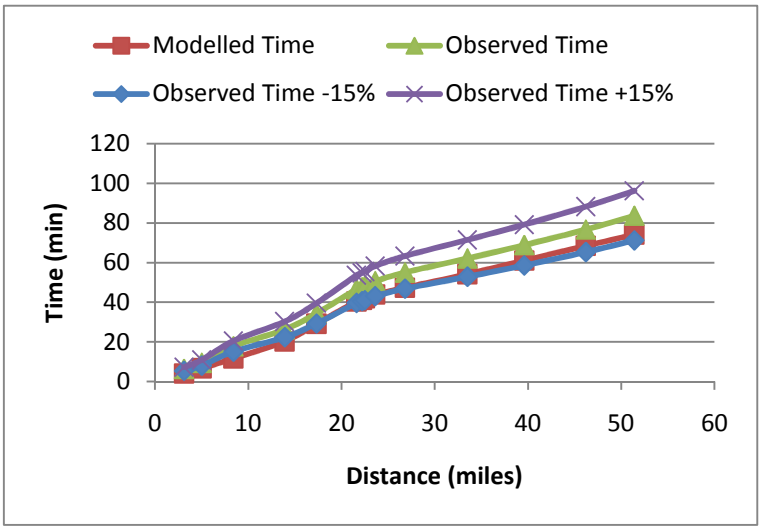
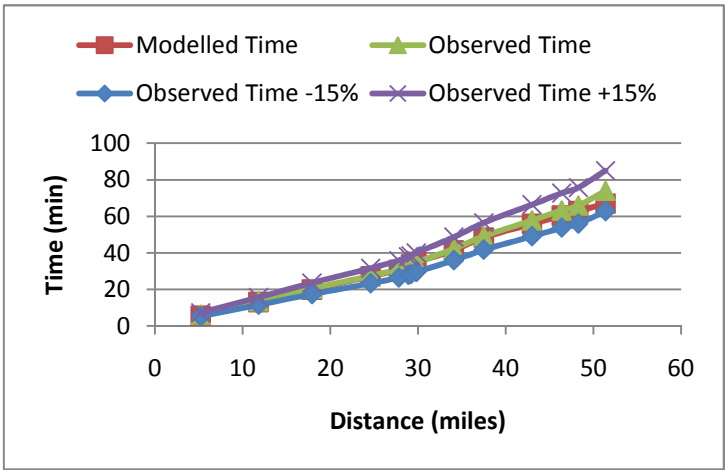
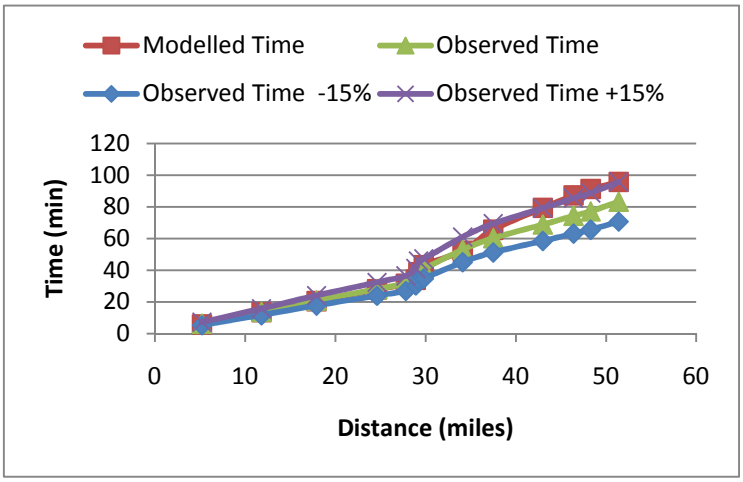


Figure 12: Peak Sunday Journey Time Graphs

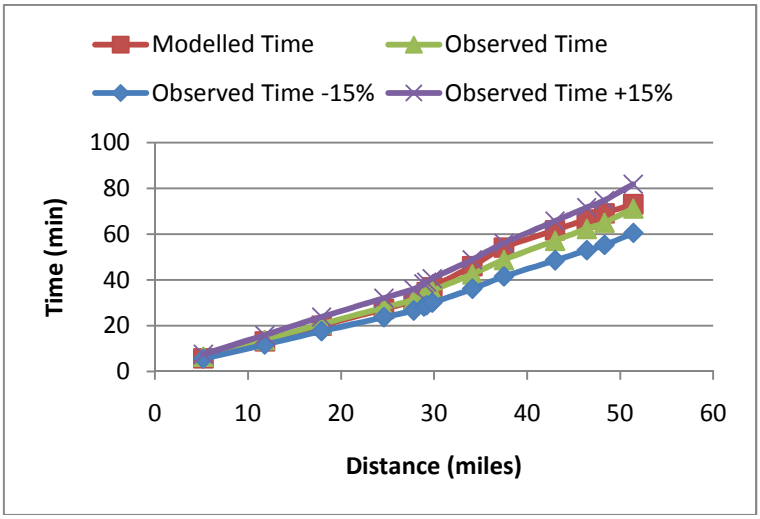
Inbound AM



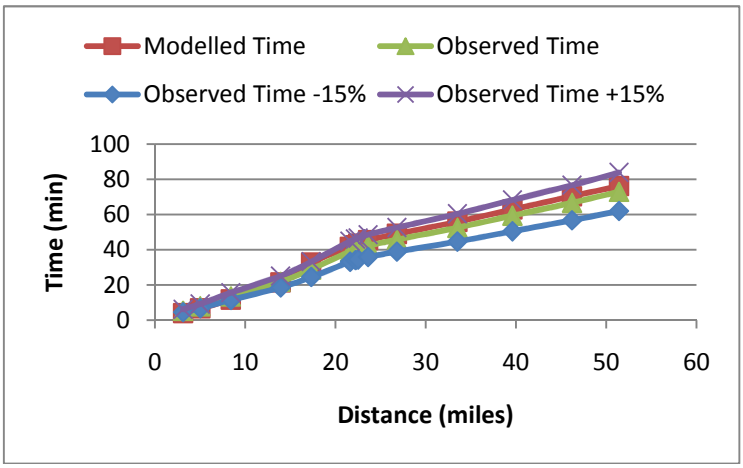
Inbound MD



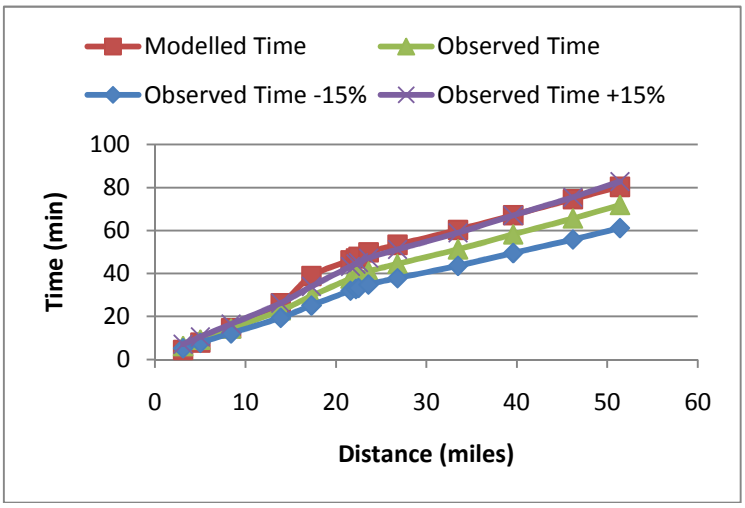
Inbound PM



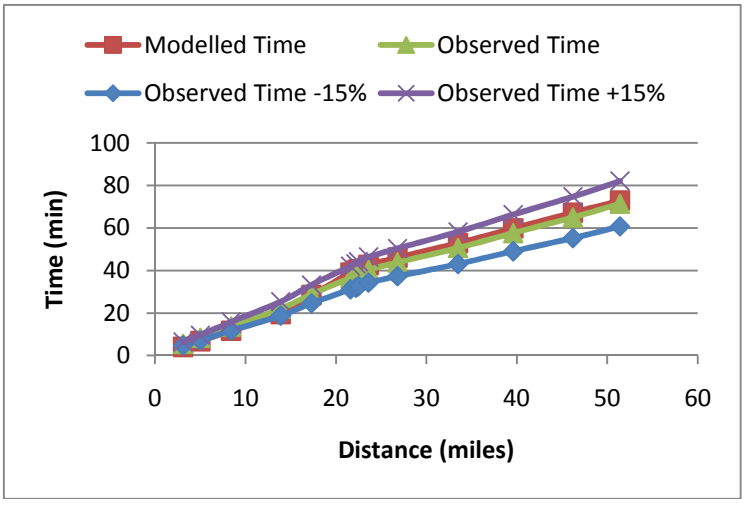
Outbound AM



Outbound MD



Outbound PM



Appendix E

Turning Movement Validation

E1 Turning Movement Validation Results

Figure 13: Peak Weekday AM, Wright Memorial Bridge, (Veh/hr)

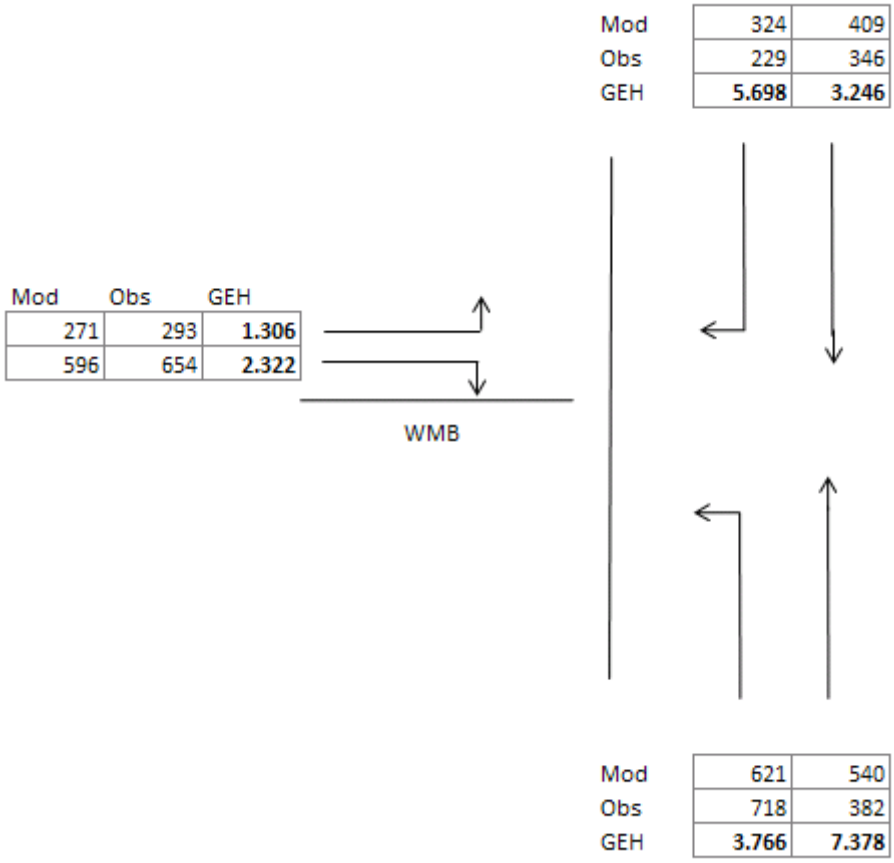


Figure 14: Peak Weekday MD, Wright Memorial Bridge, (Veh/hr)

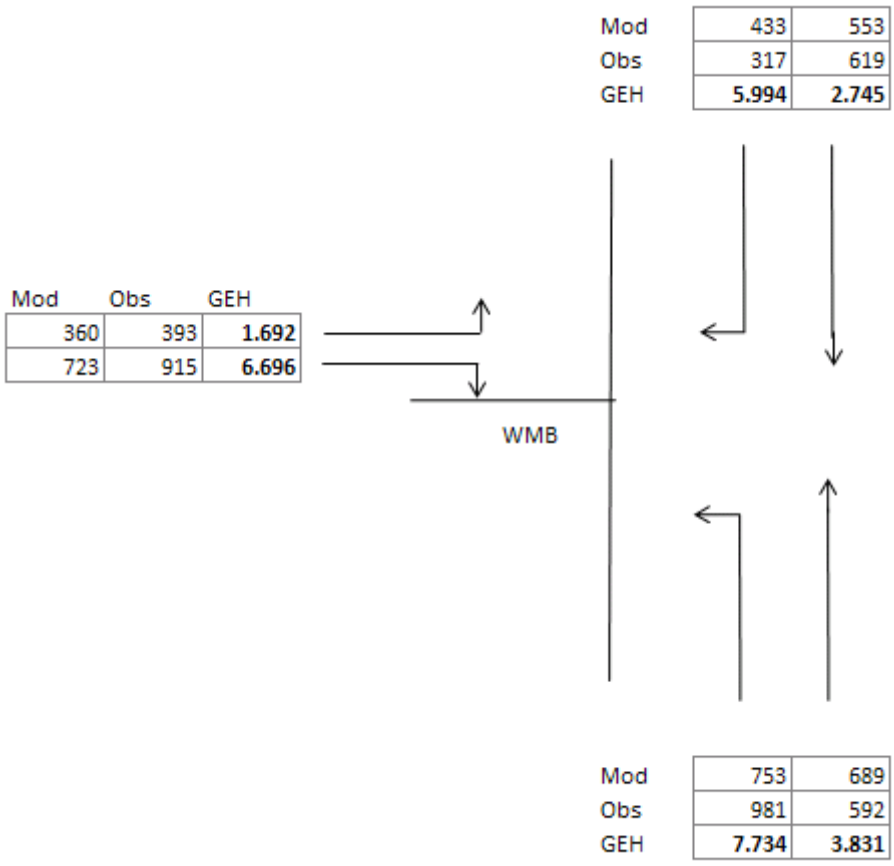


Figure 15: Peak Weekday PM, Wright Memorial Bridge, (Veh/hr)

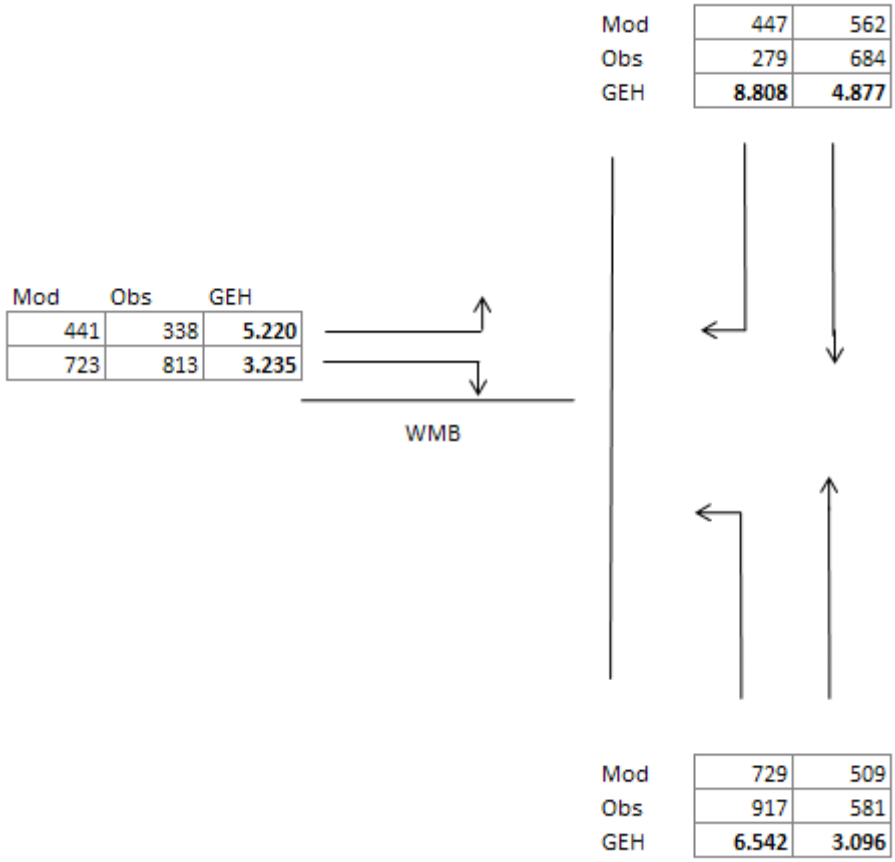


Figure 16: Peak Saturday AM, Wright Memorial Bridge, (Veh/hr)

