

Appendix C

Ridership Study

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1. Introduction

1.1 Background

This report presents the methodology of AECOM's effort to develop/update the North Carolina Southeast Corridor model, also used by Amtrak and Virginia, to address high speed rail service and feeder line in corridors within North Carolina and Virginia. The corridors to be evaluated include:

- Southeast High Speed Rail (SEHSR), serving Charlotte, Raleigh, Richmond, Hampton Roads (Newport News and Norfolk), Washington, New York, and other markets
- Southeastern North Carolina (SENC), serving Wilmington, NC and other markets
- Western North Carolina (WNC), serving Asheville and other intermediate markets
- Virginia's Piedmont Corridor, serving Charlottesville, Lynchburg, and Roanoke

Below is a list of inputs required to complete the analysis:

- Rail schedules for the Silver Meteor/Star, Carolinian, Palmetto, and Piedmont train services as well as the Northeast Regional trains serving Virginia
- Rail surveys for the Silver Meteor/Star, Carolinian, Palmetto, and Piedmont trains services as well as the Northeast Regional trains serving Virginia
- Auto surveys for key locations in North Carolina and Virginia throughout the study area
- Air surveys conducted at the Charlotte and Raleigh airports addressing travel to other places within the study area
- Geographic zone system covering the entire study area
- Highway network connecting all the zones and all the rail stations in the study area
- Socio-economic data for the zone system
- Ridership information for the North Carolina and Virginia state corridor services
- Auto trip table
- Travel characteristics for auto, air and rail

The report describes the study area geography; size and description of the various survey data used for the analysis; and the highway network used to compute auto travel characteristics.

1.2 Study Area Zone Geography

The study area consists of the states of North Carolina, Virginia, and portions of key areas in adjacent states and within the Northeast Corridor, from Washington D.C. to Boston. A geographic-based zone system was developed for this study area based on the previous version of the zone system, and was updated to reflect specific areas of interest in the study area. This zone system defines the geographic level of detail at which the intercity travel demand forecasting process is applied. The zone system is based on county boundaries, city boundaries and 5-digit zip code boundaries. Exhibit 1.1 shows the extent of this zone system. This current study area is focused around the geographic area surrounding Southeast High Speed Rail (SEHSR), the Southeastern North Carolina (SENC) and Western North Carolina

(WNC) corridors. A more aggregate system of 20 districts is shown in Exhibits 1.2 and 1.3, consisting of a map with groups of zones and a table describing the zones included in each.

Exhibit 1.1 – Travel Analysis Zones



Exhibit 1.2 – Study Area Summary Districts



Exhibit 1.3: Study Area District Description

| District | Description | Zones Included |
|---------------------------|--|---|
| Boston | Boston Metro--Worcester, MA | 1-5,7 |
| New England | Bridgeport--New Haven--Norwich-Providence, CT-RI-MA | 6,8-14 |
| New York | New York Metro NY-NJ-PA-Allentown, PA | 15-31,33,35 |
| Philadelphia | Philadelphia Metro, PA-NJ-DE-MD-Trenton-Ewing, NJ | 32,34,36-45,50 |
| Baltimore | Baltimore Metro, MD | 61-63,65,67,76 |
| Washington D.C | Washington Metro DC-VA-MD-WV | 64,66,68-84,92,95 |
| Richmond | Richmond Metro, VA | 98,102,103,106-109,111,120,126,128-135,144,156-159,175 |
| Rural VA | Rural VA-Brunswick | 123,174,176,177-179 |
| Raleigh | Raleigh Metro-Henderson, NC | 267-273,427,428 |
| Charlotte | Charlotte Metro-Albemarle-Lincoln-Rockingham-Shelby, NC | 232-235,245,247,250,251,254,255,335 |
| Charlottesville-Lynchburg | Charlottesville-Lynchburg-Danville-Roanoke-Blacksburg, VA | 86-89,96,97,110,112,117-122,180-183,185-188,190,191,194,195 |
| Virginia Beach | Virginia Beach-Norfolk-Newport News, VA-DC | 149,150,152,154,155,160-173,303 |
| Rocky Mount | Rocky Mount-Wilson-Roanoke Rapids, NC | 278-282 |
| Winston Salem-Greensboro | Winston Salem-Greensboro-Highpoint-Thomasville-Lexington, NC | 237-242,257-259 |
| Asheville-Hickory | Asheville-Hickory-Statesville-Forest City, NC | 213-223,226,234,236,244 |
| Rockingham-S. Pines | Rockingham-Southern Pines-Sanford, NC | 252,253,256,266 |
| Durham--Burlington | Durham-Chapel Hill-Burlington, NC | 260-265 |
| Fayetteville-Lumberton | Fayetteville-Lumberton-Laingsburg-Dunn, NC | 274-277,295,296,298 |
| New Bern-Morehead City | New Bern-Morehead City-Washington-Greenville-Kinston, NC | 285-292,311,313 |
| Wilmington-Jacksonville- | Wilmington-Jacksonville-Goldsboro, NC | 288,291,293,294,297,299,300, |

2. Travel Surveys and Market Data

The analysis and prediction of future travel demand begins with a complete description of the existing travel market in geographic, trip purpose, and other key dimensions. This detailed travel market information can only be obtained through conducting travel surveys. These travel surveys also provide a means of assessing traveler responses to changes in the characteristics of future travel alternatives. The following section of the report documents the travel survey information and the assembly/analysis of the base travel market data for the Southeast.

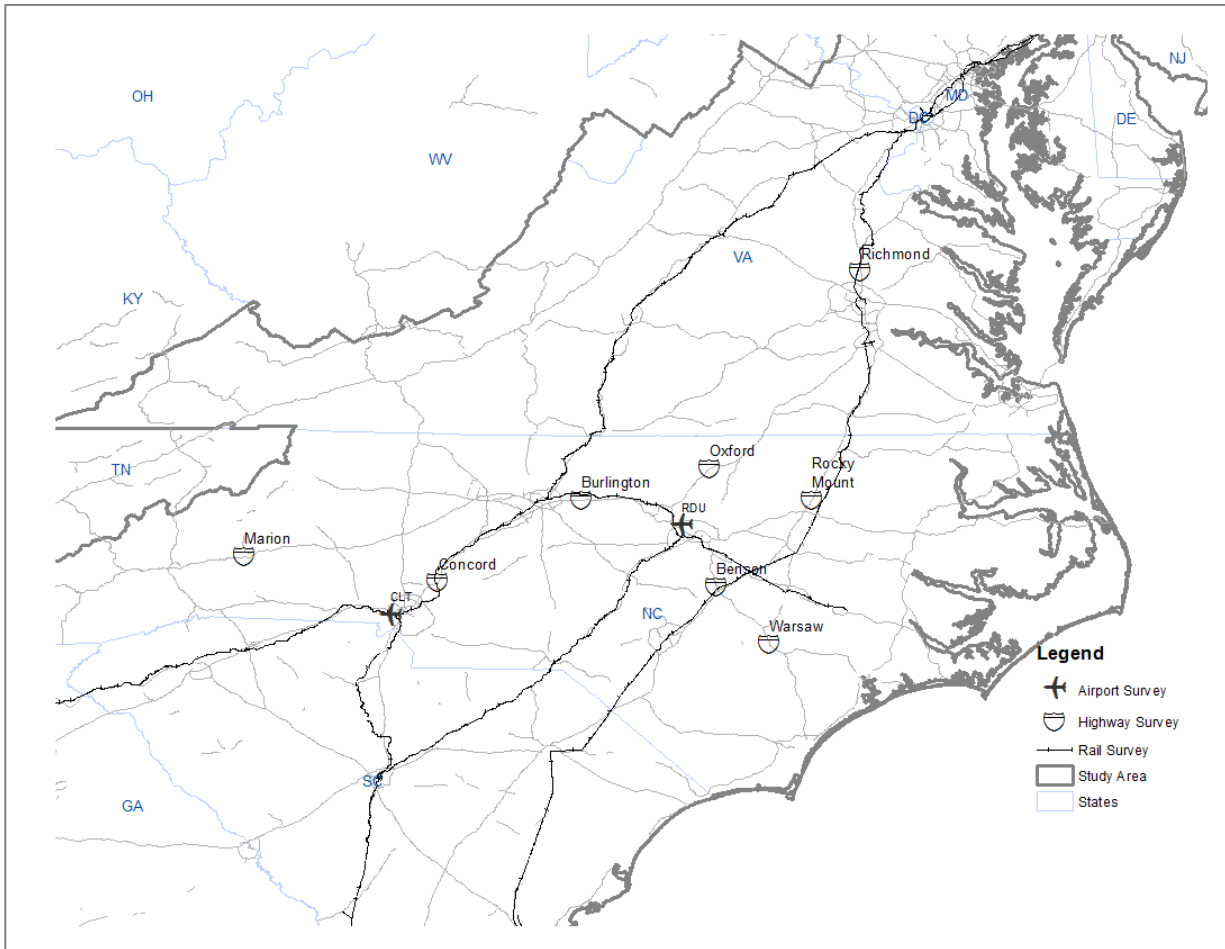
2.1 Travel Survey Program

An extensive travel survey program was conducted to support this study, consisting of:

- Eight (8) Intercity Highway survey locations, seven in North Carolina (I-40/I-85/I-95) and one in Virginia (I-95)
- Two Airport survey locations: Charlotte, NC and Raleigh, NC
- On-Board train surveys along the six different routes serving southeast corridor

Exhibit 2.1 summarizes the specific locations of the surveys by mode, including the highway surveys conducted in the states of North Carolina and Virginia.

Exhibit 2.1: Southeast Travel Survey Program (All Modes)



The survey program conducted for the study consisted of two parts:

- A short interview, focusing on basic trip and traveler market characteristics, such as origin and destination, and trip purpose
- A respondent-specific choice experiment section, addressing more detailed stated preferences questions of a respondent mode choices under a series of future situations comparing the survey mode to other modes, considering changes in the travel time, cost and service frequencies of these modes

Exhibit 2.2 through 2.4 provides a sample of short interview questions included in the auto, air and rail surveys.