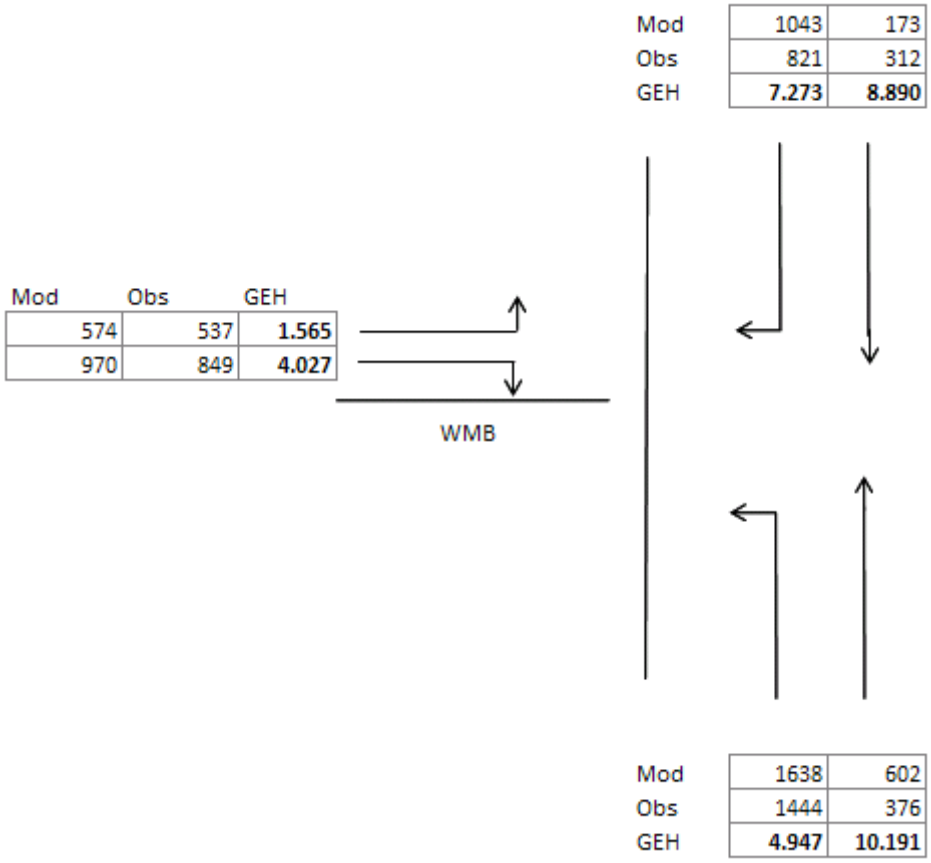


Figure 17: Peak Saturday MD, Wright Memorial Bridge, (Veh/hr)

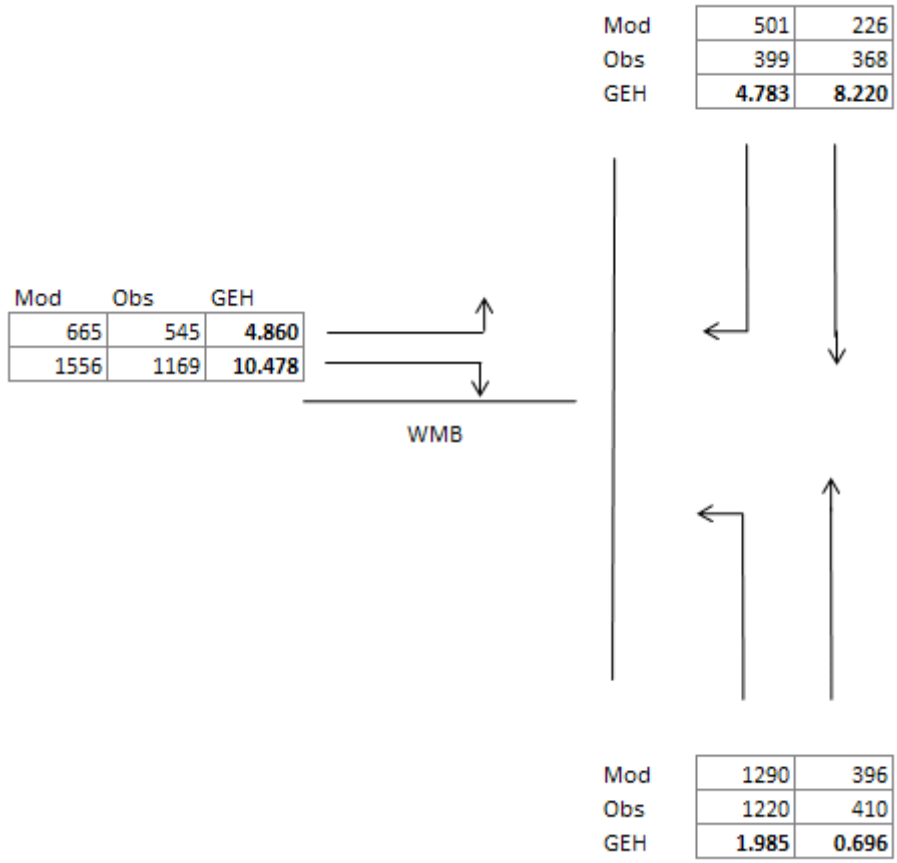


Figure 18: Peak Saturday PM, Wright Memorial Bridge, (Veh/hr)

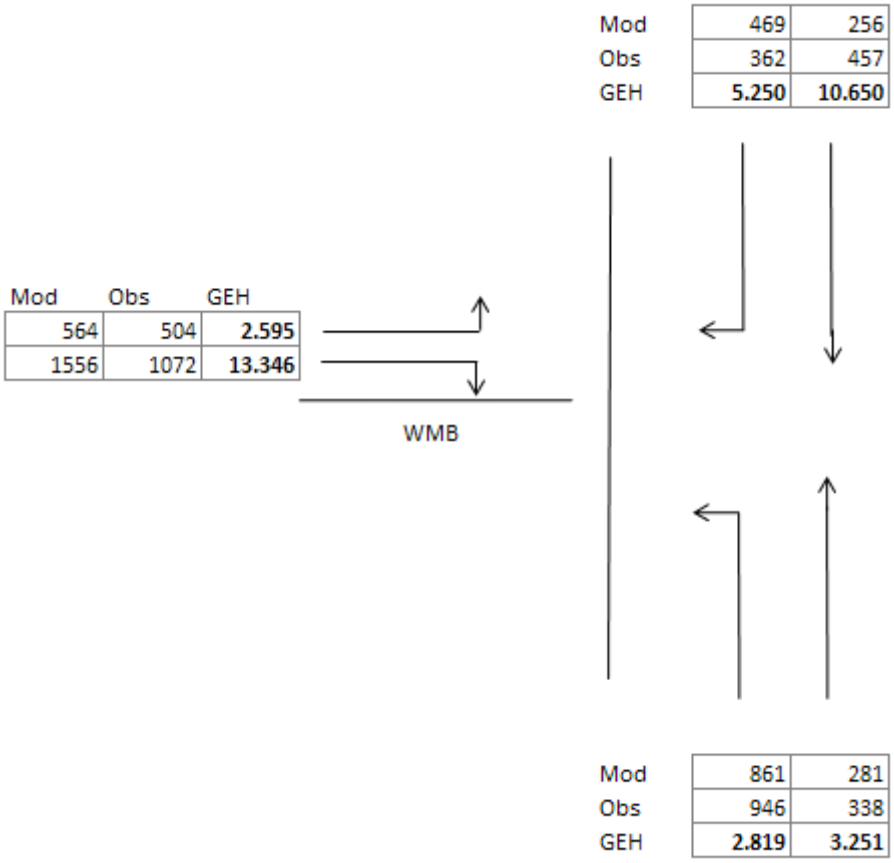


Figure 19: Peak Sunday AM, Wright Memorial Bridge, (Veh/hr)

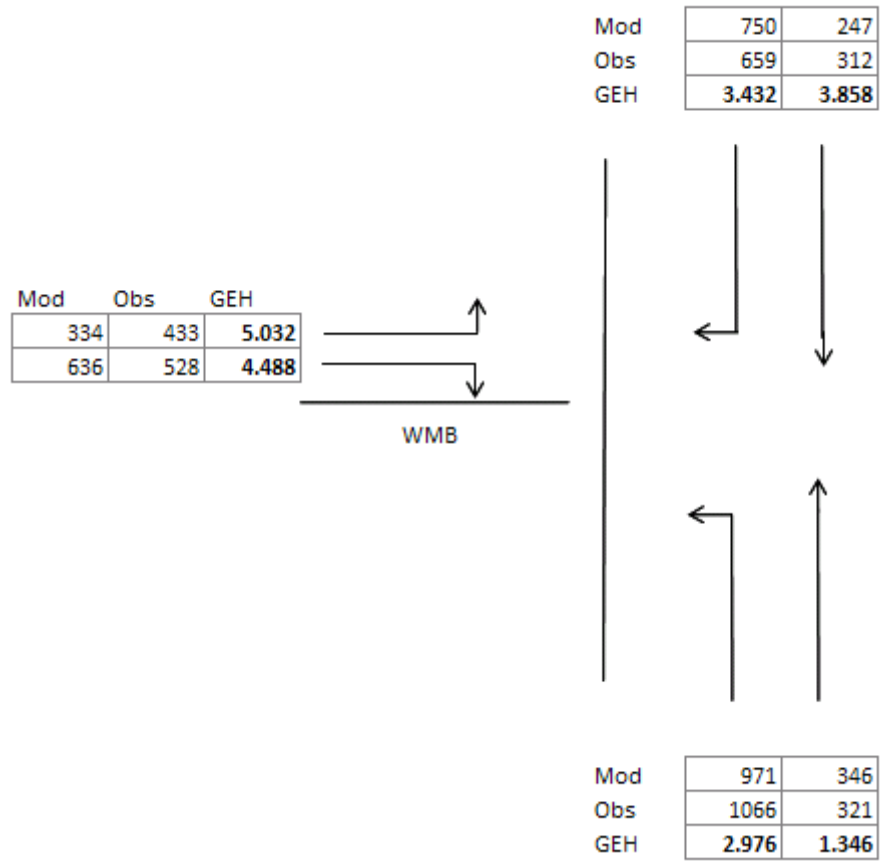


Figure 20: Peak Sunday MD, Wright Memorial Bridge, (Veh/hr)

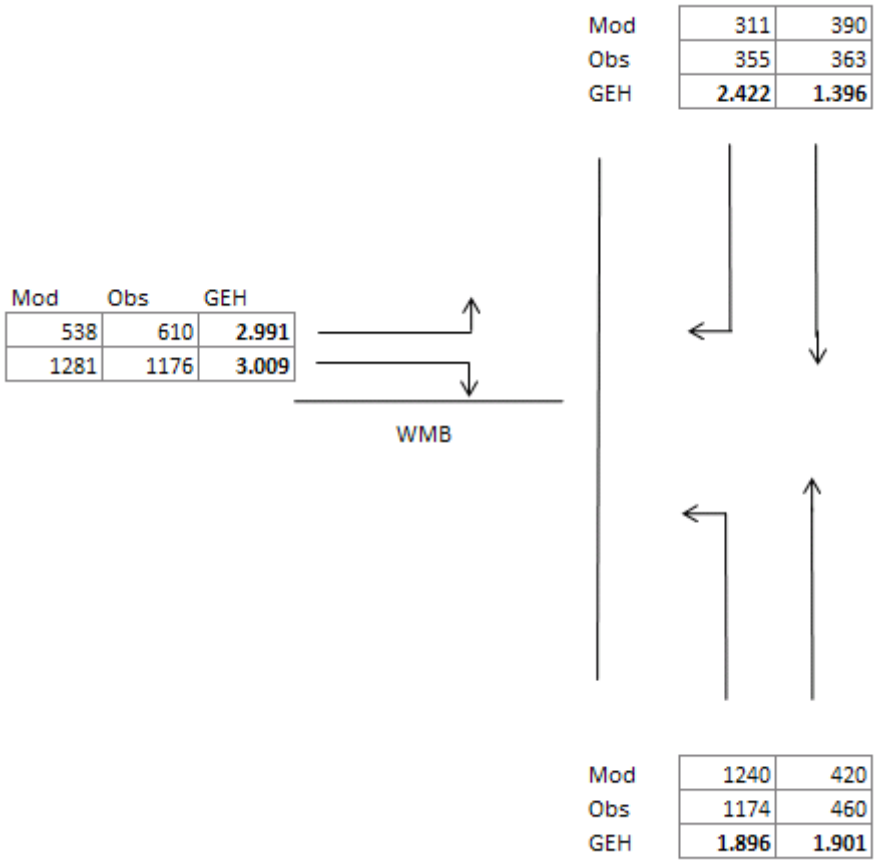


Figure 21: Peak Sunday PM, Wright Memorial Bridge, (Veh/hr)

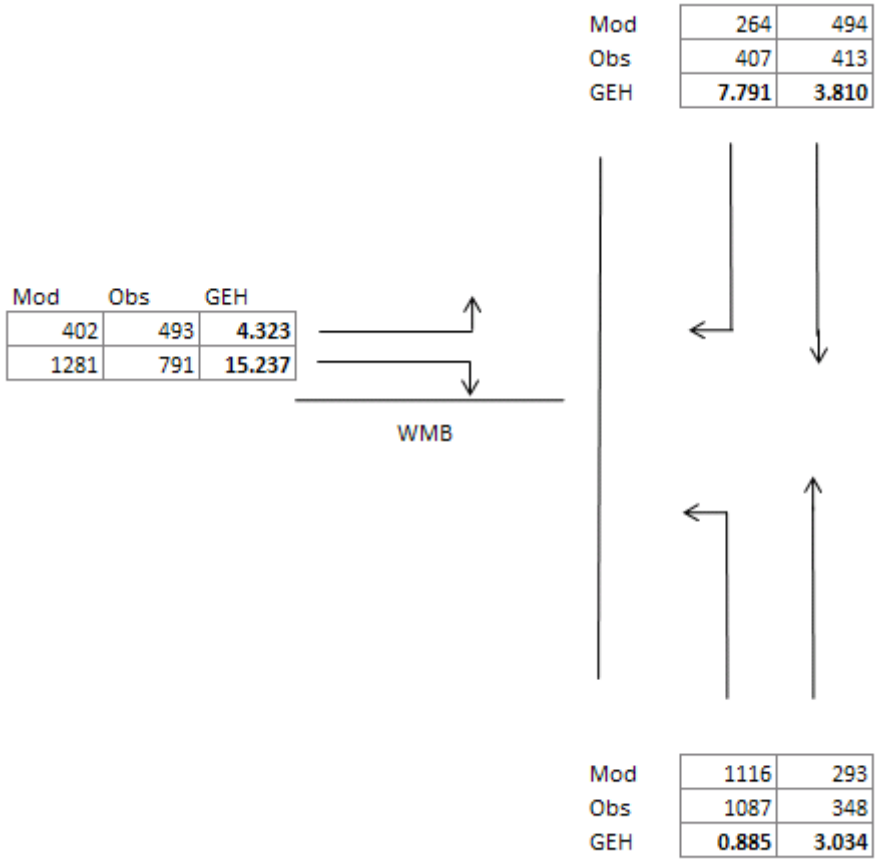


Figure 22: Shoulder-Peak Weekday AM, Wright Memorial Bridge, (Veh/hr)

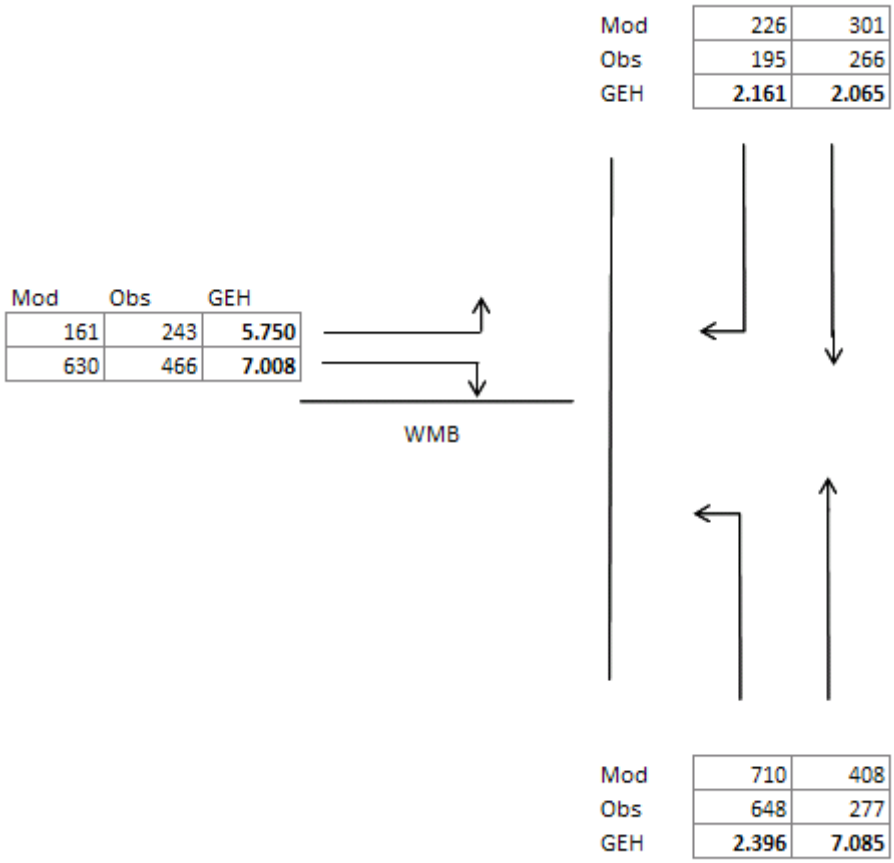


Figure 23: Shoulder-Peak Weekday MD, Wright Memorial Bridge, (Veh/hr)

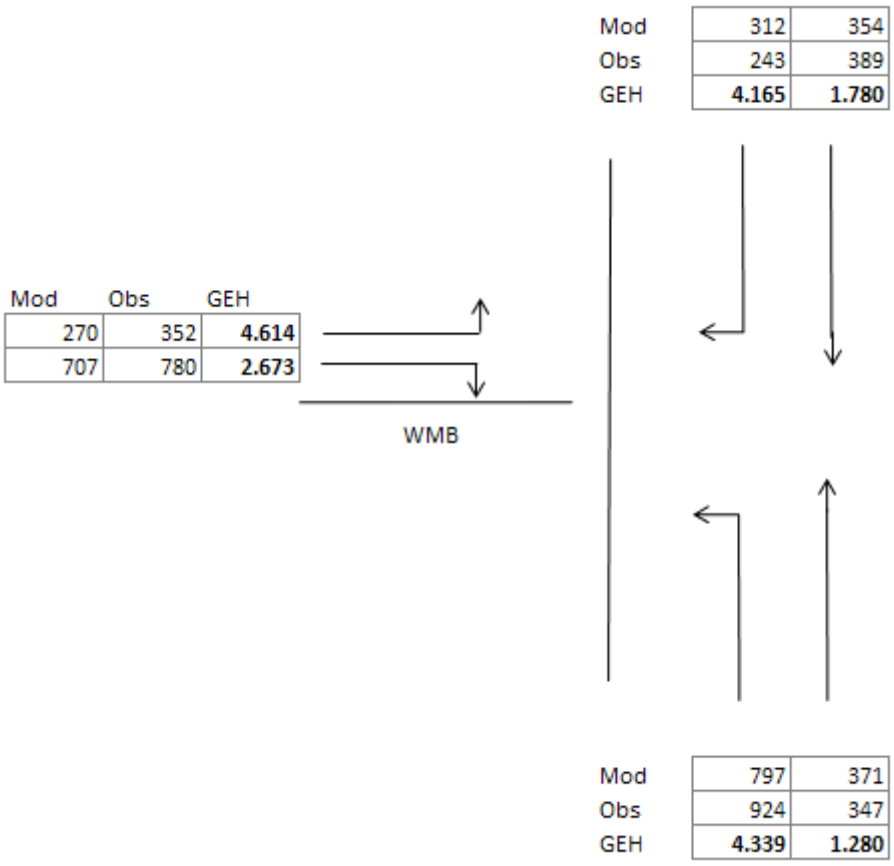


Figure 24: Shoulder-Peak Weekday PM, Wright Memorial Bridge, (Veh/hr)

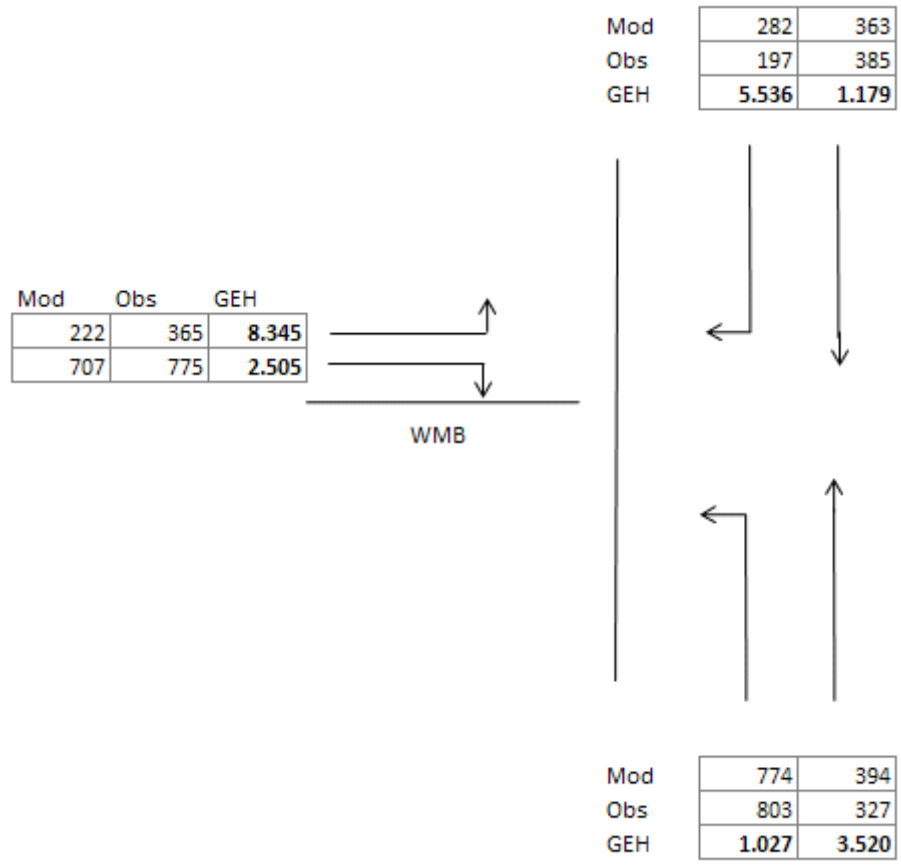


Figure 25: Shoulder-Peak Weekend AM, Wright Memorial Bridge, (Veh/hr)

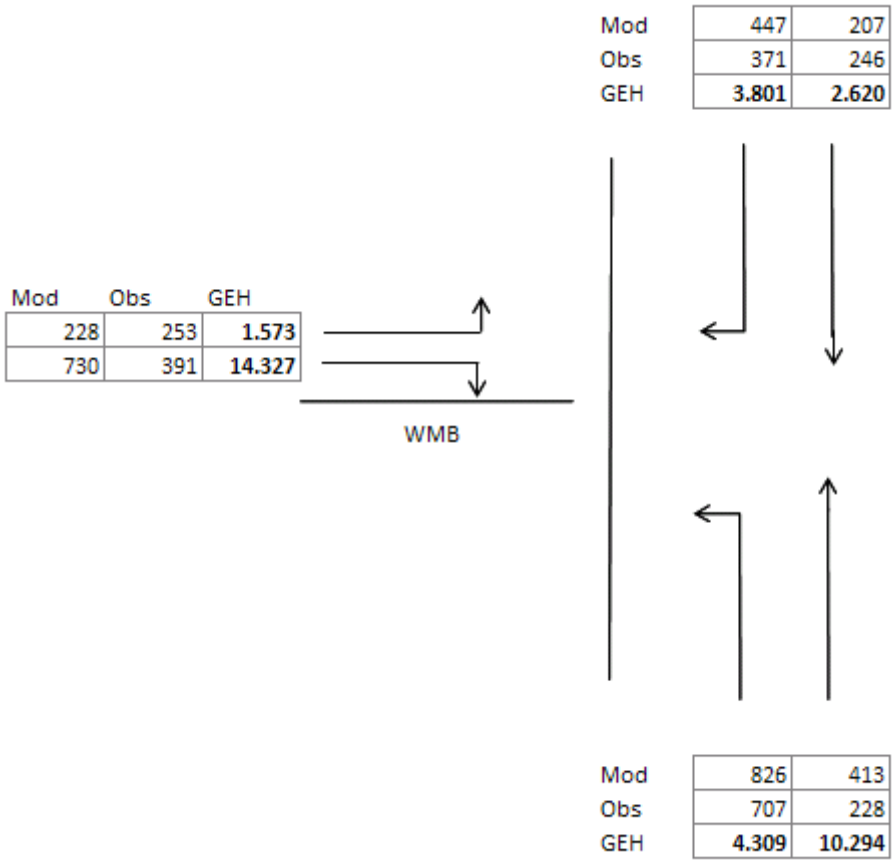


Figure 26: Shoulder-Peak Weekend MD, Wright Memorial Bridge, (Veh/hr)

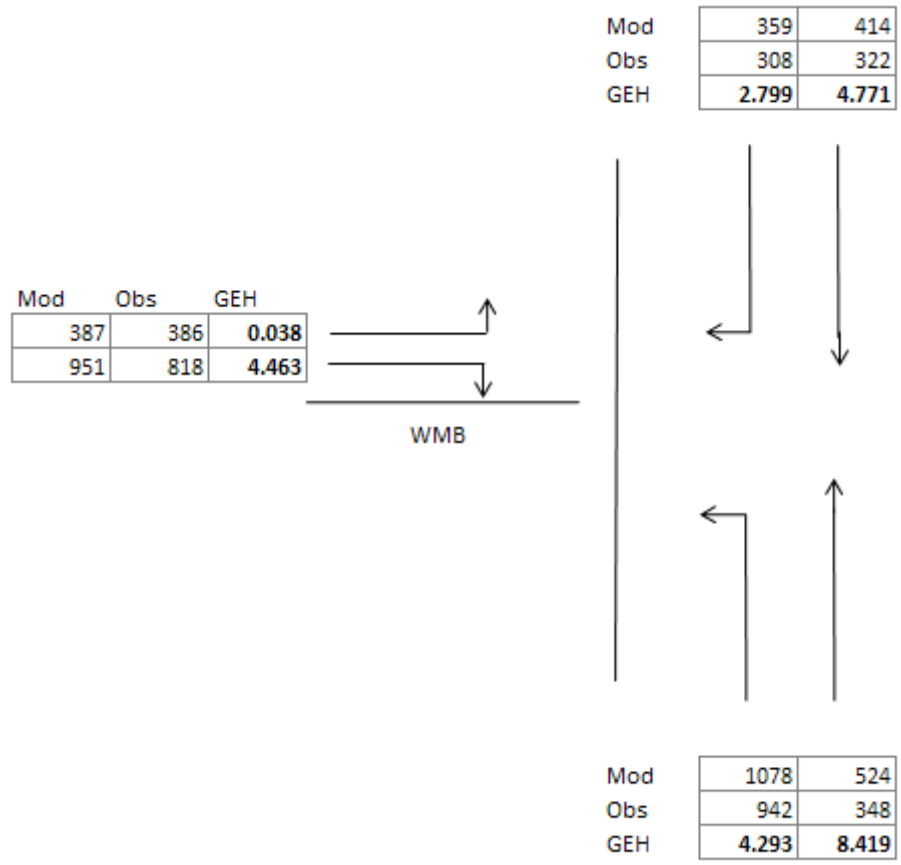
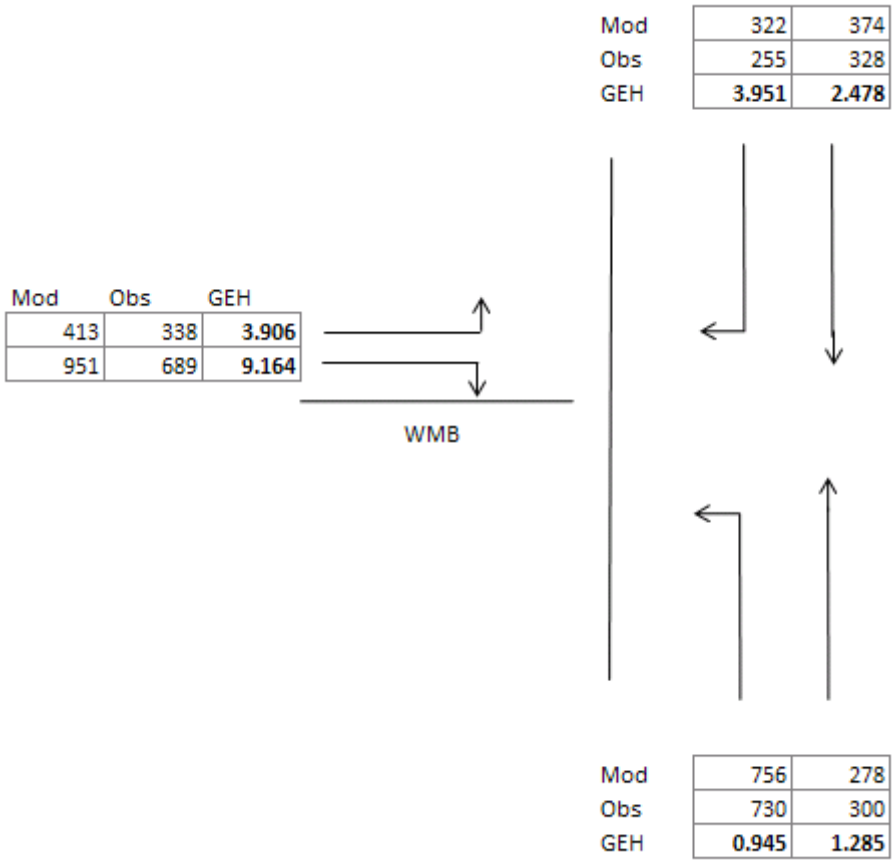


Figure 27: Shoulder-Peak Weekend PM, Wright Memorial Bridge, (Veh/hr)



Appendix K

Technical Memo #9 - Forecasting Methodology & Growth Models Report

Currituck Development Group

Mid-Currituck Bridge

Technical Memo #9 - Forecasting Growth Model Methodology

TM9/209783

Final | November 2010

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 209783

ARUP

Document Verification

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Executive Summary

This technical note summarizes the forecasting methodology which will be applied to the Mid-Currituck Transport Models (MCTM). In order for the impact of the Mid-Currituck Bridge to be assessed, future year forecast models will be developed from the 15 base year models for 2015 (opening year), 2020 and 2030. These will be developed from the existing base year models which replicate observed travel patterns in the Outer Banks to a high standard.