Exhibit 2.2: Highway Travel Survey Interview Questions

| | | |
|----|----------------------------------|--|
| 1 | Vehicle Occupancy | |
| 2 | Traveler Age | |
| 2 | Origin | city/state/zip |
| 3 | Destination | city/state/zip |
| 4 | Trip Purpose | Regular Commute (To/From Work) Work Related Business Travel Vacation/Recreation Other |
| 5 | Home | city/state/zip |
| 6 | Employment Status | |
| 7 | Travel Time (in mins) | |
| 8 | Travel Cost (in dollars) | |
| 9 | Round Trip | Yes/No |
| 10 | Willingness to pay taxes for HSR | Yes/No |

Exhibit 2.3: Air Travel Survey Interview Questions

| | | |
|----|---------------------------------------|---|
| 1 | Vehicle Occupancy/Group Size | |
| 2 | Traveler Age | |
| 3 | Origin | Terminal/city/state/zip |
| 4 | Destination | Terminal/city/state/zip |
| 5 | Connecting from/to Flight | Yes/No |
| 6 | Access/Egress Travel Mode | Private Car – Parked at station Private Car – Dropped off at station Rental Car Hotel Bus/Van/Shuttle Taxi Local Bus or Rail Transit Other including walk |
| 7 | Access/Egress Travel Time (in mins) | |
| 8 | Trip Purpose | Regular Commute (To/From Work) Work Related Business Travel Vacation/Recreation Other |
| 9 | Home | city/state/zip |
| 10 | Employment Status | |
| 11 | Travel Time (in mins) | |
| 12 | Travel Cost (one-way fare in dollars) | |
| 13 | Round Trip | Yes/No |
| 14 | Willingness to pay taxes for HSR | Yes/No |

Exhibit 2.4: Rail Travel Survey Interview Questions

| | | |
|----|---------------------------------------|---|
| 1 | Vehicle Occupancy/Group Size | |
| 2 | Traveler Age | |
| 3 | Origin | Station/city/state/zip |
| 4 | Destination | Station/city/state/zip |
| 5 | Connecting from/to Train | Yes/No |
| 6 | Access/Egress Travel Mode | Private Car – Parked at station Private Car – Dropped off at station Rental Car Hotel Bus/Van/Shuttle Taxi Local Bus or Rail Transit Other including walk |
| 7 | Access/Egress Travel Time (in mins) | |
| 8 | Trip Purpose | Regular Commute (To/From Work) Work Related Business Travel Vacation/Recreation Other |
| 9 | Home | city/state/zip |
| 10 | Employment Status | |
| 11 | Travel Time (in mins) | |
| 12 | Travel Cost (one-way fare in dollars) | |
| 13 | If no train service available | Traveled by car/plane/bus/cancel |
| 14 | Round Trip | Yes/No |
| 15 | Willingness to pay taxes for HSR | Yes/No |

A key characteristic of the interview survey activities was the use of portable laptop computers to permit real time data entry during the conduct of each interview. The use of computers replaces the paper based survey program and helped accomplish the following objectives:

- Automated screening to avoid illogical survey data entries
- Allow on-site editing at any time during or after the interview
- Provide for automatically assigning the traffic analysis zones to origin and destination place names before completing the actual interview.

The last objective greatly reduces the post-survey processing time and aids in the development of a more precise origin-destination pair. This is done by developing a database which includes all place names in the study area and assigning the corresponding zone number for each location, to be included in the survey application.

2.2 Highway Survey Program

Highway surveys were conducted at eight (8) rest areas by interviewing the driver of a sample of vehicles passing each location. Extensive planning, project control and team training was conducted to develop procedures for collecting, summarizing, and geo-coding the origin-destination information.

A total of 7,688 surveys were carried out for all the eight highway survey locations. Surveys were conducted on a weekday and weekend at each location. Exhibit 2.5 summarizes the total survey records conducted, refused, incomplete records and complete stated preferences records on each highway survey location by direction.

Exhibit 2.5: Highway Travel Survey Program

| Interstate | Locations | Number of Records | Refused | Complete OD* | Complete SP** |
|------------|--------------------|-------------------|---------|--------------|---------------|
| I-40 | Benson_NC_EB | 559 | 131 | 329 | 97 |
| I-40 | Benson_NC_WB | 732 | 139 | 499 | 162 |
| I-40 | Burlington_NC_EB | 523 | 90 | 318 | 188 |
| I-40 | Burlington_NC_WB | 551 | 130 | 297 | 166 |
| I-85 | Concord_NC_NB | 433 | 124 | 237 | 83 |
| I-85 | Concord_NC_SB | 582 | 172 | 346 | 184 |
| I-40 | Marion_NC_EB | 532 | 168 | 187 | 80 |
| I-40 | Marion_NC_WB | 401 | 26 | 198 | 96 |
| I-85 | Oxford_NC_NB | 506 | 141 | 302 | 168 |
| I-85 | Oxford_NC_SB | 505 | 144 | 284 | 147 |
| I-95 | Rocky_Mount_I95_NB | 809 | 296 | 352 | 148 |
| I-95 | Rocky_Mount_I95_SB | 545 | 56 | 314 | 123 |
| I-40 | Wilmington_NC_EB | 352 | 78 | 216 | 86 |
| I-40 | Wilmington_NC_WB | 268 | 67 | 156 | 66 |
| I-95 | Richmond_VA_NB | 239 | 38 | 109 | 64 |
| I-95 | Richmond_VA_SB | 151 | 26 | 65 | 34 |
| Total | | 7688 | 1826 | 4209 | 1892 |

* Complete OD – Origin and Destination responses are complete and within study area.

** Complete SP – Stated Preferences questions were asked and responses are complete.

2.3 Airport Survey Program

Airport surveys were conducted at the gate in the departure area serving each flight surveyed. This required advanced coordination, cooperation and approval from airport management and authorities. Passengers were interviewed prior to the boarding of each flight. The surveys

were conducted using the portable laptop computers allowing automated screening to avoid illogical survey data entries.

A total of 2,517 surveys were carried out to air passengers at the two airports Charlotte and Raleigh (CLT and RDU) within the Southeast region. These surveys were conducted on at least one weekday and one weekend. Both these surveys were eventually used to develop base year market data.

Exhibit 2.6 summarizes the total survey records conducted, refused, incomplete records and complete stated preferences records on each surveyed flight for CLT and RDU airports.

Exhibit 2.6: Air Travel Survey Program

| Flights | Total Records | Refused | Connecting Flight | Complete OD* | Complete SP** |
|------------------------|----------------------|----------------|--------------------------|---------------------|----------------------|
| CLT-BWI | 207 | 38 | 119 | 46 | 29 |
| CLT-DCA | 156 | 29 | 89 | 27 | 12 |
| CLT-EWR | 207 | 37 | 139 | 27 | 11 |
| CLT-IAD | 65 | 14 | 44 | 5 | 1 |
| CLT-JFK | 132 | 24 | 57 | 44 | 19 |
| CLT-LGA | 378 | 78 | 144 | 135 | 60 |
| CLT-PHL | 231 | 65 | 123 | 33 | 15 |
| CLT-RDU | 53 | 11 | 39 | 1 | 0 |
| CLT-RIC | 113 | 25 | 72 | 11 | 7 |
| Total Charlotte | 1542 | 321 | 826 | 329 | 154 |
| RDU-BWI | 68 | 16 | 12 | 31 | 21 |
| RDU-CLT | 133 | 33 | 92 | 7 | 5 |
| RDU-DCA | 147 | 25 | 78 | 38 | 31 |
| RDU-EWR | 71 | 24 | 15 | 27 | 17 |
| RDU-IAD | 43 | 6 | 20 | 10 | 6 |
| RDU-JFK | 155 | 33 | 38 | 72 | 36 |
| RDU-LGA | 197 | 53 | 22 | 101 | 53 |
| RDU-PHL | 161 | 28 | 62 | 58 | 31 |
| Total Raleigh | 975 | 218 | 339 | 344 | 200 |

* Complete OD – Origin and Destination responses are complete and within study area.

** Complete SP – Stated Preferences questions were asked and responses are complete.

2.4 On-Board Rail Surveys

Rail surveys were conducted on-board Amtrak's *Silver Star*, *Silver Meteor*, *Carolinian*, *Piedmont*, *Palmetto*, and *Northeast Regional* trains serving Virginia. Surveys were conducted of passengers riding these trains within Virginia and North Carolina.

Survey distribution included one weekend day and one weekday for each train. A total of 1,339 surveys were conducted on-board for the above mentioned routes. Exhibit 2.7 summarizes the total survey records conducted, refused, incomplete records and complete stated preferences.

Exhibit 2.7: Rail Travel Survey Program

| Amtrak Routes & Train Numbers⁺ | Number of Records | Refused | Complete OD[*] | Complete SP^{**} |
|--|--------------------------|----------------|--------------------------------|---------------------------------|
| Carolinian_79 | 183 | 46 | 134 | 87 |
| Carolinian_80 | 186 | 44 | 132 | 53 |
| Northeast_125 | 29 | 10 | 19 | 14 |
| Northeast_164 | 14 | 7 | 7 | 1 |
| Northeast_174 | 18 | 1 | 17 | 5 |
| Northeast_194 | 36 | 8 | 28 | 13 |
| Northeast_66 | 10 | 2 | 7 | 3 |
| Northeast_67 | 17 | 3 | 14 | 2 |
| Northeast_82 | 27 | 11 | 16 | 12 |
| Northeast_83 | 37 | 13 | 23 | 16 |
| Northeast_86 | 44 | 3 | 41 | 19 |
| Northeast_87 | 32 | 9 | 23 | 9 |
| Northeast_93 | 11 | 3 | 8 | 5 |
| Northeast_94 | 26 | 3 | 19 | 5 |
| Northeast_95 | 15 | 1 | 13 | 6 |
| Palmetto_89 | 76 | 12 | 59 | 31 |
| Palmetto_90 | 74 | 14 | 55 | 21 |
| Piedmont_73 | 91 | 5 | 85 | 72 |
| Piedmont_74 | 109 | 15 | 93 | 64 |
| Piedmont_75 | 48 | 3 | 42 | 24 |
| Piedmont_76 | 47 | 4 | 43 | 29 |
| Silver Star_91 | 85 | 17 | 38 | 18 |
| Silver Star_92 | 124 | 38 | 58 | 27 |
| Total | 1339 | 272 | 974 | 536 |

+ Odd numbered trains are southbound (from the NEC to VA/NC; from Raleigh to Charlotte) and even numbers trains are northbound (from VA/NC to the NEC; from Charlotte to Raleigh)

* Complete OD – Origin and Destination responses are complete and within study area.

** Complete SP – Stated Preferences questions were asked and responses are complete.

2.5 Multimodal Travel Market Data and Results

Multimodal intercity passenger market data for the Southeast were assembled from a number of different sources. The following subsections highlight the key sources and methodology used to develop the base travel market data by intercity mode.

2.5.1 Base Auto Market Data

Travel market data addressing existing automobile travel were assembled from the highway surveys described above and traffic counts.

The key activities associated with processing and combining these data sources into a single base auto travel market data included:

- Assigning study area zones to the origins and destinations
- Assigning adjustment factors to combine different estimates of the same origin-destination market from different data sources.