Table 1 below details the models representing the average AM peak, midday inter peak and PM peak hours which will be developed for the future year forecasts (2015, 2020, 2030):

Table 1: Forecast Year Models (2015, 2020, 2030)

Peak Season	**Shoulder-Peak Season**
Peak Weekday AM	Shoulder-Peak Weekday AM
Peak Weekday Midday	Shoulder-Peak Weekday Midday
Peak Weekday PM	Shoulder-Peak Weekday PM
Peak Saturday AM	Shoulder-Peak Weekend AM
Peak Saturday Midday	Shoulder-Peak Weekend Midday
Peak Saturday PM	Shoulder-Peak Weekend PM
Peak Sunday AM	
Peak Sunday MD	
Peak Sunday PM	

The key aspects of the base year models are retained, including the zone system and trip distribution. The model structure detailed in Technical Memos #7 and #8 has been retained. The key differentiation between the base year and forecasting MCTM models are the inclusion of the Mid-Currituck Bridge and the associated toll choice model. This has been developed and calibrated according to the Willingness to Pay (WTP) survey conducted by NuStats, as detailed in their final report dated January 2010.

The future year trip tables will be developed based on extensive regression analysis, highlighting the existence of robust relationships between the observed trip movements and demographic characteristics of the area. A thorough review of NCDOT's STIP (State Transport Improvement Program) documents indicates that no network improvements are proposed in the area, so the only network revision is the inclusion of the Mid-Currituck Bridge. This will be integrated into the MCTM in line with the design specifications.

Annualization factors have been developed based on analysis of the Wright Memorial Bridge permanent count site. Our experience shows that the characteristics of tolled facilities differ from a non-tolled road when analyzing both night time and off-peak usage. Differing levels of diversion are observed during these time periods and, as a result, usage of the tolled facility will vary. The Wright Memorial Bridge data does not include these effects on traffic volumes. As such, we will revisit the annualization factors during the forecasting process to ensure that the adopted factors are appropriate for the study. Tolling

and revenue assumptions are still being discussed with the Developer, and will be confirmed in the documentation that accompanies each set of forecasts.

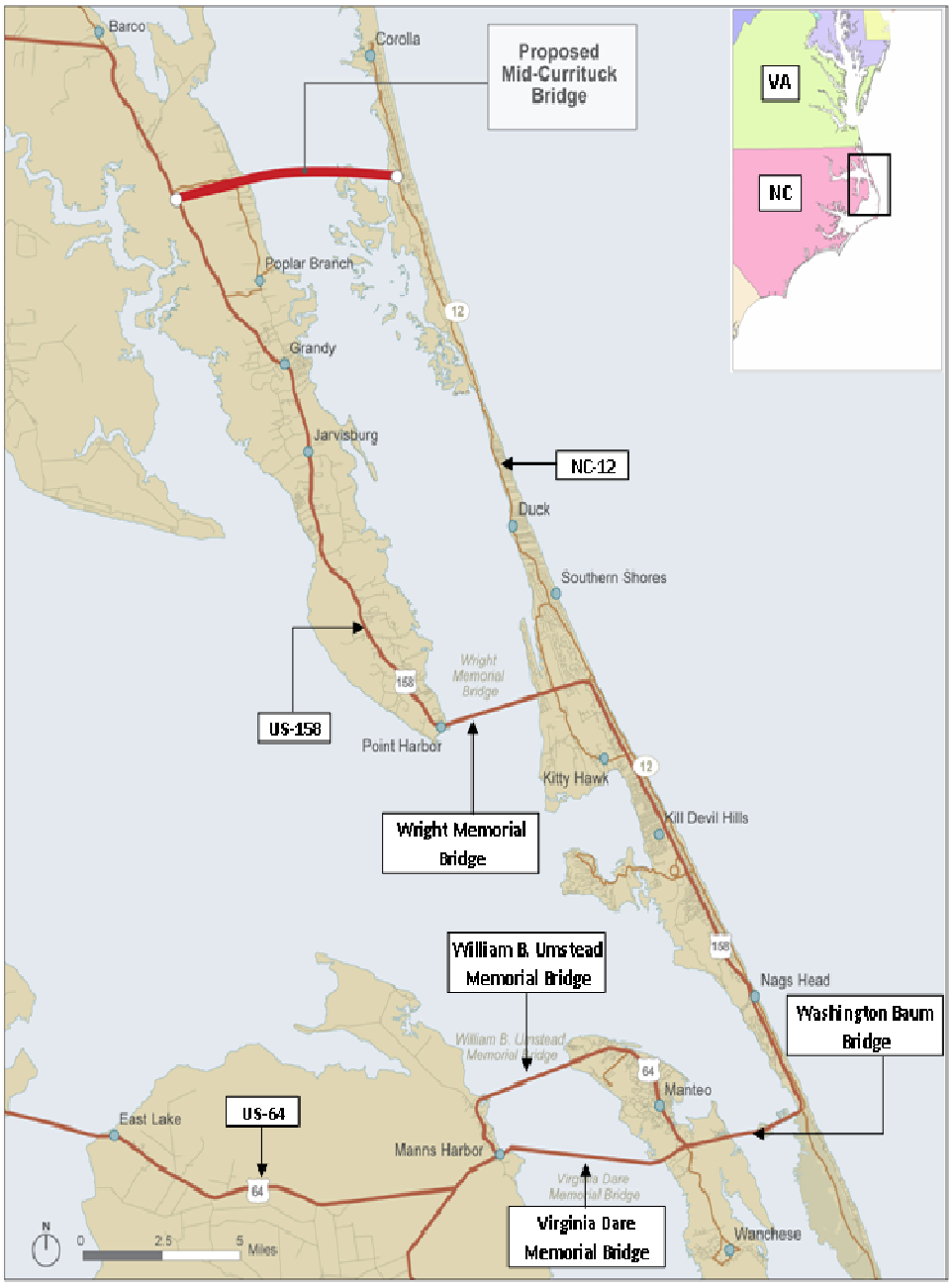
In conclusion, the forecasting methodology proposed is robust for the purpose of an investment grade study. It utilizes the MCTM base year models, which have been validated to a high standard against turning movement counts and observed journey time data, to produce traffic and revenue forecasts for the proposed toll facility, whilst retaining the unique characteristics of the Outer Banks and its travel patterns. As such, the proposed methodology is appropriate for informing funding decisions regarding the proposed bridge.

1 Introduction

1.1 Project Background

The North Carolina Turnpike Authority (NCTA) is authorized to study, plan, develop and undertake preliminary design work on the Mid-Currituck Bridge, a proposed toll facility in the Outer Banks. The Mid-Currituck Bridge is located in northeastern NC and would connect the Currituck County mainland, to Currituck County on the Outer Banks (see Figure 1).

Figure 1: Study Area



The Outer Banks is a 200-mile (320-km) long string of narrow barrier islands off the coast of North Carolina. They cover approximately half the northern North

Carolina coastline, separating the Albemarle Sound and Pamlico Sound from the Atlantic Ocean. The majority of the Outer Banks island communities, from Corolla to Nags Head, are prime summer vacation destinations. At the moment there are two crossing south of the Virginia border; the Wright Memorial Bridge (around 32 miles south of the Virginia border) and the Washington Baum Bridge further south. Both crossings are untolled facilities.

1.2 The Project and Wider Area of Influence

The proposed Mid-Currituck Bridge involves the construction of approximately seven miles of new road from US-158 on mainland Currituck County, to NC-12 on the Outer Banks (see Figure 1). The exact design is currently under development.

This area currently has very limited road access. US-158 and NC-12 are the only means of north-south travel to the Outer Banks. According to preliminary analysis, the new bridge will save approximately 35 miles and significant time for some journeys. It will also improve the evacuation time of the outer banks in the event of emergencies.

In the summer, the Outer Banks become heavily congested and the proposed bridge will significantly ease this congestion whilst facilitating continued growth within the area.

The Outer Banks attracts millions of vacationers throughout the year and significant growth has been observed in recent years. Traffic within the area is highly seasonal, with peak weekend flows between June and August about 125 percent higher on the existing Wright Memorial Bridge and the Outer Banks than traffic observed during the rest of the season. Similarly, weekend traffic is about seventy percent higher than weekday traffic.

The existing road infrastructure operates near or at capacity on NC-12 between US-158/NC-12 and Corolla during summer weekends. The new bridge will substantially improve traffic flow conditions on NC-12 and US-158 and, at the same time, reduce travel time between the mainland and the Outer Banks and improve the overall system efficiency with additional linkage. As a result, it will provide opportunities for the sustainable development of the northern part of the Outer Banks and the mainland.

In this respect, the Project presents a unique marketing opportunity to leverage the existing Outer Banks travel/tourism industry with tailored marketing strategies to highlight substantial travel time savings, cost savings, and increased accessibility to this beautiful and unique destination.

1.3 Purpose of this Report

This technical note summarizes the proposed specification and methodology for the development of the forecasting models within the Mid-Currituck Traffic Model (MCTM). It outlines the following aspects of the forecasting:

- Future year network assumptions.
- Future year demand.
- Willingness to pay parameters.

- Toll choice modeling.

Many aspects of the forecasting models are still in development. As a result, these assumptions are subject to change. Specific details of the forecasting assumptions will accompany each set of forecasts (i.e. Technical Memo #13 will include details of the assumptions included in the preliminary forecasts, and Technical Memo #14 will include the assumptions used to develop the final forecasts).

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2 Future Year Networks

2.1 Introduction

Three future year models, each comprising of fifteen sub-models representing the individual peaks, days and average hours, are to be developed for the Mid-Currituck Bridge traffic and revenue forecasts. These cover:

- 2015 (opening year)
- 2020
- 2030

The study area and zone system used in the base year model are to be retained in the forecasting models. The demographic and socioeconomic study (conducted by Delta Associates) confirmed that there is no need to change the zoning system as it contains sufficient detail for the accurate representation of future year development. The MCTM coverage includes the area of influence surrounding the Mid-Currituck Bridge as defined by the realtor's survey rental contract database, and contains a total of 70 zones. These are extensively reported in Technical Memo #8 – Base Year Model Validation.

2.2 Base Year Network

The base year network has been used as the base from which to develop the future year networks. The base year network was developed based on GIS information available from NCDOT. The available GIS layer included link distance, route class and the number of lanes. Additional information regarding other road characteristics was appended to the network for use within the base year assignment process including link classification, the number of lanes and free flow travel times. These were based on site visit notes produced following a visit to the study area. Extensive logic checking was conducted on the base year network to ensure its suitability for use within the model.

2.3 Network Improvements

2.3.1 Mid-Currituck Bridge Characteristics

Based on ongoing discussions with the Developer, the Mid-Currituck Bridge is assumed to have the following characteristics:

Table 2: Mid-Currituck Bridge Assumptions

Variable	**Assumption**	**Comments**
Mid-Currituck Bridge Alignment	C1 (mainland: 0.35 miles north of Aydlett Road. OBX: Between Ocean Trail street and Ocean Forest. At the southern end of the Corolla Bay subdivision)	In accordance with design specifications
Mid-Currituck Bridge Capacity (vehicles per hour per lane)	1800	Based on Arup's experience of similar projects
Number of Lanes	2	In accordance with design specifications
Toll Bridge Distance	6.87 miles	In accordance with design specifications
Speed	60 miles per hour	In accordance with design specifications

2.3.2 Other Schemes

No committed improvements are noted within NCDOT's State Transport Improvement Program (STIP, June 2008). The future year networks are identical to the base year network with the exception of the Mid-Currituck Bridge.

3 Traffic Growth

3.1 Introduction

Regression analyses were conducted on the 2009 and 2010 in-scope travel demand and the base year demographic conditions developed by Delta. These regressions were conducted on a traffic analysis zone (TAZ) level. The results of the regression analysis demonstrate that logical and statistically significant relationships are observed in the O-D data. The future year trip tables for the peak weekday, peak Saturday, shoulder-peak weekday and shoulder peak weekend models will be derived by factoring the base year demand to represent each of the forecast horizons by using the above regression analysis. Given the synthetic nature of the peak Sunday model, an alternative approach was required as detailed in Section 3.5.

3.2 Data Sources

3.2.1 Demographic Forecasts

A demographic, land use and long-term development survey was commissioned to highlight the potential for the development of the Outer Banks. This will have a marked impact on the potential use of the Project, and the land use survey was required to produce both land use and socioeconomic projections for use within the forecasting methodology.

Three sets of demographic forecasts were developed (one central case and two variations) on a zonal basis for the model forecast years.

A series of regressions were developed relating specific demographic variables to the number of trips within each journey purpose on a zone-by-zone basis. These relationships will be utilized in developing the future year trip tables.

Full details regarding the demographic forecasts, their development and all associated assumptions can be found in the Demographic Survey Final Report by Delta Associates.

3.2.2 GDP & GRP Forecasts

As part of the demographic survey, US GDP and study area GRP forecasts (Currituck and Dare counties) have been developed. Cyclicality in historical US GDP data was observed within 10 economic cycles from 1945 - 2001, with a 5-year expansion period followed by a downturn in year 6. These characteristics have been retained in the GDP and GRP (gross regional product) forecasts. The cyclical growth rates are shown in

Table 3: Cyclical GDP / GRP Growth Rates

	Cyclical Growth Rates					
US GDP	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
Downside	2.5%	2.2%	2.1%	2.0%	1.5%	-0.9%
Central	3.9%	3.5%	3.4%	3.2%	2.6%	-0.7%
Upside	4.7%	4.4%	4.2%	3.9%	3.0%	-1.8%
GRP						
Downside	3.2%	2.8%	2.7%	2.5%	2.1%	-0.4%
Central	3.9%	3.5%	3.4%	3.2%	2.6%	-0.7%
Upside	5.4%	5.0%	4.8%	4.5%	3.6%	-1.3%

Source: Delta Associates

US GDP is forecast to increase at a compound annual growth rate of 2.08% per annum between 2009 and 2040, while the study area GRP is forecast to increase at 2.51% per annum. These are shown graphically in Figure 2 and Figure 3.

Figure 2: US GDP Forecasts, Source: Delta Associates

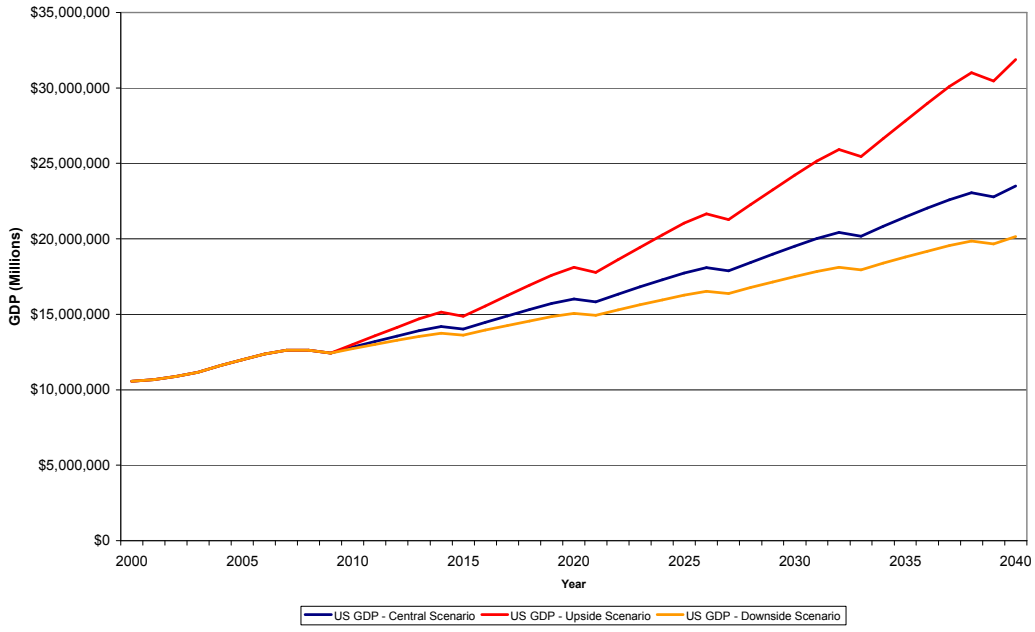
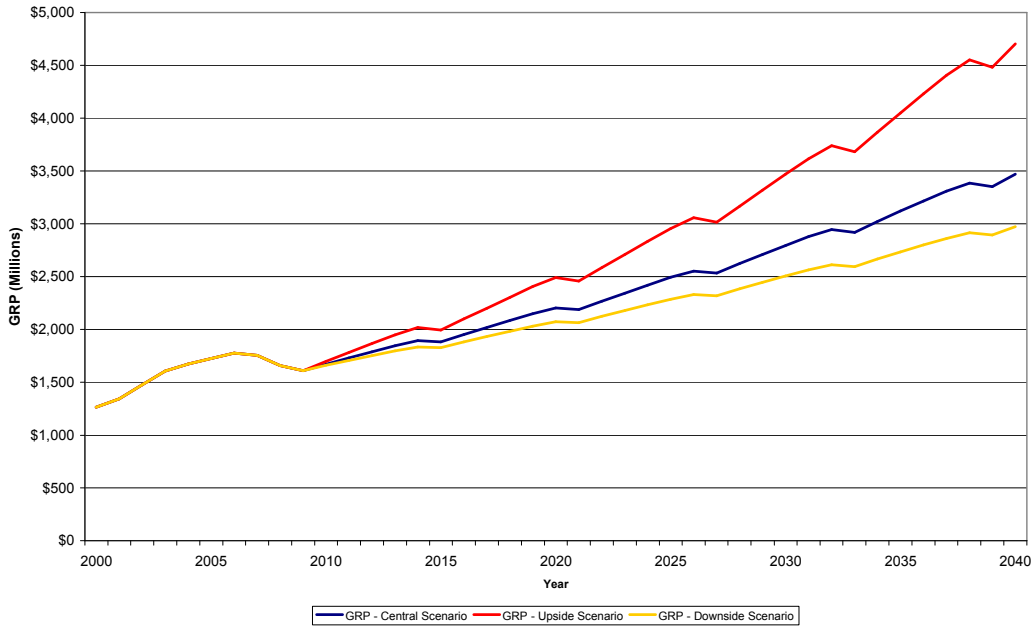


Figure 3: Study Area GRP Forecasts (Currituck & Dare Counties, Source: Delta Associates)



Details of the GDP and GRP forecasts were included in the Demographic Survey Final Report by Delta Associates.

3.3 Regression Analysis

3.3.1 Methodology

The following process was followed to explore the relationships between the demographic variables and in-scope traffic levels within the base year model:

1. The number of in-scope trips (origins and destinations) was calculated for each zone in each model.
2. The number of in-scope trips in each peak hour model was combined for analysis. For clarity purposes, the regression analysis was undertaken on a daily basis (i.e. peak weekday, peak Saturday, etc.) as disaggregation to time periods (i.e. am, pm, midday) would not provide sufficient trip sample sizes for the analysis.
3. Initial regressions were run for the total number of trips in each zone against each demographic variable, highlighting relationships between each journey purpose and the demographic characteristics of the area.

Based on the initial regressions, further multiple regressions were run for combinations of demographic variables to explore additional explanatory relationships. This process was conducted by season, day of week, residency type and journey purpose.

3.3.2 Key Features

There are several key features of this process which need to be highlighted relating to this analysis:

- As expected, analysis of the demographic variables highlighted several cases of colinearity, whereby linear relationships between explanatory variables were observed. Where colinearity was identified, it was not appropriate to use both explanatory variables within the regression analyses.
- During extensive discussions with the demographic sub-consultant (Delta Associates), these interrelationships between demographic variables were confirmed. For example, a number of variables, including items such as retail and rental bedroom numbers are utilized in generating seasonal population numbers by zone. As a result, all datasets are utilized within the regressions, albeit indirectly, through these interrelationships.
- The relationships are consistent for each journey purpose and residency type across all seasons and day of week combinations.

The relationships, coefficients and explanatory variables are outlined in Table 4.

3.3.3 Regression Results

It was found that:

- There are strong correlations relating the demographic variables to the number of observed trips in terms of r-squared values and t-statistics for the key journey purposes. This indicates a robust observed trip table for these market segments.
- Significant relationships were observed for trips that fall under the category ‘other’ (both resident and visitor), and weekday vacation trips. While these showed lower r-squared values, the coefficients are still highly significant in term of their t-statistic. Furthermore, the number of resident and visitor trips within the ‘other’ trip purpose must be dictated by the total population of these two residency categories within the study area.
- Less strong relationships were observed in some very minor segments, such as peak weekday business trips for example. This is due to very few trips in the observed trip tables. These show lower r-squared values for these relationships. Despite this, the relationships are still significant in terms of their associated t-statistics.

The relationships generated in this process verify that the observed trip tables are logical given the demographic characteristics of the zones in question. This highlights that the demographic characteristics were generating consistent numbers of in-scope trips throughout the core market of the Mid-Currituck Bridge on the Outer Banks. As a result, these relationships were deemed appropriate for use in developing the forecasting model trip tables for the peak weekday and Saturday models, and the shoulder-peak weekday and weekend models

Table 4: Trip Generation Regression Results

Year	Season	Day of Week	Resident Type	Trip Purpose	Input Variable 1	Origin	Destination	Input Variable 2	Origin	Destination
2010	Peak	Weekday	Resident / Visitor	Business	Peak of Peak Season Employment	0.147	0.232			
2010	Peak	Saturday	Resident / Visitor	Business	Peak of Peak Season Employment	0.030	0.065			
2009	Shoulder-Peak	Weekday	Resident / Visitor	Business	Spring/Fall Shoulder Season Employment	0.222	0.116			
2009	Shoulder-Peak	Weekend	Resident / Visitor	Business	Spring/Fall Shoulder Season Employment	0.130	0.115			
2010	Peak	Weekday	Resident	Commute	Permanent Population	0.659	0.327	Permanent Employment	0.193	0.453
2010	Peak	Saturday	Resident	Commute	Permanent Population	0.378	0.329	Permanent Employment	0.050	0.102
2009	Shoulder-Peak	Weekday	Resident	Commute	Permanent Population	0.484	0.353	Permanent Employment	0.158	0.188
2009	Shoulder-Peak	Weekend	Resident	Commute	Permanent Population	0.123	0.443	Permanent Employment	0.292	0.030
2010	Peak	Weekday	Resident	Other	Permanent Population	1.083	1.303			
2010	Peak	Saturday	Resident	Other	Permanent Population	0.700	0.244			
2009	Shoulder-Peak	Weekday	Resident	Other	Permanent Population	1.029	0.825			
2009	Shoulder-Peak	Weekend	Resident	Other	Permanent Population	0.851	0.956			
2010	Peak	Weekday	Visitor	Other	Total Bedrooms (Rental & Hotel)	0.103	0.113			
2010	Peak	Saturday	Visitor	Other	Total Bedrooms (Rental & Hotel)	0.039	0.028			
2009	Shoulder-Peak	Weekday	Visitor	Other	Total Bedrooms (Rental & Hotel)	0.046	0.039			
2009	Shoulder-Peak	Weekend	Visitor	Other	Total Bedrooms (Rental & Hotel)	0.062	0.038			
2010	Peak	Weekday	Visitor	Vacation	Total Bedrooms (Rental & Hotel)	0.058	0.043			
2010	Peak	Saturday	Visitor	Vacation	Total Bedrooms (Rental & Hotel)	0.233	0.198			
2009	Shoulder-Peak	Weekday	Visitor	Vacation	Total Bedrooms (Rental & Hotel)	0.027	0.029			
2009	Shoulder-Peak	Weekend	Visitor	Vacation	Total Bedrooms (Rental & Hotel)	0.072	0.080			
2010	Peak	Weekday	Resident / Visitor	Business	Peak of Peak Season Employment	0.147	0.232			
2010	Peak	Saturday	Resident / Visitor	Business	Peak of Peak Season Employment	0.030	0.065			
2009	Shoulder-Peak	Weekday	Resident / Visitor	Business	Spring/Fall Shoulder Season Employment	0.222	0.116			
2009	Shoulder-Peak	Weekend	Resident / Visitor	Business	Spring/Fall Shoulder Season Employment	0.130	0.115			

3.4 Trip Table Growth

3.4.1 In-Scope Traffic

The relationships outlined in Table 4 will be used in forecasting growth in traffic by journey purpose for the peak weekday and Saturday models, and the shoulder-peak weekday and weekend models. The growth in each demographic variable will be input into the relevant equations to calculate the increase in observed traffic for each zone during each day (i.e. peak weekday, shoulder peak weekday etc.)

These daily trips will then be distributed between the three models (AM, MD and PM) according to the observed temporal distribution from the intercept survey, before being distributed spatially in line with the base year distribution.

Where trips were not observed in particular zones in the base year model due to sampling in the mail-back survey but growth is forecast, a distribution will be seeded for that particular zone. This seeded distribution (based on either an average distribution from across all zones within the Northern Outer Banks or an entirely synthetic distribution) will then be factored so that the row and column totals associated with those zones are equal to the forecast number of trips as calculated by the trip generation stage.

As previously discussed, there are no developments in the baseline demographic forecasts to justify trip redistribution. This was confirmed by Delta as part of the outcome of their study. Additional developments were incorporated in the upside demographic forecast, such as an amusement park on the Currituck Peninsula. Such developments would lead to a different trip distribution than that currently found within the existing trip tables. These will be assessed using a synthetic gravity model, similar to that currently in use to distribute the out-of-scope traffic, and trip rates from the ITE Trip Generation Handbook (8^{th} edition).

3.5 Peak Sunday Model

As the origin / destination data collected during the intercept survey undertaken by WSA in 2006 was only collected on a Saturday, synthetic models were required for the peak Sunday models. As a result, the growth forecasting methodology detailed above was not appropriate for the peak Sunday model. Growth in the peak Sunday model will be forecast and applied using the following methodology:

1. Calculate growth by origin-destination pair in the peak Saturday model by dividing the forecast year trip table (prior to induced traffic) by the base year trip table to calculate a table of growth factors by origin-destination pair and journey purpose.
2. Multiply the peak Sunday base year trip table by the table of growth factors by origin-destination pair for each journey purpose to calculate a peak Sunday trip table for each forecast year.

3.6 Induced Traffic

The impacts of induced traffic will be forecast as a proxy for a number of behavioral responses, including the generation of new trips, trip frequency and trip redistribution responses relating to the implementation of the MCB.

An elasticity-based induced traffic module will be integrated into the Mid-Currituck traffic model. The elasticity-based approach uses the generalized costs (including vehicle operating costs as a function of distance) for each movement within the model. These will be extracted for both a 'no-build' scenario and the standard forecasting scenarios (including the new tolled facility). The change in the generalized cost between the no-build and 'build' scenario is then calculated.

Where a generalized cost improvement is observed, an elasticity of demand will be applied to the cost savings in order to calculate the absolute number of induced trips in each sector-to-sector movement. The elasticity's applied will be based on U.S. research and Federal guidance. The U.S. DOT Highway Economic Requirements System (HERS) investment analysis model uses a travel demand elasticity factor of –0.8 for the short term and –1.0 for the long term (FHWA, 2000).. An elasticity factor of -0.8 means that for every 1% reduction in travel cost time there will be a 0.8% increase in travel demand. The results will be checked for reasonableness taking into account the characteristics of the area.

3.7 Growth in Car Ownership

The forecasts will also include an increase in the level of car ownership, albeit this will be relatively small over the growth period. Differential growth rates will be applied to the visitor and resident trip rates utilized in the future year trip table development, based on the Delta Associates car ownership forecasts. The growth rates forecast in internal zones will be applied to resident journey purposes, while the rates forecast in external zones will be applied to visitor journey purposes. These growth rates are shown in the table below.

Table 5: Car Ownership per Person, Internal and External Zones (Delta Demographic Forecasts, Central Scenario)

Year	Internal Zones	Growth (from 2009)	External Zones	Growth (from 2009)
2009	0.961		0.638	
2015	0.984	2.39%	0.651	2.15%
2020	0.997	3.70%	0.658	3.22%
2025	1.006	4.67%	0.662	3.76%
2030	1.013	5.37%	0.662	3.83%

Full details of the derivation of the car ownership forecasts can be found in Delta Associates' Final Report.

3.8 Annualization

3.8.1 Introduction

Each forecast year comprises of 15 models, consistent in definition with the base year models outlined in Technical Memo #8. These are detailed below in Table 6.

Table 6: Forecasting Models

Season	Day	Peak
Peak Season	Weekday	AM
		Midday
		PM
	Saturday	AM
		Midday
		PM
	Sunday	AM
		Midday
		PM
Shoulder Peak	Weekday	AM
		Midday
		PM
	Weekend	AM
		Midday
		PM

The results from these models will be combined using a series of factors in order to present the number of transactions and total revenue on both a daily, seasonal and an annual basis. This will be done through a series of annualization factors which convert the model results into daily values, before converting these into seasonal (peak of peak season and shoulder-peak season) and average annual daily traffic totals.

3.8.2 Annualization Factors

The proposed annualization factors, based on the NCDOT Wright Memorial Bridge permanent count side data, are shown below in Table 7Table 7: 12-Hour to 24-Hour Factors

Time Period	Observed 12-Hour Traffic	Observed 24-Hour Traffic	Factor
Modeled Peak Weekday (12 Hour) to Average Peak Weekday (24 Hour)	19,047	22,865	1.20
Modeled Peak Saturday (12 Hour) to Average Peak Saturday (24 Hour)	36,926	45,547	1.23
Modeled Peak Sunday (12 Hour) to Average Peak Sunday (24 Hour)	28,690	33,675	1.17
Shoulder Peak Weekday (12 to 24 Hour)	15,704	19,616	1.25
Shoulder Peak Weekend (12 to 24 Hour)	24,076	26,406	1.10
Shoulder Peak Weekday (12 Hour) to Off Peak Weekday (24 Hour)	15,704	15,076	0.96

Shoulder Peak Weekend (12 Hour) to Off Peak Weekend (24 Hour)	24,076	14,395	0.60

The number of week and weekend days within each season was calculated to facilitate the presentation of seasonal totals. These are shown below in Table 8. The annual traffic and revenue totals will then be calculated by summing the seasonal totals.

Table 8: Duration of Time Periods.

Time Period	**Days**
Peak Weekday	66
Peak Saturday	13
Peak Sunday	13
Shoulder Peak Weekday	44
Shoulder Peak Weekend	18
Off Peak Weekday	151
Off Peak Weekend	60

The model outputs represent an average hour for each AM peak (07:00 to 10:00), midday period (10:00 to 16:00), and PM peak (16:00 to 19:00). Each model output will be multiplied by the total number of hours within each period (3, 6 and 3 hours respectively) and summed to produce a 12 hour total output. The 12 to 24 hour factors will be applied to these traffic volumes.

Our experience shows that the characteristics of tolled facilities differ to a non-tolled road when analyzing both night time and off-peak usage. Differing levels of diversion are observed during these time periods and, as a result, usage of the tolled facility will vary. The Wright Memorial Bridge data does not include these effects on traffic volumes. As such, we will revisit the annualization factors during the forecasting process to ensure that the adopted factors are appropriate for the study. These will be revised if required. Full details will accompany each set of forecasts in the appropriate technical memos.

3.9 Treatment of Heavy Vehicles

The traffic model includes cars and pick-up trucks. The proportion of trucks is negligible, consisting of just 3% of total traffic on a peak weekday, 0.7% on a peak Saturday and 0.4% on a peak Sunday. Heavy vehicles constituted an average of 2.7% during shoulder-peak weekdays, and 2.2% during shoulder-peak weekends (see Technical Memos #5 and #6). It is assumed that the off-peak periods will have the same characteristics as the shoulder-peak periods.

Potential truck traffic utilizing the tolled facility and associated revenue will be assessed outside of the traffic model using this data based on analysis of the 2009 and 2010 classified turning movement survey conducted at the intersection of NC-12 and US-158 in Southern Shores.