Once all the highway survey records are assigned to origins and destinations, several expansion factors are applied based on traffic count data and market location. The hourly traffic count data with vehicle classification for passenger vehicles and trucks were obtained from North Carolina Department of Transportation and Virginia Department of Transportation.

The first factor to be calculated is the hourly expansion factor, which is obtained by dividing the number of passenger vehicles (based on the hourly traffic count data) by the number of complete useable survey records for that hour. Next, the daily expansion factor is computed by dividing the Annual Average ADT counts by the total of the hourly NCDOT traffic counts for the hours during which complete useable auto surveys were obtained. The final count-based factor is the annual expansion factor, which transforms the factored daily data to reflect annual travel, and it is calculated assuming a full year with 253 weekdays and 112 weekend and holiday days. The final combined survey expansion factor for each interview survey observation is represented by the product of hourly, daily and annual factors.

After the count-based factors are computed, district/cordon adjustment factors are assigned to each of the survey locations on an origin-destination basis to avoid multiple counting of markets when the data are merged across different survey locations. This is necessary because many trips within the study area are captured by multiple survey locations. A district/cordon area system was overlaid upon the study area zone system, with the district areas and cordon boundaries defined by the locations of each survey. Factors for combining the survey data were then specified for each survey location, by district-to-district pair, representing the contribution of each survey location to the estimate of total travel between the district areas.

2.5.2 Base Air Market Data

Travel market data addressing air travel were assembled from the following sources:

- Airport to Airport volume data from the Federal Aviation Administration (FAA) 10 percent ticket sample and other similar sources.
- Air passenger survey data, including the new Airport surveys described in the Air survey data program

2.5.3 Base Rail Market Data

Travel market data addressing rail travel were assembled from the following sources:

- Station to station ridership data provided by Amtrak
- New rail survey data collected on-board the six passenger train routes serving the Southeast as described above.

2.5.4 Summary of Base Market Data

The expanded auto, air, and rail survey data provide the basis for estimating existing annual person travel in several different dimensions. The trip purposes displayed by this and other exhibits in this report represent a consolidation of the trip purposes obtained from the surveys as follows:

- Business - includes all work related business trips
- Recreation - includes all recreation trips
- Other - includes commute to/from work, school, shopping, visit friends/relatives, personal business, and other trips

As shown by Exhibit 2.6 other purpose travel represents the largest intercity trip purpose in total and in most of the major markets.

Exhibit 2.6 Summary of Existing Annual 2012 Person Trips by Purpose

| Base Market | Business | Recreation | Other | Total |
|---|-----------------|-------------------|--------------|--------------|
| Charlotte-Rockingham -- Raleigh-Durham | 2,953,713 | 1,333,769 | 4,939,528 | 9,227,010 |
| Charlotte-Rockingham -- Winston Salem-Greensboro | 1,745,063 | 1,135,279 | 4,243,987 | 7,124,329 |
| Charlotte-Rockingham -- Rocky Mount-New Bern | 960,019 | 536,069 | 978,923 | 2,475,011 |
| Charlotte-Rockingham -- Ashville-Morgan Hickory | 1,336,857 | 837,756 | 1,721,106 | 3,895,719 |
| Charlotte-Rockingham -- Fayetteville-Wilmington | 1,528,585 | 1,024,785 | 1,661,012 | 4,214,382 |
| Charlotte-Rockingham -- Richmond-Brunswick | 1,708,582 | 1,108,874 | 2,019,091 | 4,836,548 |
| Charlotte-Rockingham -- Charlottesville-Lynchburg | 1,710,338 | 1,104,144 | 1,874,558 | 4,689,039 |
| Charlotte-Rockingham -- Virginia Beach | 1,192,685 | 740,794 | 1,366,639 | 3,300,118 |
| Charlotte-Rockingham -- Washington D.C | 2,037,865 | 1,385,788 | 2,750,753 | 6,174,406 |
| Charlotte-Rockingham -- New York | 3,635,461 | 2,450,782 | 4,930,695 | 11,016,938 |
| Charlotte-Rockingham -- Rest of North East | 2,934,418 | 1,947,381 | 4,300,955 | 9,182,755 |
| Raleigh-Durham -- Winston Salem-Greensboro | 2,402,323 | 1,987,405 | 5,957,953 | 10,347,680 |
| Raleigh-Durham -- Rocky Mount-New Bern | 1,328,209 | 804,571 | 1,194,182 | 3,326,962 |
| Raleigh-Durham -- Ashville-Morgan Hickory | 1,466,809 | 1,214,537 | 2,628,608 | 5,309,954 |
| Raleigh-Durham -- Fayetteville-Wilmington | 2,396,764 | 2,656,835 | 3,434,092 | 8,487,691 |
| Raleigh-Durham -- Richmond-Brunswick | 1,978,096 | 1,168,722 | 2,475,584 | 5,622,402 |
| Raleigh-Durham -- Charlottesville-Lynchburg | 1,989,093 | 1,165,530 | 2,037,626 | 5,192,249 |
| Raleigh-Durham -- Virginia Beach | 1,355,038 | 817,683 | 1,621,616 | 3,794,337 |
| Raleigh-Durham -- Washington D.C | 2,278,260 | 1,556,499 | 3,289,292 | 7,124,051 |
| Raleigh-Durham -- New York | 4,044,388 | 2,626,763 | 5,456,462 | 12,127,613 |
| Raleigh-Durham -- Rest of North East | 3,355,380 | 2,189,730 | 5,252,780 | 10,797,889 |
| Winston Salem-Greensboro -- Rocky Mount-New Bern | 549,570 | 343,641 | 692,759 | 1,585,970 |
| Winston Salem-Greensboro -- Ashville-Morgan Hickory | 782,415 | 691,438 | 1,255,487 | 2,729,339 |
| Winston Salem-Greensboro -- Fayetteville-Wilmington | 362,849 | 488,414 | 478,096 | 1,329,359 |
| Winston Salem-Greensboro -- Richmond-Brunswick | 1,106,139 | 724,837 | 1,382,757 | 3,213,732 |
| Winston Salem-Greensboro -- Charlottesville-Lynchburg | 1,072,826 | 663,798 | 1,221,622 | 2,958,246 |
| Winston Salem-Greensboro -- Virginia Beach | 741,729 | 471,876 | 888,527 | 2,102,132 |
| Winston Salem-Greensboro -- Washington D.C | 1,221,861 | 1,143,261 | 1,952,824 | 4,317,946 |
| Winston Salem-Greensboro -- New York | 2,319,374 | 1,599,447 | 3,550,123 | 7,468,944 |
| Winston Salem-Greensboro -- Rest of North East | 1,804,443 | 1,230,543 | 2,731,184 | 5,766,170 |
| Rocky Mount-New Bern -- Ashville-Morgan Hickory | 762,563 | 466,687 | 1,072,491 | 2,301,740 |
| Rocky Mount-New Bern -- Fayetteville-Wilmington | 835,924 | 454,288 | 716,642 | 2,006,854 |
| Rocky Mount-New Bern -- Richmond-Brunswick | 1,131,885 | 651,743 | 1,207,271 | 2,990,898 |
| Rocky Mount-New Bern -- Charlottesville-Lynchburg | 417,550 | 254,920 | 463,159 | 1,135,629 |
| Rocky Mount-New Bern -- Virginia Beach | 733,828 | 455,676 | 840,460 | 2,029,964 |
| Rocky Mount-New Bern -- Washington D.C | 1,392,102 | 1,022,911 | 1,705,449 | 4,120,462 |
| Rocky Mount-New Bern -- New York | 2,381,632 | 1,609,139 | 3,228,060 | 7,218,831 |
| Rocky Mount-New Bern -- Rest of North East | 1,891,246 | 1,250,757 | 2,910,037 | 6,052,040 |

| Base Market | Business | Recreation | Other | Total |
|--|--------------------|-------------------|--------------------|--------------------|
| Ashville-Morgan Hickory -- Fayetteville-Wilmington | 1,163,198 | 718,993 | 1,281,834 | 3,164,025 |
| Ashville-Morgan Hickory -- Richmond-Brunswick | 1,408,760 | 862,332 | 1,547,307 | 3,818,399 |
| Ashville-Morgan Hickory -- Charlottesville-Lynchburg | 1,359,688 | 816,180 | 1,460,081 | 3,635,949 |
| Ashville-Morgan Hickory -- Virginia Beach | 930,471 | 574,086 | 1,052,903 | 2,557,460 |
| Ashville-Morgan Hickory -- Washington D.C | 1,779,373 | 1,153,166 | 2,104,439 | 5,036,978 |
| Ashville-Morgan Hickory -- New York | 3,036,653 | 2,038,336 | 4,008,142 | 9,083,131 |
| Ashville-Morgan Hickory -- Rest of North East | 2,490,751 | 1,635,651 | 3,161,235 | 7,287,637 |
| Fayetteville-Wilmington -- Richmond-Brunswick | 1,522,129 | 956,097 | 1,806,721 | 4,284,947 |
| Fayetteville-Wilmington -- Charlottesville-Lynchburg | 1,496,522 | 920,962 | 1,645,519 | 4,063,002 |
| Fayetteville-Wilmington -- Virginia Beach | 1,007,366 | 632,241 | 1,195,877 | 2,835,484 |
| Fayetteville-Wilmington -- Washington D.C | 1,914,438 | 1,674,239 | 3,072,427 | 6,661,104 |
| Fayetteville-Wilmington -- New York | 3,269,950 | 2,245,661 | 4,464,050 | 9,979,661 |
| Fayetteville-Wilmington -- Rest of North East | 2,472,617 | 1,855,403 | 3,269,772 | 7,597,792 |
| Richmond-Brunswick -- Charlottesville-Lynchburg | 1,574,442 | 926,461 | 1,626,331 | 4,127,234 |
| Richmond-Brunswick -- Virginia Beach | 1,302,574 | 788,481 | 1,421,502 | 3,512,557 |
| Richmond-Brunswick -- Washington D.C | 3,098,806 | 2,178,171 | 4,224,968 | 9,501,945 |
| Richmond-Brunswick -- New York | 4,241,616 | 2,794,104 | 6,253,571 | 13,289,291 |
| Richmond-Brunswick -- Rest of North East | 6,507,524 | 4,127,724 | 8,285,660 | 18,920,908 |
| Charlottesville-Lynchburg -- Virginia Beach | 1,193,038 | 732,969 | 1,339,253 | 3,265,261 |
| Charlottesville-Lynchburg -- Washington D.C | 2,387,144 | 1,506,931 | 2,819,061 | 6,713,136 |
| Charlottesville-Lynchburg -- New York | 3,914,781 | 2,619,819 | 5,136,270 | 11,670,870 |
| Charlottesville-Lynchburg -- Rest of North East | 5,827,774 | 3,864,007 | 7,521,748 | 17,213,529 |
| Virginia Beach -- Washington D.C | 1,466,038 | 3,608,015 | 5,341,922 | 10,415,975 |
| Virginia Beach -- New York | 2,592,355 | 1,776,700 | 4,799,320 | 9,168,375 |
| Virginia Beach -- Rest of North East | 4,106,455 | 2,944,460 | 6,336,712 | 13,387,627 |
| Total | 125,910,343 | 87,268,261 | 175,609,013 | 388,787,617 |

3. Socio-Economic Data

Socio-economic characteristics represent the key independent variables in forecasting growth in total travel volumes, irrespective of change in the level of service provided by competing travel modes. The three socio-economic indicators used in this project include:

- Population
- Employment
- Per-capita Income

These data were obtained from AECOM’s national vendor Economy.com; which provides the forecasting data at annual intervals up to 2040 at the county level.