The model forecasts the total number of vehicles which will use the Mid-Currituck Bridge. The number of heavy vehicles using the tolled facility will be

forecast by applying the above assumptions to the total bridge traffic volumes to forecast the percentage of transactions associated with heavy vehicles.

4 Willingness to Pay Results

4.1 Introduction

For a large proportion of trips within the study area, the Mid-Currituck Bridge will offer a reduction in travel times. In order to produce traffic and revenue forecasts, it is necessary to estimate the value that travelers are willing to place on their time when deciding on their route choice.

The value of time (VOT), expressed in dollars per hour, is used to compare the value of time saved using a toll road with the toll cost incurred and, in this context, is more correctly a measure of the value of travel time savings. VOT is an individual preference for spending money to save time and this information will be used to build toll diversion models for use within the traffic and revenue model.

An extensive willingness to pay survey was conducted through a Stated Preference (SP) survey by NuStats, a specialized SP survey firm. SP surveys are a form of attitudinal survey and are strongly recommended when a substantially new alternative is being introduced and there is little historical evidence of how people might respond to this alternative. The survey collected data on current travel behavior, presented respondents with information about the proposed toll road, and, with the use of stated preference experiments, collected information that was used to estimate travelers'' values of time and their propensity to use the proposed toll road under a range of possible future conditions. Complete details of the willingness to pay survey are presented in the Willingness to Pay Final Report by NuStats, dated January 2010.

4.2 Value of Time

There is a strong relationship between VOT and personal or household income and with trip purpose. The willingness to pay survey provided VOTs for each market segment, specific to the unique characteristics of the study area, and the typical patrons of the proposed bridge. These were provided for four different income bands,

Weighted average values of time were produced using the zonal household income data from Delta Associates, who developed the income distribution dataset, the 2006 mailback survey trip distribution, and the realtors' survey contract database. This process was required to ensure that the values of time represented the income distributions observed within the study area rather than those observed in the WTP sample. The base year values of time are outlined below in Table 9. These are the base from which values of time are calculated for each forecast year model.

Table 9: Base Year (2009) Values of Time, Weighted By Income (Pre-Multiple Occupancy and Congestion Factor)

Variable	**VOT (2009 $US)**	**Comments**
VOT per Hour - Resident – Business	$10.69	Weighted according to the

VOT per Hour - Resident – Commute	$10.02	Realtors Contracts Database (visitor trip purposes) and the observed trip distribution (resident trip purposes)
VOT per Hour - Resident – Other	$11.59	
VOT per Hour – Visitor – Vacation	$14.25	
VOT per Hour - Visitor – Business	$11.04	
VOT per Hour - Visitor - Other	$11.97	

4.3 Multiple Occupancy

The values of time include consideration of an adjustment to allow for multiple occupancy for trips that could include more than one financial contributor to the toll. This is based on an analysis of vehicle occupancy by journey purpose taken from the WSA intercept survey.

The only user class which was found to warrant further investigation was the resident commute journey purpose. The weighted average occupancy of resident commute trips based on analysis of the WSA intercept survey data was found to be 1.3, indicating that carpooling is present and many of these vehicles are occupied by multiple economically active occupants. It would be expected that the toll would be shared by all occupants and, as such, it is proposed to apply this factor to the value of time detailed in Table 9 within the forecasting models.

Adjustments will not be applied to any other journey purpose. Visitor vacation trips show the greatest levels of multiple occupancy. However, these do not exceed 6 occupants within a vehicle. While it is possible that these occupants may include more than one financial contributor to the toll, it is not possible to ascertain the proportion of these. It is presumed that these are predominantly large families rather than multiple families carpooling. As such, the approach will assume no adjustments will be made to these journey purposes. Multiple occupancy was considerably lower for 'resident other' trips and no adjustment is justified based on the data.

Similarly, it is not appropriate to apply any adjustments to the business journey purposes, as any costs accrued will presumably be reimbursed by their employer and, as a result, the costs will not be shared between economically active occupants.

4.4 Congestion Factor

An adjustment to allow for the time spent in congested conditions will also be applied to the generalized cost calculation. Analysis of the WTP survey data undertaken by RSG indicated that time spent in congested conditions was valued more highly and therefore an adjustment should be made to the cost of travel in the traffic model to allow for this. A weight of 1.2 was calculated using the locally collected WTP survey data.

This factor will be applied in all models to time spent in congested conditions for all journey purposes other than commuting trips. This is because in the model commuting trips already include a congestion coefficient calculated based on data output from the willingness to pay survey. Congested travel time is calculated by skimming the actual travel time between all origin destination pairs, and the free

flow (uncongested) travel time. The weighting is applied to the difference between the two (i.e. additional travel time due to congestion).

4.5 Value of Time Escalation

It is generally accepted that the VOT exhibits growth over time. One of the most important considerations in assessing the change in value of time is the disposable income available to potential users. Growth in GDP per capita is used a proxy in terms of assessing growth in disposable income.

International experience and research highlight the relationship between real income level growth and toll road patronage. For example, international guidance recommends the use of the GDP per capita as a measure of income and also as a driver of the value of time growth. The same paper also states that the value of non-working time is assumed to increase with income, with an elasticity of 0.8. Working values of time are assumed to grow in line with income, with an elasticity of 1.

The VOT escalation rates proposed are outlined below in Table 10.

Table 10: Value of Time Escalation Rates (Central Scenario)

Variable	Assumption	Comments
Visitor Business Trips	In line with GDP per capita based on Delta Associates GDP forecast 2009 – 2015 Total Growth = 6.6% 2015 – 2020 Total Growth = 9.0% 2020 – 2030 Total Growth = 11.3%	GDP and GRP per capita based on Delta Associates Forecasts. Escalation based international guidance
Visitor Non-Business Trips (Including commute)	In line with GDP per capita based on Delta Associates GDP forecast with an elasticity of 0.8 2009 – 2015 Total Growth = 5.2% 2015 – 2020 Total Growth = 7.2% 2020 – 2030 Total Growth = 9.0%	
Resident Business Trips	In line with GRP per capita based on Delta Associates GRP forecast 2009 – 2015 Total Growth = 4.9% 2015 – 2020 Total Growth = 7.7% 2020 – 2030 Total Growth = 8.9%	
Resident Non-Business Trips (Including commute)	In line with GRP per capita based on Delta Associates GRP forecast with an elasticity of 0.8 2009 – 2015 Total Growth = 3.9% 2015 – 2020 Total Growth = 6.1% 2020 – 2030 Total Growth = 7.1%	

5 Tolling & Revenue

5.1 Introduction

This section outlines the proposed tolling and revenue assumptions for inclusion in the Mid-Currituck forecast year models. These relate to toll rates, toll escalation and toll collection methods. Arup are in ongoing discussions with the Developer regarding many aspects of the tolling and revenue strategy, and specific details regarding these assumptions will be included in the associated documentation which will accompany each set of forecasts.

5.2 Base Year Model Toll Optimization

An extensive toll optimization program is being undertaken using the base year model and future year networks. A wide range of tolls will be applied to each of the 15 base year models in order to identify the revenue maximizing toll rates. This process will be conducted on varying levels of market segment disaggregation, as outlined below:

1. Stage 1 - Toll free runs
2. Stage 2 - Toll optimization by time period
3. Stage 3 – To be confirmed with CDG (by direction, or journey purpose segmentation)
4. Stage 4 - Toll products

The revenue maximizing toll rates from this process will be utilized in defining the toll products to be modeled in the forecasting models.

5.3 Tolling Assumptions

The following tolling assumptions will be applied within the forecast models:

- Real tolls will be modeled, in 2010 prices.
- The heavy vehicle toll rate factor will be agreed in consultation with CDG.
- Average toll rates will be defined following the extensive toll optimization process.
- Appropriate levels of toll violation and leakage, that is revenue lost due to uncollectable tolls, will be agreed in consultation with CDG once the tolling methods are confirmed.
- Traffic ramp-up and long-term growth will be confirmed in consultation with CDG.

5.4 Summary

Table 11 summarizes the tolling and revenue assumptions for the forecast models.

Table 11: Tolling & Revenue Assumptions

Variable	**Assumption**	**Comments**
Modeling of Tolls	Real tolls modeled (2010 prices)	Standard practice for studies of this nature
Toll Escalation	Assumed in line with inflation. No real toll increases.	Arup assumption. Developer to confirm
Average Toll Rate / Toll Products	TBC following toll optimization	
Overnight / Off Peak Toll Rate	TBC in consultation with Developer	
Tolling Methods	Cash / Electronic / Open Road Tolling	Developer to confirm
Traffic Ramp-Up	Differential ramp-up for visitors and resident trip purposes. Ramp-up assumptions dependant on marketing strategy. Proposed ramp-up assumptions (subject to change): Residents: Year 1 – 70% Year 2 – 80% Year 3 – 90% Year 4 – 100% Visitors: Year 1 – 90% Year 2 – 95% Year 3 – 100%	Developer to confirm
Leakage	Dependant on tolling methods. May be incorporated in financial model.	Developer to confirm
Long Term Growth (Beyond 2030)	Dependant on forecast MCB growth rates to 2030. To be confirmed in TM #13 and TM #14.	

6 Toll Choice Modeling

6.1 Introduction

The likelihood of paying tolls was forecast outside the assignment model using a logit choice model. This model compares the generalized costs via the tolled route and by avoiding the tolls and estimates the proportion of trips that will use the motorway. The toll choice model is a binary (toll/non-toll) pre-route choice model, undertaken for all six market segments. The binary choice structure was preferred to an assignment based approach using generalized costs including tolls in the route choice procedure as it was felt likely to give more stable and realistic results, and avoids simplistic 'all or nothing' responses.

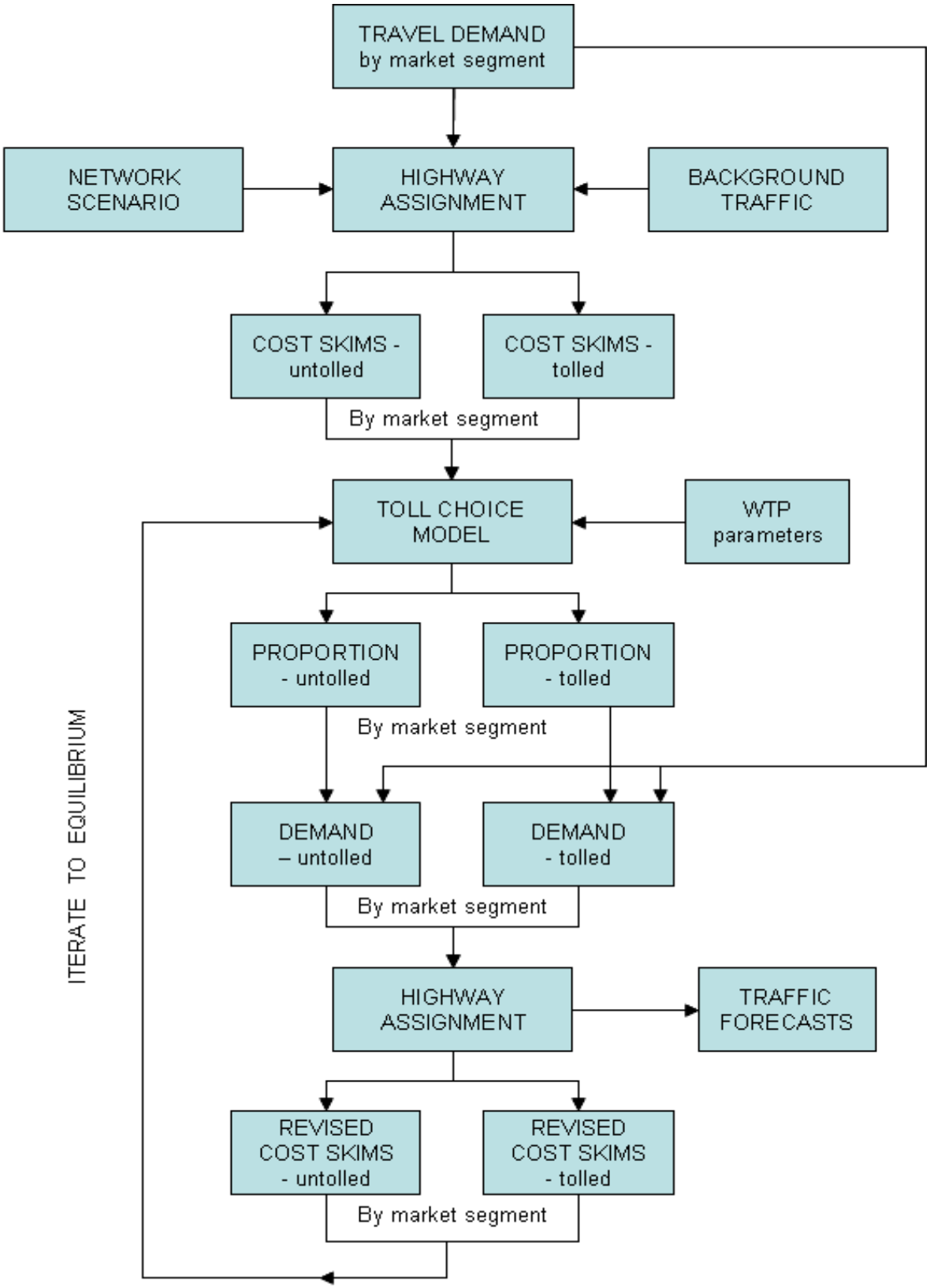
Traffic splits between the tolled motorway and the existing road network are based on forecast probabilities, calculated from the cost differences between the alternatives. This avoids the potential instability of an assignment based approach, in which a small change in costs on one route could trigger all forecasted traffic to switch from one alternative to the other.

6.2 Toll; Choice Model

6.2.1 Model Structure

The structure of the toll choice model is outlined below in Figure 4.

Figure 4: Toll Choice Model



The proportion of toll bridge users for each market segment and movement is forecast based on the tolled and untolled generalized costs. Because of the congested nature of the local road network, this is an iterative procedure, with

initially forecast toll bridge and non-toll bridge demand from the toll choice model re-assigned to the highway network. Each class of demand is restricted to the appropriate crossing (toll or non-toll) in assignment.

The changes in traffic volumes forecast will affect the journey times of the two options and therefore change the forecast use of each bridge from the original forecast. A new set of costs is extracted and input to the toll choice model and the procedure repeated until a stable solution is reached.

The procedure can be summarized as follows:

1. Assign future year demand segmented by journey purpose and residency (D) to future year network using multi-class assignment
2. Extract travel times and distances for in-scope trips via tolled bridge and via untolled bridge
3. Calculate generalized costs Ctoll and Cnotoll for each segment
4. Calculate proportion paying toll Ptoll for each segment
5. Calculate toll bridge demand Dtoll = Ptoll * D for each segment
6. Calculate untolled bridge demand Dtoll = (1-Ptoll) * D for each segment
7. Assign Dtoll and Dnotoll for all segments to future year network using multi-class assignment, controlling to route tolled and untolled demand via the appropriate bridge.
8. Extract revised travel times for in-scope trips via tolled bridge and via untolled bridge

Stages 3-8 are repeated until a stable solution is reached.

6.2.2 Logit Model

The logit model determines the probability of selecting the toll bridge based on the time and cost savings. The model has the following structure:

Equation 1: Toll Choice Logit Model

$$P_{toll} = exp(-\lambda * C_{toll}) / [exp(-\lambda * C_{toll}) + exp(-\lambda * C_{notoll})]$$

Toll choice coefficients were developed for each trip purpose. These toll model parameters were determined by the stated preference survey conducted by NuStats. Full details of the willingness to pay survey and subsequent modeling is reported in NuStats' January 2010 Final Report.

6.2.3 Vehicle Operating Costs

Perceived vehicle operating costs will be incorporated in the model in the assignment and toll choice procedures. Perceived vehicle operating costs include 'out of pocket' costs for a particular journey, and therefore costs associated with fuel, oil maintenance and tire wear. Other costs, including insurance, vehicle ownership costs, financing and depreciation, have been excluded as they are not considered as an element of perceived costs in route choice decision making.

The data sources and impact of vehicle operating costs on the modeling are outlined below:

- Vehicle operating costs per mile were obtained from the American Automobile Association ('Your Driving Costs 2009') and integrated into the assignment and toll choice procedures. A average value (covering all car types) of $0.154 per mile will be used; and
- The inclusion of vehicle operating costs as a function of distance within the toll choice model adds considerable benefit to the tolled crossing, ensuring that the complete benefits of the bridge in terms of both time and distance savings are incorporated within the toll choice model.

7 Forecasting Assumptions

7.1 Summary

A summary of the forecasting assumptions can be found below overleaf in Table 12.

Table 12: Forecasting Assumptions

Category	Variable	Forecasting Assumption	Comments
Concession Period	Opening Year	2015	In accordance with design specifications
	End of Concession	TBC	Developer to confirm
	Modeled Years	2015, 2020, 2030	As previously agreed with the Developer
Network Assumptions	Mid-Currituck Bridge Alignment	C1 (mainland: 0.35 miles north of Aydlett Road. OBX: Between Ocean Trail street and Ocean Forest. At the southern end of the Corolla Bay subdivision)	In accordance with design specifications
	Mid-Currituck Bridge Capacity (vehicles per hour per lane)	1800	Based on Arup's experience of similar projects
	Lanes per Direction	1	In accordance with design specifications
	Toll Bridge Distance	6.87 miles	In accordance with design specifications
	Speed	60 miles per hour	In accordance with design specifications
	Wright Memorial Bridge Capacity (vehicles per hour per lane)	1200	Based on Arup's experience of similar projects
	Other Study Area Future Year Network Improvements	None	In accordance with NC State Transport Improvement Program (June 2008)
Demographic & Economic Forecasts	Demographic & Economic Forecasts	Delta Associates Forecasts	
Annualization Factors	Modeled Peak to Average Peak Season Weekday: 12 Hour to 24 Hour Factor	1.20	Based on NCDOT WMB Permanent Count Data. Differing levels of diversion are observed during these time periods and, as a result, usage of the tolled facility will vary. We will revisit the annualization factors during the forecasting process to ensure that the adopted factors are appropriate for the study.
	Peak Season: Number of Weekdays	66	
	Modeled Peak to Average Peak Season Saturday: 12 Hour to 24 Hour Factor	1.23	
	Peak Season: Number of Saturdays	13	
	Modeled Peak to Average Peak Season Sunday: 12 Hour to 24 Hour Factor	1.17	

	Peak Season: Number of Sundays	13	
	Shoulder Peak Season Weekday: 12 Hour to 24 Hour Factor	1.25	
	Shoulder Peak Season: Number of Weekdays	44	
	Shoulder Peak Season Weekend: 12 Hour to 24 Hour Factor	1.10	
	Shoulder Peak Season: Number of Weekend Days	18	
	Off Peak Season Weekday: Shoulder Peak 12 Hour to Off Peak 24 Hour Factor	0.96	
	Off Peak Season: Number of Weekdays	151	
	Off Peak Season Weekend: Shoulder Peak 12 Hour to Off Peak 24 Hour Factor	0.60	
	Off Peak Season: Number of Weekend Days	60	
Heavy Vehicle Percentage	Peak Weekday	3.0%	Based on 2009/2010 Classified Turning Movement Survey for all 'in-scope' movements (i.e. WMB to Northern Outer Banks and vice versa). Off-peak percentages assumed to be the same as Shoulder-peak models
	Peak Saturday	0.7%	
	Peak Sunday	0.4%	
	Shoulder-Peak Weekday	2.7%	
	Shoulder-Peak Weekend	2.2%	
	Off-Peak Weekday	2.7%	
	Off-Peak Weekend	2.2%	
Value of Time (2009 $US)	VOT per Hour - Resident Business	$10.69	Based on 2009 WTP Survey, weighted by realtors contract database, 2006 mailback survey and Delta Associates' income distributions
	VOT per Hour - Resident Commute	$10.02	
	VOT per Hour - Resident Other	$11.59	
	VOT per Hour - Visitor Vacation	$14.25	
	VOT per Hour - Visitor Business	$11.04	
	VOT per Hour - Visitor Other	$11.97	

	Resident Commute Occupancy Factor	1.3	Based on WSA intercept survey
	Congestion Factor	1.2	Based on RSG analysis of WTP survey data
VOT Escalation	Visitor Business Trips	In line with GDP per Capita based on Delta Associates GDP Forecast 2009 - 2015 Growth = 6.55% 2015 - 2020 Growth = 8.96% 2020 - 2030 Growth = 11.29%	GDP and GRP per Capita based on Delta Associates Forecasts. Escalation based on international guidance
	Visitor Non-Business Trips	In line with GDP per Capita based on Delta Associates GDP Forecast with elasticity of 0.8 2009 - 2015 Growth = 5.24% 2015 - 2020 Growth = 7.16% 2020 - 2030 Growth = 9.03%	
	Resident Business Trips	In line with GRP per Capita based on Delta Associates GRP Forecast 2009 - 2015 Growth = 4.86% 2015 - 2020 Growth = 7.65% 2020 - 2030 Growth = 8.92%	
	Resident Non-Business Trips	In line with GRP per Capita based on Delta Associates GRP Forecast with elasticity of 0.8 2009 - 2015 Growth = 3.89% 2015 - 2020 Growth = 6.12% 2020 - 2030 Growth = 7.14%	
Vehicle Operating Cost	Vehicle Operating Cost per Mile	$0.154 per mile	American Automobile Association - '*Your Driving Costs 2009*'
Tolls	Modeling of Tolls	Real tolls modeled (2010 prices)	Standard practice
	Toll Escalation	Assumed in line with inflation. No real toll increases.	Standard practice
	Average Toll Rate / Toll Products	TBC following toll optimization	
	Overnight / Off Peak Toll Rate	TBC following toll optimization in	

		consultation with Developer	
	Tolling Methods	Cash / Electronic / Open Road Tolling	Developer to confirm
Other Revenue Parameters	Traffic Ramp-Up	Differential ramp-up for visitors and resident trip purposes. Ramp-up assumptions dependant on marketing strategy. Proposed ramp-up assumptions (subject to change): <u>Residents:</u> Year 1 – 70% Year 2 – 80% Year 3 – 90% Year 4 – 100% <u>Visitors:</u> Year 1 – 90% Year 2 – 95% Year 3 – 100%	Subject to change.
	Leakage	Dependant on tolling methods. May be incorporated in financial model.	Developer to confirm
	Long Term Growth (Beyond 2030)	Dependant on forecast MCB growth rates to 2030 and potential capacity constraints. To be confirmed in TM #13 and TM #14.	
	2009 to 2010 CPI Assumption	2%	Bureau of Labor Statistics Data

Appendix L

Final Traffic and Revenue Forecasts

Year	Annual Transactions - Optimal Toll Scenario							
	Peak Weekday	Peak Saturday	Peak Sunday	Shoulder-Peak Weekday	Shoulder-Peak Weekend	Off-Peak Weekday	Off-Peak Weekend	Total
2010	0	0	0	0	0	0	0	0
2015	242,290	148,507	82,382	112,325	73,535	256,123	107,844	1,023,006
2016	285,338	169,053	92,926	129,717	82,916	311,749	130,502	1,202,201
2017	332,097	191,227	104,111	149,720	93,154	372,235	155,010	1,397,555
2018	370,791	205,569	111,285	165,681	99,699	436,992	181,171	1,571,188
2019	397,039	217,666	116,734	175,021	104,848	461,626	190,527	1,663,462
2020	423,287	229,763	122,182	184,361	109,997	486,260	199,884	1,755,735
2021	442,744	238,216	129,450	191,418	113,919	504,875	207,010	1,827,632
2022	462,200	246,669	136,719	198,476	117,840	523,490	214,135	1,899,528
2023	481,657	255,121	143,987	205,533	121,761	542,105	221,261	1,971,425
2024	501,113	263,574	151,255	212,591	125,682	560,720	228,386	2,043,321
2025	520,570	272,026	158,523	219,649	129,604	579,334	235,512	2,115,217
2026	540,026	280,479	165,792	226,706	133,525	597,949	242,637	2,187,114
2027	559,482	288,931	173,060	233,764	137,446	616,564	249,763	2,259,010
2028	578,939	297,384	180,328	240,821	141,367	635,179	256,888	2,330,907
2029	598,395	305,836	187,596	247,879	145,288	653,794	264,014	2,402,803
2030	617,852	314,289	194,865	254,937	149,210	672,409	271,139	2,474,699
2031	630,209	320,575	198,762	260,035	152,194	685,857	276,562	2,524,193
2032	642,813	326,986	202,737	265,236	155,238	699,574	282,093	2,574,677
2033	655,669	331,761	206,792	270,541	158,342	713,565	287,735	2,624,406
2034	668,783	336,631	210,928	275,952	161,509	727,837	293,490	2,675,129
2035	682,158	341,598	215,146	281,471	164,739	742,393	299,360	2,726,866
2036	692,391	345,399	218,373	285,693	167,211	753,529	303,850	2,766,445
2037	702,777	349,256	221,649	289,978	169,719	764,832	308,408	2,806,618
2038	713,318	353,171	224,974	294,328	172,264	776,305	313,034	2,847,394
2039	724,018	357,144	228,348	298,743	174,848	787,949	317,729	2,888,781
2040	734,878	361,178	231,774	303,224	177,471	799,768	322,495	2,930,789
2041	742,227	363,907	234,091	306,256	179,246	807,766	325,720	2,959,214
2042	749,649	366,664	236,432	309,319	181,038	815,844	328,978	2,987,924
2043	757,146	369,448	238,797	312,412	182,849	824,002	332,267	3,016,920
2044	764,717	372,260	241,185	315,536	184,677	832,242	335,590	3,046,207
2045	772,364	375,100	243,596	318,691	186,524	840,565	338,946	3,075,786
2046	778,157	377,251	245,423	321,082	187,923	846,869	341,488	3,098,193
2047	783,993	379,418	247,264	323,490	189,332	853,220	344,049	3,120,767
2048	789,873	381,602	249,119	325,916	190,752	859,620	346,630	3,143,511
2049	795,797	383,802	250,987	328,360	192,183	866,067	349,229	3,166,426
2050	801,766	386,019	252,869	330,823	193,624	872,562	351,848	3,189,512
2051	805,775	387,508	254,134	332,477	194,592	876,925	353,608	3,205,018
2052	809,804	389,004	255,404	334,139	195,565	881,310	355,376	3,220,602
2053	813,853	390,508	256,681	335,810	196,543	885,716	357,153	3,236,264
2054	817,922	392,019	257,965	337,489	197,526	890,145	358,938	3,252,004
2055	822,011	393,538	259,255	339,177	198,514	894,596	360,733	3,267,823
2056	826,122	395,064	260,551	340,872	199,506	899,069	362,537	3,283,720
2057	830,252	396,598	261,854	342,577	200,504	903,564	364,349	3,299,698
2058	834,403	398,140	263,163	344,290	201,506	908,082	366,171	3,315,755
2059	838,575	399,689	264,479	346,011	202,514	912,622	368,002	3,331,892
2060	842,768	401,246	265,801	347,741	203,526	917,185	369,842	3,348,111
2061	846,982	402,811	267,130	349,480	204,544	921,771	371,691	3,364,410
2062	851,217	404,384	268,466	351,227	205,567	926,380	373,550	3,380,791
2063	855,473	405,965	269,808	352,983	206,595	931,012	375,417	3,397,253
2064	859,751	407,553	271,157	354,748	207,627	935,667	377,295	3,413,798
2065	864,049	409,150	272,513	356,522	208,666	940,345	379,181	3,430,426

Year	Annual Revenue (2010 $) - Optimal Toll Scenario							
	Peak Weekday	Peak Saturday	Peak Sunday	Shoulder-Peak Weekday	Shoulder-Peak Weekend	Off-Peak Weekday	Off-Peak Weekend	Total
2010	$0	$0	$0	$0	$0	$0	$0	$0
2015	$3,015,550	$2,710,041	$1,179,233	$1,236,098	$972,227	$2,747,451	$1,375,666	$13,236,264
2016	$3,533,102	$3,073,928	$1,325,148	$1,408,496	$1,088,272	$3,332,002	$1,659,681	$15,420,629
2017	$4,094,000	$3,470,765	$1,479,673	$1,626,545	$1,218,403	$3,967,146	$1,966,727	$17,823,260
2018	$4,540,511	$3,715,978	$1,574,102	$1,782,387	$1,294,091	$4,637,840	$2,290,707	$19,835,615
2019	$4,859,847	$3,933,183	$1,649,592	$1,882,908	$1,358,497	$4,899,285	$2,409,013	$20,992,327
2020	$5,179,184	$4,150,388	$1,725,083	$1,983,430	$1,422,904	$5,160,730	$2,527,319	$22,149,039
2021	$5,415,700	$4,297,141	$1,827,628	$2,058,351	$1,471,768	$5,358,291	$2,617,414	$23,046,293
2022	$5,652,216	$4,443,893	$1,930,173	$2,133,273	$1,520,632	$5,555,852	$2,707,508	$23,943,548
2023	$5,888,732	$4,590,646	$2,032,718	$2,208,194	$1,569,496	$5,753,413	$2,797,602	$24,840,802
2024	$6,125,248	$4,737,399	$2,135,263	$2,283,116	$1,618,361	$5,950,974	$2,887,697	$25,738,056
2025	$6,361,763	$4,884,151	$2,237,808	$2,358,037	$1,667,225	$6,148,535	$2,977,791	$26,635,311
2026	$6,598,279	$5,030,904	$2,340,353	$2,432,959	$1,716,089	$6,346,095	$3,067,886	$27,532,565
2027	$6,834,795	$5,177,656	$2,442,898	$2,507,880	$1,764,954	$6,543,656	$3,157,980	$28,429,820
2028	$7,071,311	$5,324,409	$2,545,443	$2,582,801	$1,813,818	$6,741,217	$3,248,074	$29,327,074
2029	$7,307,827	$5,471,162	$2,647,989	$2,657,723	$1,862,682	$6,938,778	$3,338,169	$30,224,329
2030	$7,544,343	$5,617,914	$2,750,534	$2,732,644	$1,911,546	$7,136,339	$3,428,263	$31,121,583
2031	$7,695,229	$5,730,272	$2,805,544	$2,787,297	$1,949,777	$7,279,066	$3,496,829	$31,744,015
2032	$7,849,134	$5,844,878	$2,861,655	$2,843,043	$1,988,773	$7,424,647	$3,566,765	$32,378,895
2033	$8,006,117	$5,936,487	$2,918,888	$2,899,904	$2,028,548	$7,573,140	$3,638,100	$33,001,184
2034	$8,166,239	$6,029,929	$2,977,266	$2,957,902	$2,069,119	$7,724,603	$3,710,862	$33,635,920
2035	$8,329,564	$6,125,239	$3,036,811	$3,017,060	$2,110,502	$7,879,095	$3,785,080	$34,283,350
2036	$8,454,507	$6,198,151	$3,082,364	$3,062,316	$2,142,159	$7,997,281	$3,841,856	$34,778,634
2037	$8,581,325	$6,272,157	$3,128,599	$3,108,251	$2,174,292	$8,117,240	$3,899,484	$35,281,347
2038	$8,710,045	$6,347,273	$3,175,528	$3,154,874	$2,206,906	$8,238,999	$3,957,976	$35,791,601
2039	$8,840,695	$6,423,516	$3,223,161	$3,202,197	$2,240,009	$8,362,584	$4,017,346	$36,309,509
2040	$8,973,306	$6,500,903	$3,271,508	$3,250,230	$2,273,610	$8,488,023	$4,077,606	$36,835,185
2041	$9,063,039	$6,553,268	$3,304,223	$3,282,733	$2,296,346	$8,572,903	$4,118,382	$37,190,893
2042	$9,153,669	$6,606,156	$3,337,266	$3,315,560	$2,319,309	$8,658,632	$4,159,566	$37,550,158
2043	$9,245,206	$6,659,573	$3,370,638	$3,348,716	$2,342,502	$8,745,218	$4,201,161	$37,913,015
2044	$9,337,658	$6,713,525	$3,404,345	$3,382,203	$2,365,927	$8,832,670	$4,243,173	$38,279,501
2045	$9,431,035	$6,768,016	$3,438,388	$3,416,025	$2,389,587	$8,920,997	$4,285,605	$38,649,652
2046	$9,501,767	$6,809,293	$3,464,176	$3,441,645	$2,407,508	$8,987,905	$4,317,747	$38,930,041
2047	$9,573,031	$6,850,880	$3,490,157	$3,467,457	$2,425,565	$9,055,314	$4,350,130	$39,212,534
2048	$9,644,828	$6,892,778	$3,516,334	$3,493,463	$2,443,757	$9,123,229	$4,382,756	$39,497,144
2049	$9,717,165	$6,934,991	$3,542,706	$3,519,664	$2,462,085	$9,191,653	$4,415,626	$39,783,890
2050	$9,790,043	$6,977,520	$3,569,276	$3,546,062	$2,480,550	$9,260,590	$4,448,744	$40,072,786
2051	$9,838,994	$7,006,086	$3,587,123	$3,563,792	$2,492,953	$9,306,893	$4,470,987	$40,266,828
2052	$9,888,189	$7,034,794	$3,605,058	$3,581,611	$2,505,418	$9,353,428	$4,493,342	$40,461,840
2053	$9,937,629	$7,063,646	$3,623,084	$3,599,519	$2,517,945	$9,400,195	$4,515,809	$40,657,827
2054	$9,987,318	$7,092,642	$3,641,199	$3,617,517	$2,530,535	$9,447,196	$4,538,388	$40,854,794
2055	$10,037,254	$7,121,783	$3,659,405	$3,635,604	$2,543,187	$9,494,432	$4,561,080	$41,052,746
2056	$10,087,440	$7,151,070	$3,677,702	$3,653,782	$2,555,903	$9,541,904	$4,583,885	$41,251,688
2057	$10,137,878	$7,180,503	$3,696,091	$3,672,051	$2,568,683	$9,589,613	$4,606,805	$41,451,624
2058	$10,188,567	$7,210,084	$3,714,571	$3,690,411	$2,581,526	$9,637,562	$4,629,839	$41,652,560
2059	$10,239,510	$7,239,812	$3,733,144	$3,708,864	$2,594,434	$9,685,749	$4,652,988	$41,854,501
2060	$10,290,707	$7,269,689	$3,751,810	$3,727,408	$2,607,406	$9,734,178	$4,676,253	$42,057,451
2061	$10,342,161	$7,299,716	$3,770,569	$3,746,045	$2,620,443	$9,782,849	$4,699,634	$42,261,416
2062	$10,393,872	$7,329,892	$3,789,421	$3,764,775	$2,633,545	$9,831,763	$4,723,132	$42,466,401
2063	$10,445,841	$7,360,219	$3,808,369	$3,783,599	$2,646,713	$9,880,922	$4,746,748	$42,672,411
2064	$10,498,070	$7,390,698	$3,827,410	$3,802,517	$2,659,947	$9,930,327	$4,770,482	$42,879,451
2065	$10,550,561	$7,421,330	$3,846,547	$3,821,530	$2,673,246	$9,979,978	$4,794,334	$43,087,526