Using the 2010 Census employment and population, the county-level forecasts were split to the smaller Census Division geographic level for use with the zone system. Exhibit 3.1, 3.2 and 3.3 below provide the population, employment and per capita income summary for the major markets respectively.

Exhibit 3.1 Population Forecast for Major Markets

| Market | Description | Population (in thousands) | | | |
|---------------------------|--|---------------------------|--------|--------|--------|
| | | 2012 | 2020 | 2030 | 2040 |
| Charlotte-Rockingham | Charlotte Metro, NC-SC-Rockingham | 2,313 | 2,730 | 3,339 | 3,918 |
| Raleigh-Durham | Raleigh Metro--Henderson-Durham--Chapel Hill, NC | 2,016 | 2,366 | 2,890 | 3,436 |
| Winston Salem-Greensboro | Winston Salem--Greensboro--Lexington, NC | 1,528 | 1,657 | 1,844 | 2,037 |
| Rocky Mount-New Bern | Rocky Mount--Wilson-New Bern--Morehead City, NC | 811 | 865 | 943 | 1,015 |
| Asheville-Morgan Hickory | Asheville--Hickory--Statesville--Forest City, NC | 1,157 | 1,270 | 1,432 | 1,591 |
| Fayetteville-Wilmington | Fayetteville--Lumberton-Wilmington--Jacksonville, NC | 1,569 | 1,735 | 1,971 | 2,204 |
| Richmond-Brunswick | Richmond Metro, VA | 1,407 | 1,514 | 1,644 | 1,774 |
| Charlottesville-Lynchburg | Charlottesville-Lynchburg, VA | 1,233 | 1,312 | 1,413 | 1,515 |
| Virginia Beach | Virginia Beach-Norfolk-Newport News, VA | 1,716 | 1,815 | 1,944 | 2,072 |
| Washington D.C | Washington Metro DC-VA-MD-WV | 5,652 | 6,168 | 6,793 | 7,400 |
| New York | New York Metro NY-NJ | 19,130 | 19,497 | 20,019 | 20,811 |
| Rest of Northeast | Boston-New England-Philadelphia-Baltimore Metro | 17,891 | 18,367 | 18,858 | 19,328 |
| All | Total Study Area | 56,423 | 59,296 | 63,089 | 67,098 |

Exhibit 3.2 Employment Forecast for Major Markets

| Market | Description | Employment (in thousands) | | | |
|---------------------------|--|---------------------------|--------|--------|--------|
| | | 2012 | 2020 | 2030 | 2040 |
| Charlotte-Rockingham | Charlotte Metro, NC-SC-Rockingham | 1,000 | 1,189 | 1,387 | 1,603 |
| Raleigh-Durham | Raleigh Metro--Henderson-Durham--Chapel Hill, NC | 902 | 1,076 | 1,271 | 1,478 |
| Winston Salem-Greensboro | Winston Salem--Greensboro--Lexington, NC | 645 | 716 | 784 | 847 |
| Rocky Mount-New Bern | Rocky Mount--Wilson-New Bern--Morehead City, NC | 317 | 360 | 399 | 429 |
| Asheville-Morgan Hickory | Asheville--Hickory--Statesville--Forest City, NC | 442 | 498 | 560 | 620 |
| Fayetteville-Wilmington | Fayetteville--Lumberton-Wilmington--Jacksonville, NC | 517 | 598 | 684 | 781 |
| Richmond-Brunswick | Richmond Metro, VA | 665 | 738 | 776 | 809 |
| Charlottesville-Lynchburg | Charlottesville-Lynchburg, VA | 539 | 602 | 646 | 693 |
| Virginia Beach | Virginia Beach-Norfolk-Newport News, VA | 754 | 824 | 858 | 885 |
| Washington D.C | Washington Metro DC-VA-MD-WV | 2,994 | 3,309 | 3,521 | 3,878 |
| New York | New York Metro NY-NJ | 8,503 | 9,394 | 9,801 | 10,374 |
| Rest of Northeast | Boston-New England-Philadelphia-Baltimore Metro | 8,487 | 9,244 | 9,590 | 9,975 |
| All | Total Study Area | 25,766 | 28,548 | 30,275 | 32,374 |

Exhibit 3.3 Per Capita Income Forecast for Major Markets

| Market | Description | Per Capita Income | | | |
|---------------------------|--|-------------------|--------|--------|--------|
| | | 2012 | 2020 | 2030 | 2040 |
| Charlotte-Rockingham | Charlotte Metro, NC-SC-Rockingham | 33,952 | 36,366 | 38,337 | 41,691 |
| Raleigh-Durham | Raleigh Metro--Henderson-Durham--Chapel Hill, NC | 34,230 | 37,810 | 40,870 | 44,378 |
| Winston Salem-Greensboro | Winston Salem--Greensboro--Lexington, NC | 31,563 | 34,529 | 37,449 | 40,019 |
| Rocky Mount-New Bern | Rocky Mount--Wilson-New Bern--Morehead City, NC | 29,309 | 33,408 | 38,418 | 43,830 |
| Asheville-Morgan Hickory | Asheville--Hickory--Statesville--Forest City, NC | 28,574 | 31,459 | 34,967 | 38,775 |
| Fayetteville-Wilmington | Fayetteville--Lumberton-Wilmington--Jacksonville, NC | 31,251 | 36,717 | 45,200 | 57,376 |
| Richmond-Brunswick | Richmond Metro, VA | 36,248 | 41,439 | 46,161 | 51,019 |
| Charlottesville-Lynchburg | Charlottesville-Lynchburg, VA | 31,199 | 35,741 | 39,799 | 43,993 |
| Virginia Beach | Virginia Beach-Norfolk-Newport News, VA | 36,346 | 41,761 | 45,879 | 49,676 |
| Washington D.C | Washington Metro DC-VA-MD-WV | 51,289 | 59,171 | 66,480 | 76,964 |
| New York | New York Metro NY-NJ | 49,879 | 60,393 | 70,563 | 81,491 |
| Rest of Northeast | Boston-New England-Philadelphia-Baltimore Metro | 46,596 | 55,758 | 65,113 | 75,056 |
| All | Total Study Area | 44,861 | 52,794 | 60,295 | 68,646 |

4. Multimodal Networks and Service Characteristics

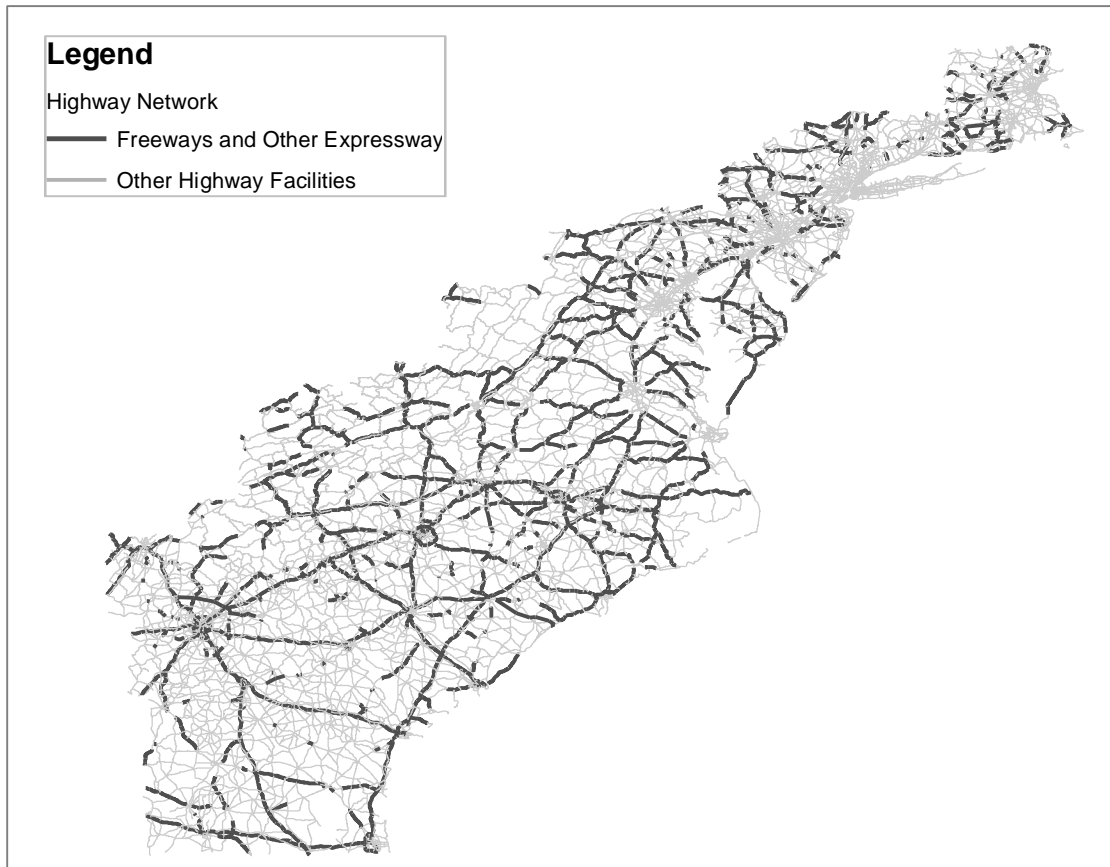
Modal service characteristics represent the key independent variables for modeling and forecasting the market shares captured by each intercity mode of travel. These characteristics influence the mode choice behavior by providing individuals with a measure of travel impedance between zones for the competitive modes. The mode choice models include the following characteristics:

- Travel Time (hours, minutes)
- Travel Cost (dollars)
- Frequency of service (departures per day)

4.1 Highway Network and Auto Service Characteristics

Auto impedances were developed from an intercity highway network representing interstate, principal arterial, and other highway facilities connecting all study area zones and intercity passenger terminals. The highway network was derived from Oak Ridge National Laboratory's existing highway network database. Travel times were calculated for each link based on facility type, distance, and state speed limits. Exhibit 4.1 illustrates the resulting highway network within the study area.

Exhibit 4.1 Southeast Highway Network



In order to create zone-to-zone characteristics for auto, a set of network “skims” (total time, distance, and tolls paid between each origin-destination pair) were produced using an ArcGIS based application called Network Analyst. Network Analyst was used to calculate the minimum path, based on minimizing travel time to/from each of the zones in the study area. Each minimum path calculation developed the time, distance, and toll costs associated with the trip. Auto costs are then computed by applying an appropriate rate per mile to reflect fully allocated costs (per IRS), for business travel, and incremental costs (fuel and other incremental costs only), for non-business travel. Using the same procedure, access and egress times were also calculated for all rail stations and airports within the study area.

This process produced zone-to-zone distance and time matrices based on the minimum travel time route between each study area zone pair.

4.2 Rail and Air Service Characteristics

Travel characteristics for rail and air travel were also developed for each study area zone pair using published timetables and the highway network for access to/from stations/airports. Key

characteristics include line haul time, frequency/schedule of service, fares, and access times and costs. The line haul time is the scheduled rail/air time between stations/airports.

Published Amtrak timetables (2013) and airline data (2012) obtained from Bureau of Transportation Statistics (BTS) provide the basis for quantifying the line haul time and frequency of service in each market. Average rail fares were computed by dividing actual Amtrak ticket revenue by ridership and average air fares were similarly computed by dividing the total market fare revenue by total passengers obtained from BTS.

The access times and costs include the time/cost traveling from the origin zone to the boarding rail station/airport; the time/cost associated with the station, including waiting/boarding times and parking costs; and the time/cost traveling from the destination station/airport to the final destination zone. Access times and costs for travel between zones and stations/airports were developed using the same network procedure and cost per mile rates described above and used for the auto zone-to-zone travel characteristics.

4.3 Summary of Existing Service Characteristics

Exhibits 4.2 through 4.9 show respectively auto, air and rail bus travel service characteristics for the Charlotte-Raleigh, Charlotte-Washington, Raleigh-New York, Raleigh-Richmond, Richmond-New York, Raleigh-Baltimore, Charlotte-Greensboro, Wilmington, NC-Washington, and Asheville-Raleigh markets – reflecting downtown-downtown trips.

Exhibit 4.2: Key Travel Service Characteristics by Mode for Charlotte-Raleigh

| Line Haul | Auto | Air | Rail |
|--------------------------------|-------------|------------|-------------|
| Airport/Stations/Terminals | | CLT-RDU | CLT-RGH |
| Distance(miles) | 169 | | |
| Travel Cost (full/incremental) | \$91/\$20 | \$ 163 | \$ 29 |
| Travel Time (mins) | 196 | 160 | 194 |
| Frequency (departures/day) | | 9 | 3 |
| Access-Egress | | | |
| Distance (miles) | | 23 | 7 |
| Travel Time (mins) | | 30 | 9 |

Exhibit 4.3: Key Travel Service Characteristics by Mode for Charlotte-Washington

| Line Haul | Auto | Air | Rail |
|--------------------------------|-------------|------------|-------------|
| Airport/Stations/Terminals | | CLT-DCA | CLT-WAS |
| Distance(miles) | 408 | | |
| Travel Cost (full/incremental) | \$220/\$49 | \$ 269 | \$ 83 |
| Travel Time (mins) | 448 | 155 | 535 |
| Frequency (departures/day) | | 10 | 3 |
| Access-Egress | | | |
| Distance (miles) | | 15 | 5 |
| Travel Time (mins) | | 21 | 8 |

Exhibit 4.4: Key Travel Service Characteristics by Mode for Raleigh-New York

| Line Haul | Auto | Air | Rail |
|--------------------------------|-------------|------------|-------------|
| Airport/Stations/Terminals | | RDU-JFK | RGH-NYP |
| Distance(miles) | 514 | | |
| Travel Cost (full/incremental) | \$277/\$62 | \$130 | \$ 99 |
| Travel Time (mins) | 566 | 137.54 | 607.5 |
| Frequency (departures/day) | | 10 | 2 |
| Access-Egress | | | |
| Distance (miles) | | 25 | 9 |
| Travel Time (mins) | | 28 | 11 |

Exhibit 4.5: Key Travel Service Characteristics by Mode for Raleigh-Richmond

| Line Haul | Auto | Air | Rail |
|--------------------------------|-------------|------------|-------------|
| Airport/Stations/Terminals | | RDU-RIC | RGH - RVR |
| Distance(miles) | 170 | | |
| Travel Cost (full/incremental) | \$102/\$23 | \$ 233 | \$ 44 |
| Travel Time (mins) | 184 | 86 | 218 |
| Frequency (departures/day) | | 1 | 2 |
| Access-Egress | | | |
| Distance (miles) | | 26 | 10 |
| Travel Time (mins) | | 28 | 13 |

Exhibit 4.6: Key Travel Service Characteristics by Mode for Richmond-New York

| Line Haul | Auto | Air | Rail |
|--------------------------------|------------|---------|---------|
| Airport/Stations/Terminals | | RIC-JFK | RVR-NYP |
| Distance(miles) | 384 | | |
| Travel Cost (full/incremental) | \$208/\$46 | \$ 199 | \$ 100 |
| Travel Time (mins) | 409 | 94 | 377 |
| Frequency (departures/day) | | 4 | 9 |
| Access-Egress | | | |
| Distance (miles) | | 22 | 8 |
| Travel Time (mins) | | 22 | 12 |

Exhibit 4.7: Key Travel Service Characteristics by Mode for Raleigh-Baltimore

| Line Haul | Auto | Air | Rail |
|--------------------------------|------------|---------|---------|
| Airport/Stations/Terminals | | RDU-BWI | RGH-BAL |
| Distance(miles) | 316 | | |
| Travel Cost (full/incremental) | \$170/\$38 | \$ 137 | \$ 74 |
| Travel Time (mins) | 336 | 103 | 436 |
| Frequency (departures/day) | | 8 | 2 |
| Access-Egress | | | |
| Distance (miles) | | 27 | 14 |
| Travel Time (mins) | | 34 | 17 |

Exhibit 4.8: Key Travel Service Characteristics by Mode for Charlotte-Greensboro

| Line Haul | Auto | Air | Rail |
|--------------------------------|-----------|-----------|---------|
| Airport/Stations/Terminals | | CLT – GSO | CLT-GRO |
| Distance(miles) | 94 | | |
| Travel Cost (full/incremental) | \$51/\$11 | \$ 98 | \$ 20 |
| Travel Time (mins) | 109 | 143 | 108 |
| Frequency (departures/day) | | 9 | 4 |
| Access-Egress | | | |
| Distance (miles) | | 20 | 8 |
| Travel Time (mins) | | 30 | 12 |

Exhibit 4.9: Key Travel Service Characteristics by Mode for Wilmington, NC-Washington

| Line Haul | Auto | Air | Rail-Bus |
|--------------------------------|-------------|------------|-------------------------|
| Airport/Stations/Terminals | | ILM - DCA | WMN - WAS |
| Distance(miles) | 370 | | |
| Travel Cost (full/incremental) | \$200/\$44 | \$ 290 | \$ 90 |
| Travel Time (mins) | 426 | 236 | 544 |
| Frequency (departures/day) | | 1 | 1 (rail-bus connection) |
| Access-Egress | | | |
| Distance (miles) | | 23 | 9 |
| Travel Time (mins) | | 27 | 14 |

Exhibit 4.10: Key Travel Service Characteristics by Mode for Asheville-Raleigh

| Line Haul | Auto | Air | Rail |
|--------------------------------|-------------|------------|-------------------|
| Airport/Stations/Terminals | | AVL - RDU | No Service |
| Distance(miles) | 249 | | |
| Travel Cost (full/incremental) | \$134/\$30 | \$ 332 | |
| Travel Time (mins) | 287 | 190 | |
| Frequency (departures/day) | | 1 | |
| Access-Egress | | | |
| Distance (miles) | | 26 | |
| Travel Time (mins) | | 30 | |

5. Model Development and Application

The travel demand modeling and forecasting approach consists of the development and application of a two stage model system. The first stage is a model which predicts total intercity passenger travel volume by origin-destination pair. The second stage predicts the share of intercity passenger travel which is expected to use each of available intercity modes. Both model stages are conditional on the service characteristics of the modes and the socio-economic conditions.

Two stage models are applied in reverse order (i.e., mode share before total demand) so that the mode share model results can be incorporated within the total demand model structure. This linkage provides the total travel model with sensitivity to changes in the level of service provided by all modes. The development of the mode choice models was based on the auto, rail, and air surveys described previously.

The overall procedure adopted in developing the mode share models consists of a number of steps. First, potential specifications of variables and segmentations were identified based on expected differences in travel behavior and on prior empirical experience with intercity mode choice models. Second, a descriptive analysis of data was undertaken to ascertain the feasibility of adopting the segments identified earlier. Third, mode share models were estimated to determine the specification of variables and finalize the model segmentations. Fourth, the model specifications are refined after initial tests of aggregate prediction results to:

- correct for aggregation error
- ensure that the model's predicted rail shares are in reasonable agreement with actual observed shares in key markets
- eliminate unnecessary complexity

5.1 Mode Share Model Framework and Estimation

Once the auto, rail, and air trip tables were created as described above, the survey records had expansion weights added to expand to the total number of trips by mode. Because the survey records only cover specific zonal pairs though, any trips which take place outside of the zonal pairs covered by the survey records were removed. The expansion weights specific to each mode were then calculated for each zonal pair as being the number of trips divided by the number of survey records. To avoid ALOGIT placing too much significance on each record, the final expansion weights are deflated so that the sum of all the weights is equal to the total number of records. Each survey records contains six stated preference questions, so for each stated preference record, the expansion weight is one-sixth of the survey record weight.

Initial testing specifications

Model estimation was first done using the unweighted revealed preference (RP) survey records, to provide initial guidance with respect to segmentation, nesting structures, and model specification. While the stated preference (SP) questions included high speed rail alternatives, the RP questions only incorporate the three existing modes which were surveyed

(auto, air, and conventional rail). Intercity bus is another existing mode option, but was not surveyed, and cannot be incorporated in the model estimation efforts.