Year	Annual Transactions - Frequent User Policy Scenario							
	Peak Weekday	Peak Saturday	Peak Sunday	Shoulder-Peak Weekday	Shoulder-Peak Weekend	Off-Peak Weekday	Off-Peak Weekend	Total
2010	0	0	0	0	0	0	0	0
2015	261,621	149,627	86,611	122,190	76,159	281,098	112,424	1,089,730
2016	306,723	170,139	97,602	140,990	85,898	340,847	135,790	1,277,989
2017	355,399	192,258	109,229	162,570	96,512	405,612	161,022	1,482,602
2018	395,828	206,473	116,776	179,997	103,410	474,750	187,914	1,665,148
2019	421,343	218,442	122,170	189,634	108,604	500,169	197,351	1,757,714
2020	446,859	230,412	127,565	199,271	113,797	525,588	206,788	1,850,280
2021	465,442	238,795	134,729	206,413	117,735	544,424	213,944	1,921,481
2022	484,026	247,177	141,892	213,554	121,672	563,260	221,099	1,992,682
2023	502,609	255,560	149,056	220,696	125,610	582,096	228,255	2,063,883
2024	521,193	263,942	156,220	227,837	129,548	600,933	235,411	2,135,084
2025	539,776	272,325	163,384	234,979	133,486	619,769	242,566	2,206,285
2026	558,359	280,708	170,548	242,120	137,424	638,605	249,722	2,277,486
2027	576,943	289,090	177,711	249,262	141,361	657,441	256,878	2,348,687
2028	595,526	297,473	184,875	256,404	145,299	676,277	264,033	2,419,888
2029	614,110	305,855	192,039	263,545	149,237	695,114	271,189	2,491,089
2030	632,693	314,238	199,203	270,687	153,175	713,950	278,345	2,562,290
2031	645,347	320,523	203,187	276,100	156,238	728,229	283,912	2,613,535
2032	658,254	325,198	207,251	281,622	159,363	742,793	289,590	2,664,071
2033	671,419	329,966	211,396	287,255	162,550	757,649	295,382	2,715,617
2034	684,847	334,830	215,624	293,000	165,801	772,802	301,289	2,768,193
2035	698,544	339,791	219,936	298,860	169,117	788,258	307,315	2,821,822
2036	709,022	343,586	223,235	303,343	171,654	800,082	311,925	2,862,847
2037	719,658	347,439	226,584	307,893	174,229	812,083	316,604	2,904,489
2038	730,453	351,349	229,982	312,511	176,842	824,264	321,353	2,946,754
2039	741,409	355,317	233,432	317,199	179,495	836,628	326,173	2,989,654
2040	752,531	359,345	236,934	321,957	182,187	849,178	331,066	3,033,197
2041	760,056	362,071	239,303	325,177	184,009	857,670	334,376	3,062,661
2042	767,657	364,824	241,696	328,428	185,849	866,246	337,720	3,092,420
2043	775,333	367,605	244,113	331,713	187,708	874,909	341,097	3,122,477
2044	783,086	370,413	246,554	335,030	189,585	883,658	344,508	3,152,834
2045	790,917	373,249	249,020	338,380	191,481	892,494	347,953	3,183,494
2046	796,849	375,398	250,887	340,918	192,917	899,188	350,563	3,206,720
2047	802,826	377,562	252,769	343,475	194,364	905,932	353,192	3,230,119
2048	808,847	379,743	254,665	346,051	195,821	912,727	355,841	3,253,694
2049	814,913	381,941	256,575	348,646	197,290	919,572	358,510	3,277,446
2050	821,025	384,154	258,499	351,261	198,770	926,469	361,199	3,301,376
2051	825,130	385,641	259,791	353,017	199,764	931,101	363,005	3,317,449
2052	829,256	387,136	261,090	354,782	200,762	935,757	364,820	3,333,603
2053	833,402	388,637	262,396	356,556	201,766	940,435	366,644	3,349,837
2054	837,569	390,147	263,708	358,339	202,775	945,138	368,477	3,366,152
2055	841,757	391,664	265,026	360,131	203,789	949,863	370,319	3,382,549
2056	845,966	393,188	266,351	361,931	204,808	954,613	372,171	3,399,028
2057	850,195	394,720	267,683	363,741	205,832	959,386	374,032	3,415,589
2058	854,446	396,260	269,022	365,560	206,861	964,183	375,902	3,432,233
2059	858,719	397,807	270,367	367,388	207,895	969,004	377,781	3,448,961
2060	863,012	399,362	271,719	369,225	208,935	973,849	379,670	3,465,772
2061	867,327	400,925	273,077	371,071	209,980	978,718	381,569	3,482,667
2062	871,664	402,496	274,443	372,926	211,029	983,611	383,477	3,499,646
2063	876,022	404,075	275,815	374,791	212,085	988,529	385,394	3,516,710
2064	880,402	405,661	277,194	376,665	213,145	993,472	387,321	3,533,860
2065	884,804	407,256	278,580	378,548	214,211	998,439	389,258	3,551,096

Year	Annual Revenue (2010 $) - Frequent User Policy Scenario							
	Peak Weekday	Peak Saturday	Peak Sunday	Shoulder-Peak Weekday	Shoulder-Peak Weekend	Off-Peak Weekday	Off-Peak Weekend	Total
2010	$0	$0	$0	$0	$0	$0	$0	$0
2015	$2,657,224	$2,573,900	$1,094,224	$1,124,727	$950,156	$2,382,130	$1,262,003	$12,044,363
2016	$3,076,810	$2,915,319	$1,223,493	$1,273,085	$1,061,371	$2,877,974	$1,519,700	$13,947,753
2017	$3,527,637	$3,286,266	$1,359,958	$1,459,885	$1,185,501	$3,415,059	$1,797,840	$16,032,146
2018	$3,859,750	$3,511,231	$1,437,643	$1,586,560	$1,255,824	$3,980,474	$2,090,854	$17,722,336
2019	$4,111,834	$3,715,903	$1,504,068	$1,671,420	$1,316,616	$4,193,593	$2,195,857	$18,709,292
2020	$4,363,918	$3,920,576	$1,570,493	$1,756,280	$1,377,408	$4,406,713	$2,300,860	$19,696,247
2021	$4,546,399	$4,060,756	$1,663,383	$1,817,808	$1,423,234	$4,564,642	$2,380,478	$20,456,699
2022	$4,728,880	$4,200,936	$1,756,272	$1,879,336	$1,469,060	$4,722,571	$2,460,096	$21,217,151
2023	$4,911,361	$4,341,116	$1,849,162	$1,940,863	$1,514,885	$4,880,500	$2,539,715	$21,977,603
2024	$5,093,843	$4,481,297	$1,942,051	$2,002,391	$1,560,711	$5,038,429	$2,619,333	$22,738,055
2025	$5,276,324	$4,621,477	$2,034,941	$2,063,919	$1,606,536	$5,196,358	$2,698,951	$23,498,506
2026	$5,458,805	$4,761,657	$2,127,830	$2,125,447	$1,652,362	$5,354,287	$2,778,570	$24,258,958
2027	$5,641,286	$4,901,837	$2,220,720	$2,186,975	$1,698,188	$5,512,216	$2,858,188	$25,019,410
2028	$5,823,767	$5,042,018	$2,313,609	$2,248,503	$1,744,013	$5,670,145	$2,937,807	$25,779,862
2029	$6,006,249	$5,182,198	$2,406,499	$2,310,030	$1,789,839	$5,828,074	$3,017,425	$26,540,314
2030	$6,188,730	$5,322,378	$2,499,388	$2,371,558	$1,835,665	$5,986,003	$3,097,043	$27,300,766
2031	$6,312,504	$5,428,826	$2,549,376	$2,418,989	$1,872,378	$6,105,723	$3,158,984	$27,846,781
2032	$6,438,754	$5,513,632	$2,600,363	$2,467,369	$1,909,825	$6,227,838	$3,222,164	$28,379,946
2033	$6,567,529	$5,600,134	$2,652,371	$2,516,717	$1,948,022	$6,352,395	$3,286,607	$28,923,775
2034	$6,698,880	$5,688,367	$2,705,418	$2,567,051	$1,986,982	$6,479,442	$3,352,339	$29,478,480
2035	$6,832,858	$5,778,364	$2,759,526	$2,618,392	$2,026,722	$6,609,031	$3,419,386	$30,044,279
2036	$6,935,351	$5,847,212	$2,800,919	$2,657,668	$2,057,123	$6,708,167	$3,470,677	$30,477,116
2037	$7,039,381	$5,917,092	$2,842,933	$2,697,533	$2,087,980	$6,808,789	$3,522,737	$30,916,445
2038	$7,144,972	$5,988,021	$2,885,577	$2,737,996	$2,119,299	$6,910,921	$3,575,578	$31,362,364
2039	$7,252,146	$6,060,013	$2,928,861	$2,779,066	$2,151,089	$7,014,585	$3,629,212	$31,814,972
2040	$7,360,928	$6,133,086	$2,972,794	$2,820,752	$2,183,355	$7,119,804	$3,683,650	$32,274,368
2041	$7,434,538	$6,182,532	$3,002,522	$2,848,959	$2,205,189	$7,191,002	$3,720,486	$32,585,227
2042	$7,508,883	$6,232,472	$3,032,547	$2,877,449	$2,227,241	$7,262,912	$3,757,691	$32,899,194
2043	$7,583,972	$6,282,911	$3,062,872	$2,906,223	$2,249,513	$7,335,541	$3,795,268	$33,216,301
2044	$7,659,811	$6,333,855	$3,093,501	$2,935,285	$2,272,008	$7,408,896	$3,833,221	$33,536,579
2045	$7,736,410	$6,385,309	$3,124,436	$2,964,638	$2,294,728	$7,482,985	$3,871,553	$33,860,059
2046	$7,794,433	$6,424,285	$3,147,869	$2,986,873	$2,311,939	$7,539,108	$3,900,590	$34,105,096
2047	$7,852,891	$6,463,553	$3,171,478	$3,009,275	$2,329,278	$7,595,651	$3,929,844	$34,351,970
2048	$7,911,788	$6,503,116	$3,195,264	$3,031,844	$2,346,748	$7,652,618	$3,959,318	$34,600,696
2049	$7,971,126	$6,542,975	$3,219,229	$3,054,583	$2,364,349	$7,710,013	$3,989,013	$34,851,288
2050	$8,030,909	$6,583,134	$3,243,373	$3,077,492	$2,382,081	$7,767,838	$4,018,930	$35,103,759
2051	$8,071,064	$6,610,107	$3,259,590	$3,092,880	$2,393,992	$7,806,677	$4,039,025	$35,273,335
2052	$8,111,419	$6,637,215	$3,275,888	$3,108,344	$2,405,961	$7,845,711	$4,059,220	$35,443,759
2053	$8,151,976	$6,664,458	$3,292,267	$3,123,886	$2,417,991	$7,884,939	$4,079,516	$35,615,035
2054	$8,192,736	$6,691,838	$3,308,729	$3,139,505	$2,430,081	$7,924,364	$4,099,914	$35,787,168
2055	$8,233,700	$6,719,355	$3,325,272	$3,155,203	$2,442,232	$7,963,986	$4,120,414	$35,960,161
2056	$8,274,868	$6,747,009	$3,341,899	$3,170,979	$2,454,443	$8,003,806	$4,141,016	$36,134,019
2057	$8,316,243	$6,774,801	$3,358,608	$3,186,834	$2,466,715	$8,043,825	$4,161,721	$36,308,747
2058	$8,357,824	$6,802,733	$3,375,401	$3,202,768	$2,479,049	$8,084,044	$4,182,529	$36,484,348
2059	$8,399,613	$6,830,804	$3,392,278	$3,218,782	$2,491,444	$8,124,464	$4,203,442	$36,660,827
2060	$8,441,611	$6,859,015	$3,409,240	$3,234,876	$2,503,901	$8,165,086	$4,224,459	$36,838,189
2061	$8,483,819	$6,887,368	$3,426,286	$3,251,050	$2,516,421	$8,205,912	$4,245,581	$37,016,437
2062	$8,526,238	$6,915,862	$3,443,417	$3,267,305	$2,529,003	$8,246,941	$4,266,809	$37,195,577
2063	$8,568,870	$6,944,499	$3,460,634	$3,283,642	$2,541,648	$8,288,176	$4,288,143	$37,375,612
2064	$8,611,714	$6,973,279	$3,477,938	$3,300,060	$2,554,356	$8,329,617	$4,309,584	$37,556,547
2065	$8,654,772	$7,002,203	$3,495,327	$3,316,560	$2,567,128	$8,371,265	$4,331,132	$37,738,388