The existing SEHSR model is segmented on two dimensions, trip purpose and distance. The trip purpose segments are business, recreation, and other. Commute was also an option for survey respondents, and the initial testing determined they fit best with the other segment. The previous model distance segments are less than 125 miles, 125 to 250 miles, and greater than 250 miles. The survey records were tabulated to ensure adequate records in each segment and the existing segmentation summaries are shown in Exhibit 5.1 and 5.2.

Exhibit 5.1 Trip Purpose Survey Record Summary

| Purpose | Air | Auto | Rail | Total |
|------------|-----|------|------|-------|
| Business | 116 | 262 | 51 | 429 |
| Commuter | 7 | 62 | 43 | 112 |
| Other | 156 | 1044 | 395 | 1595 |
| Recreation | 72 | 500 | 47 | 619 |
| Total | 351 | 1868 | 536 | 2755 |

Exhibit 5.2 Trip Distance Survey Record Summary

| Trip Distance | Air | Auto | Rail | Total |
|-----------------|-----|------|------|-------|
| < 125 Miles | 1 | 527 | 210 | 738 |
| 125 - 250 Miles | 7 | 749 | 179 | 935 |
| > 250 Miles | 343 | 592 | 147 | 1082 |
| Total | 351 | 1868 | 536 | 2755 |

Because trip distance is also used as an explanatory variable, an alternate segmentation was tested involving the metropolitan area size, to account for geographic-specific impacts. Metropolitan areas were split into rural areas (not in an MSA), minor metro areas (less than 1 million people) and major metro areas (1 million or more people). Exhibit 5.3 shows the survey records for each geography segment

Exhibit 5.3 Metro Area Size Survey Record Summary

| Origin and Destination Type | Air | Auto | Rail | Total |
|-----------------------------|------------|-------------|------------|-------------|
| Both Major Areas | 208 | 319 | 253 | 780 |
| Major and Minor | 123 | 904 | 202 | 1229 |
| Major and Rural | 16 | 257 | 54 | 327 |
| Both Minor Areas | 4 | 191 | 16 | 211 |
| Minor and Rural | 0 | 177 | 11 | 188 |
| Both Rural Areas | 0 | 20 | 0 | 20 |
| Total | 351 | 1868 | 536 | 2755 |

Because of the limited amount of alternatives in the RP dataset, only two nesting structures were tested, including no nests at all (a basic multinomial logit model), and with a single nest including air and rail. Auto travel does not share enough characteristics with air and rail to consider other nesting structures.

The last purpose for testing the RP dataset was to examine various specifications of service characteristics, including line haul and access/egress travel time, line haul and access/egress cost, and frequency.

Initial specification (from existing model):

- alternative-specific constants (auto is base)
- total travel time divided by functional form of distance (D)
- access/egress time squared divided by another functional form of distance (a)
- total cost divided by income and a functional form of distance (D)
- “damped” functional form of frequency (F)

$$D = 1.0 - \exp(kd)$$

where $k = -0.002$

$d =$ highway distance

$a =$ total highway distance minus access/egress distance

$$F = \log(1.0 - \exp(kf))$$

where $k = -0.08$

$f =$ frequency

Additional Variables:

- Functional form of percentage train is on-time ($\exp(-OTP)$)
- Indicator variable for trips between major metropolitan areas (> 1 mil)

After testing different aspects of the model components described above, three models were estimated based on the revealed preference data for business, recreation, and other trip purposes.

The RP business purpose mode choice model was best estimated as a multinomial logit (MNL) model. The model specification can be seen in Exhibit 5.4. The separate cost and travel time variables did not perform well in initial testing, and were adjusted to be a generalized cost variable, with the value of time constrained to \$22.90/hour for surface modes (auto and conventional rail) and \$57.20 for air. All other variable transformations are as described above.

Exhibit 5.4 Initial Revealed Preference MNL Business Mode Choice Model

| Variables | Coefficient | t ratio |
|----------------------------------|-------------|---------|
| Air ASC | 0.83 | 0.4 |
| Rail ASC | -1.32 | -1.1 |
| Adj Acc/Egr Travel Time | -0.00013 | -1.3 |
| Adj Generalized Cost – All Modes | -0.0000079 | -2.9 |
| Adj Generalized Cost - Air | 0.0000055 | 1.9 |
| Adj Generalized Cost - CR | 0.0000072 | 2.6 |
| Adj Frequency | 5.2900000 | 8.0 |
| Number of records | 422 | |
| Rho-squared w.r.t. Constants | 0.4349 | |

The RP recreation purpose mode choice model was also a MNL model, but did not require a generalized cost term. All variable transformations are the same as described above. The model specification can be seen in Exhibit 5.5

Exhibit 5.5 Initial Revealed Preference MNL Recreation Mode Choice Model

| Variables | Coefficient | t ratio |
|------------------------------|-------------|---------|
| Air ASC | -0.07 | -0.1 |
| Rail ASC | 2.05 | 4.8 |
| Adj Total Travel Time | -0.0031 | -3.6 |
| Adj Acc/Egr Travel Time | -0.000219 | -1.9 |
| Adj Total Cost | -0.005113 | -3.6 |
| Adj Frequency | 4.4410 | 7.8 |
| Number of records | 600 | |
| Rho-squared w.r.t. Constants | 0.3607 | |

The RP other trip purpose mode choice model was estimated as a nested logit model, with air and conventional rail sharing a nest. All variable transformations are the same as described above. The model specification can be seen in Exhibit 5.6

Exhibit 5.6 Initial Revealed Preference NL Other Mode Choice Model

| Variables | Coefficient | t ratio |
|------------------------------|-------------|---------|
| Air ASC | 1.11 | 3.2 |
| Rail ASC | 2.63 | 9.1 |
| Adj Total Travel Time | -0.0002 | -0.5 |
| Adj Acc/Egr Travel Time | -0.000121 | -2.4 |
| Adj Total Cost | -0.006188 | -7.2 |
| Adj Frequency | 4.192 | 10.2 |
| Theta | 0.78 | 7.3 |
| Number of records | 1538 | |
| Rho-squared w.r.t. Constants | 0.1951 | |

Final Model Specification

After initial testing was completed, the final mode choice models were estimated using the combined RP and SP survey records, which allowed for the inclusion of high speed rail as a mode. These models used simple expansion weights as described above and constrained some variable coefficients to the revealed preference model values. After estimation, the models were calibrated to match the stated preference mode shares for twelve specific major market pairs in the model area. The models below are the final calibrated models. All variable transformations are the same as described in the initial testing specification section. All three trip purpose mode choice models were nested logit models with an air/HSR nest. Any coefficients which have a t-ratio of zero are either asserted from the RP model specification or adjusted during calibration. The model specifications for the three models can be seen in Exhibit 5.7 through 5.9.

Exhibit 5.7 Final Nested Logit Business Mode Choice Model

| Variables | Coefficient | t ratio |
|--------------------------|-------------|---------|
| Adj Acc/Egr Travel Time | -0.000130 | 0 |
| Adj Generalized Cost | -7.90E-07 | 0 |
| Adj Total Cost - Air | -3.306E-07 | -1.9 |
| Adj Total Cost - CR | 4.692E-07 | 0.7 |
| Adj Frequency | 1.0000 | 0 |
| Auto Dist 125-250 Miles | 2.7500 | 0 |
| Auto Dist 250-400 Miles | 1.2500 | 0 |
| Auto Dist >400 Miles | 0.8000 | 0 |
| Major-Major Metro - Air | 10.34 | 11.3 |
| Major-Major Metro - Rail | -0.25 | 0 |
| Theta | 0.2996 | 16.1 |

Exhibit 5.8 Final Nested Logit Recreation Mode Choice Model

| Variables | Coefficient | t ratio |
|---------------------------|-------------|---------|
| Adj Total Travel Time | -0.0031 | 0 |
| Adj Acc/Egr Travel Time | -0.00022 | 0 |
| Adj Total Cost | -0.005434 | -9.3 |
| Adj Frequency | 1.0000 | 0 |
| Major-Major Metro - Air | 2.29E-02 | 0.1 |
| Air Dist 250-400 Miles | 0.05 | 0 |
| Air Dist >400 Miles | 14 | 0 |
| Rail Dist < 125 Miles | 2.392 | 13.6 |
| Rail Dist 125 - 250 Miles | 5 | 0 |
| Rail Dist 250-400 Miles | 5 | 0 |
| Rail Dist >400 Miles | 3 | 0 |
| Theta | 0.7572 | 28.6 |

Exhibit 5.9 Final Nested Logit Other Mode Choice Model

| Variables | Coefficient | t ratio |
|---------------------------|-------------|---------|
| Adj Total Travel Time | -0.0002 | 0 |
| Adj Acc/Egr Travel Time | -0.001200 | 0 |
| Adj Total Cost | -0.0062 | 0 |
| Adj Frequency | 1.0000 | 0 |
| Auto Dist 125-250 Miles | 6.00 | 0 |
| Auto Dist 250-400 Miles | 3.00 | 0 |
| Auto Dist >400 Miles | 2.00 | 0 |
| Major-Major Metro - Air | 1.9220 | 6.2 |
| Air Dist 125-250 Miles | 1.00 | 0 |
| Air Dist 250-400 Miles | 5.00 | 10.7 |
| Air Dist >400 Miles | 6.00 | 0 |
| Rail Dist < 125 Miles | 0.72 | 11.5 |
| Rail Dist 125 - 250 Miles | 0.69 | 12.1 |
| Rail Dist 250-400 Miles | 0.68 | 8.2 |
| Rail Dist >400 Miles | 0.79 | 6.9 |
| Theta | 0.92 | 23.8 |

5.2 Total Travel Demand Model

In the two-stage travel demand modeling approach, a total travel demand model component is required in conjunction with the modal share model. Total travel demand forecasts define the total market size to which the modal shares are applied to produce ridership forecasts by mode. In general, there are two major influences on the total travel demand between any two geographic areas:

- Population growth and changes in economic activity in the geographic areas
- Changes in the modal levels of service provided between the geographic areas

Measures used to represent the impacts of these changes respectively include:

- Socio-economic data and forecasts, such as:
 - population
 - household income
 - employment
- Composite modal level of service, defined by the modal share model structure and equivalent to summing across all modes in the MNL as follows:

$$LOS_i = \sum_i \exp(U_i)$$

where:

- i - mode
- U_i - utility of mode i

The total travel models have a multiplicative structure, with exponent coefficients on each of the independent variables. The models were estimated using a log-linear regression technique, with total trips as the dependent variable. Separate models were estimated for each of the three trip purpose market segments reflected in the mode share models -- business, recreation, and other non-recreation.

The total travel models were applied using a ratio formulation that relates total travel market growth to growth in the independent variables, computed as the ratio of the forecast year to the base year values. This is illustrated by the following equation:

$$\frac{TRP_F}{TRP_B} = \frac{POP_F}{POP_B}^a \frac{EMP_F}{EMP_B}^b \times \frac{LOS_F}{LOS_B}^c$$

where:

TRIP - trips

POP - population

EMP - employment

LOS - level of service

F - future year

B - base year

That is, interzonal trips are projected to grow in proportion to population, adjusted for its estimated effect, *a*; in proportion to the employment changes in the attraction zone, adjusted for its estimated effect, *b*; and in proportion to changes in the overall level of service, adjusted for its estimated effect, *c*.

6. Rail Alternatives and Service Characteristics

Ridership and revenue forecasts were prepared for current service and four (4) future service alternatives reflecting different levels of high-speed and conventional rail improvements in North Carolina and Virginia. These alternatives include the following rail services:

- **Current Service**, consisting of:
 - 3 round trips between Charlotte and Raleigh, with 1 round trip (the *Carolinian*) continuing into Virginia via Rocky Mount (on the A-Line) and then to New York
 - 6 round trips that begin/end in Virginia, including:
 - 5 round trips between Richmond and New York/Boston, with 2 extending to/from Newport News and 1 extending to/from Norfolk
 - 1 round trip between Lynchburg and New York/Boston
 - 4 round trips provided by Amtrak Long Distance trains (Silver Star, Silver Meteor, Palmetto, and Crescent) that pass through North Carolina and Virginia
- **Baseline (No Build)**, which adds 2 planned Charlotte-Raleigh round trips to the current service. In summary, the Baseline consists of:
 - 5 round trips between Charlotte and Raleigh, with 1 round trip (the *Carolinian*) continuing into Virginia via Rocky Mount (on the A-Line) and then to New York
 - 6 round trips that begin/end in Virginia, including:
 - 5 round trips between Richmond and New York/Boston, with 2 extending to/from Newport News and 1 extending to/from Norfolk
 - 1 round trip between Lynchburg and New York/Boston
 - 4 round trips provided by Amtrak Long Distance trains (Silver Star, Silver Meteor, Palmetto, and Crescent) that pass through North Carolina and Virginia
- **Full Build**, which replaces the Baseline North Carolina trains with new Southeast High Speed Rail (SEHSR) trains utilizing the new S-Line between Petersburg and Raleigh via Henderson, NC. In summary, the Full Build includes:
 - Southeast High Speed Rail (SEHSR) service providing 8 round trips between Charlotte and Raleigh, with:
 - 3 round trips continuing into Virginia via Henderson (on the S-Line) between Petersburg & Raleigh and then to New York
 - a 4th round trip that would operate only between Raleigh and New York via S-Line between Petersburg & Raleigh
 - 1 round trip continuing into Virginia via Rocky Mount (on the A-Line), as the *Carolinian* does currently, and then to New York
 - 6 round trips that begin/end in Virginia, including:
 - 5 round trips between Richmond and New York/Boston, with 2 extending to/from Newport News and 1 extending to/from Norfolk
 - 1 round trip between Lynchburg and New York/Boston
 - 4 round trips provided by Amtrak Long Distance trains (Silver Star, Silver Meteor, Palmetto, and Crescent) that pass through North Carolina and Virginia; including the Silver Star moved to the S-Line between Petersburg & Raleigh

- **Baseline with Additional Services**, which adds service to Asheville, Wilmington, Newport News, Norfolk, and Roanoke to the Baseline. In summary, the Baseline with Additional Services includes:
 - 5 round trips between Charlotte and Raleigh, with 1 round trip (the *Carolinian*) continuing into Virginia via Rocky Mount (on the A-Line) and then to New York
 - New train services to Asheville and Wilmington, connecting with the Charlotte-Raleigh-New York trains in Salisbury and Raleigh respectively
 - 10 round trips that begin/end in Virginia, including:
 - 8 round trips between Richmond and New York/Boston, all of which actually extend to/from Newport News, and 3 round trips to/from Norfolk, connecting with the Newport News-Richmond-New York/Boston trains in Richmond
 - 2 round trips between Roanoke, Lynchburg and New York/Boston
 - 4 round trips provided by Amtrak Long Distance trains (Silver Star, Silver Meteor, Palmetto, and Crescent) that pass through North Carolina and Virginia

- **Full Build with Additional Services**, which adds service to Asheville, Wilmington, Newport News, Norfolk, and Roanoke to the Full Build. In summary, the Full Build with Additional Services includes:
 - Southeast High Speed Rail (SEHSR) service providing 8 round trips between Charlotte and Raleigh, with:
 - 3 round trips continuing into Virginia via Henderson (on the S-Line) between Petersburg & Raleigh and then to New York
 - a 4th round trip that would operate only between Raleigh and New York via S-Line between Petersburg & Raleigh
 - 1 round trip continuing into Virginia via Rocky Mount (on the A-Line), as the *Carolinian* does currently, and then to New York
 - New train services to Asheville and Wilmington, connecting with the Charlotte-Raleigh-New York SEHSR trains in Salisbury and Raleigh respectively
 - 10 round trips that begin/end in Virginia, including:
 - 8 round trips between Richmond and New York/Boston, all of which actually extend to/from Newport News, and 3 round trips to/from Norfolk, connecting with the Newport News-Richmond-New York/Boston trains in Richmond
 - 2 round trips between Roanoke, Lynchburg and New York/Boston
 - 4 round trips provided by Amtrak Long Distance trains (Silver Star, Silver Meteor, Palmetto, and Crescent) that pass through North Carolina and Virginia; including the Silver Star moved to the S-Line between Petersburg & Raleigh

Exhibits 6.1 through 6.5 on the pages that follow show each of these five rail service alternatives graphically. In these schematics, each train frequency is represented by a line, with color coding to help distinguish among the different groups of train services.

Exhibit 6.1 Current Service

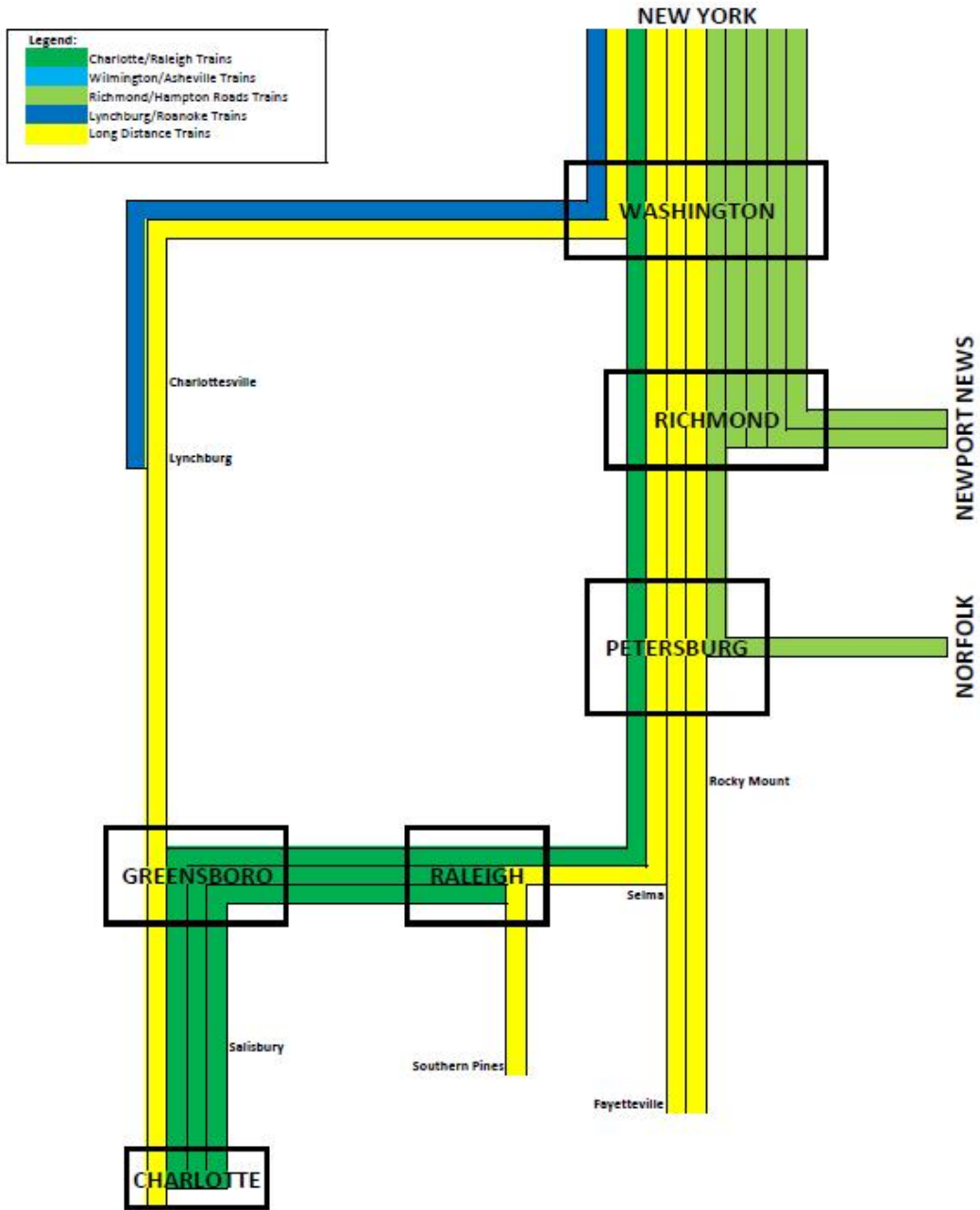


Exhibit 6.2 Baseline (No Build) Service

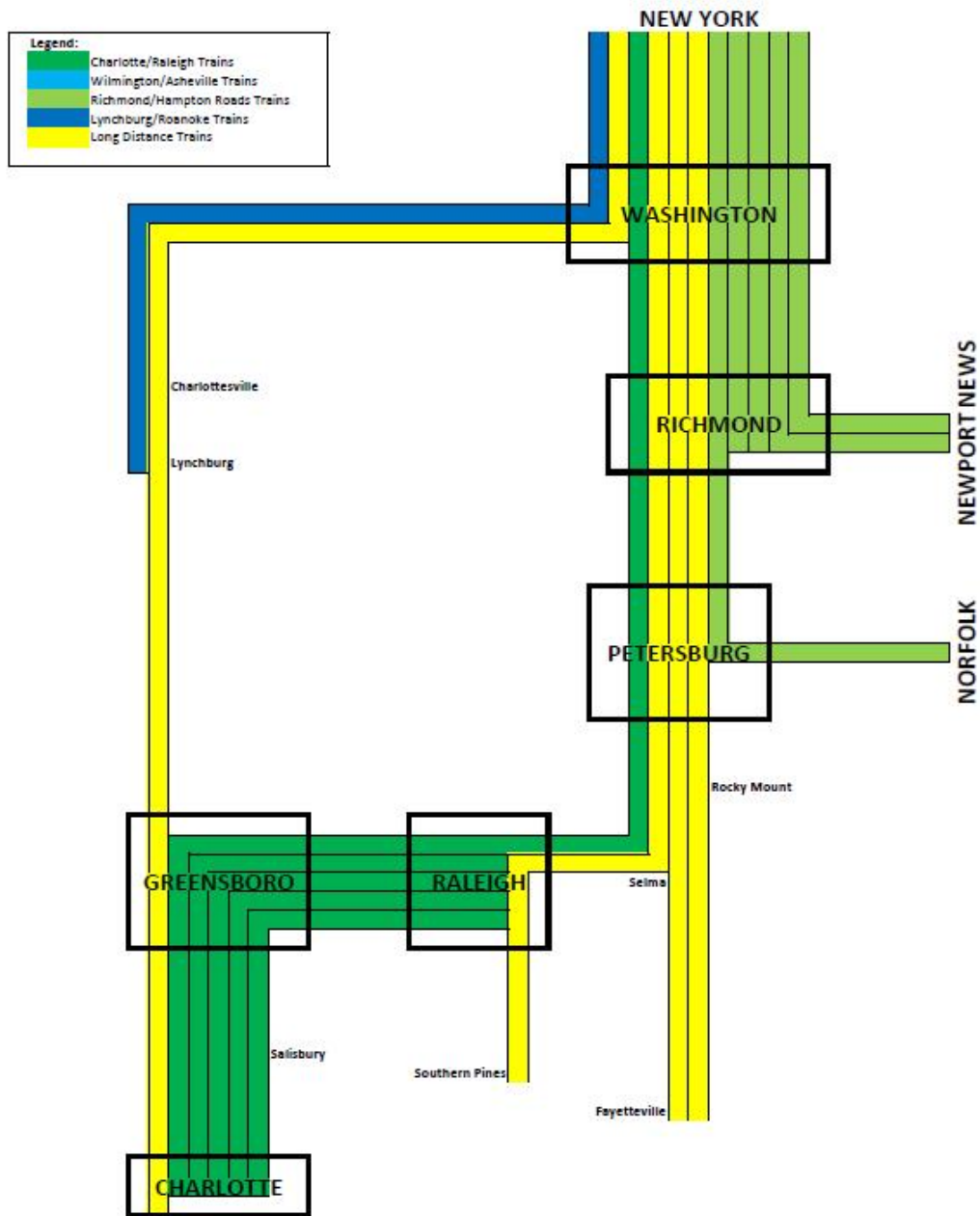


Exhibit 6.3 Full Build Service

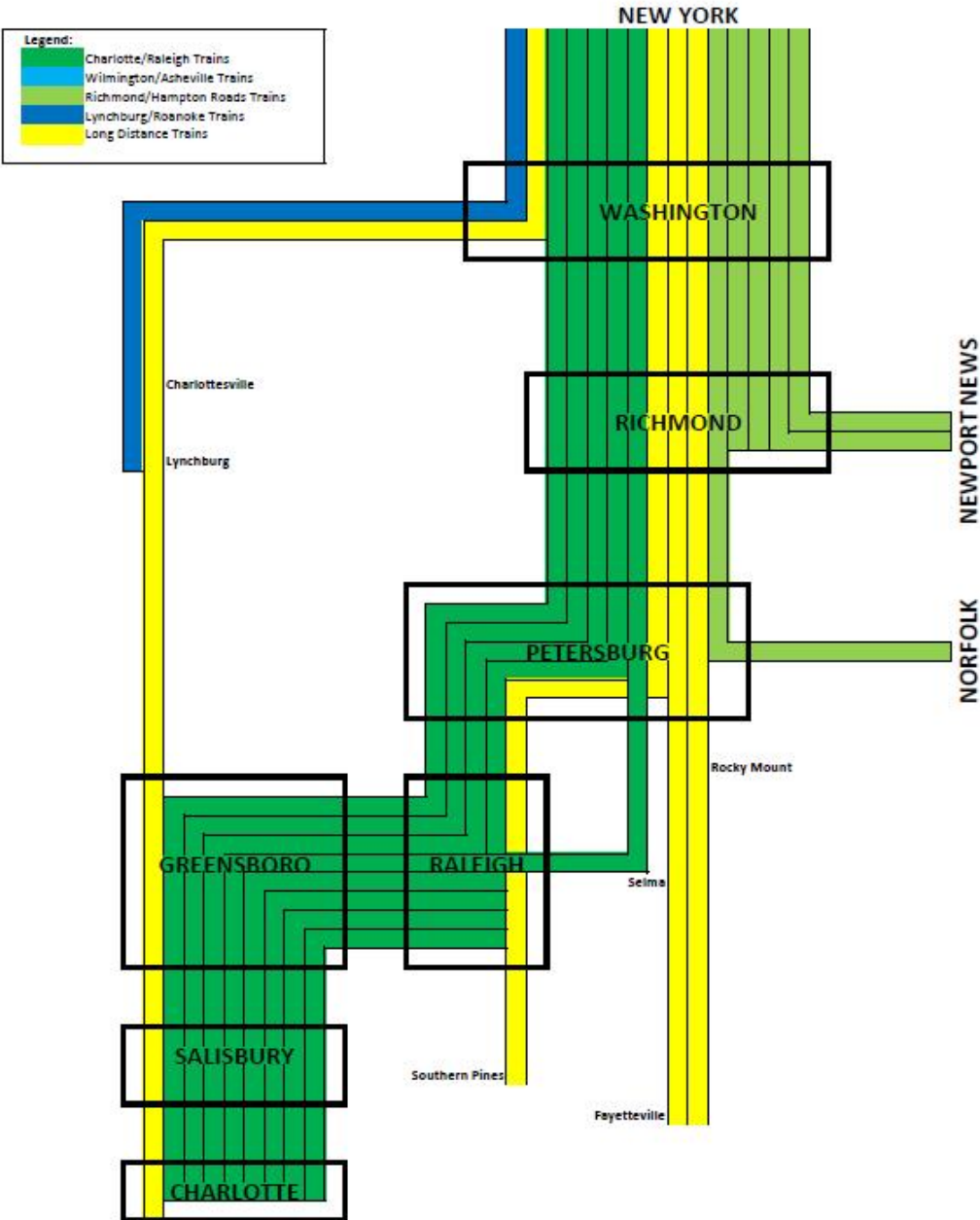


Exhibit 6.4 Baseline with Additional Service

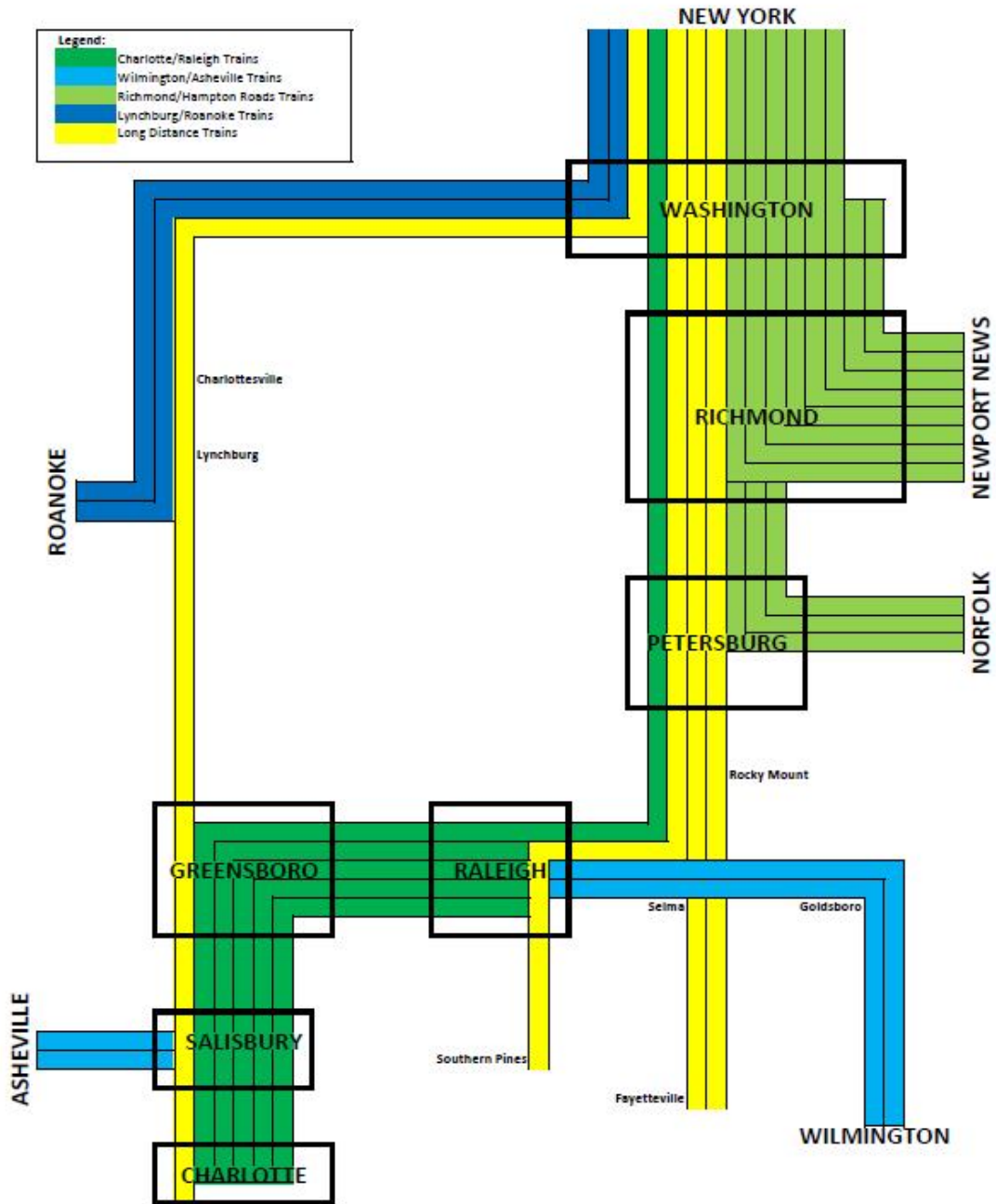
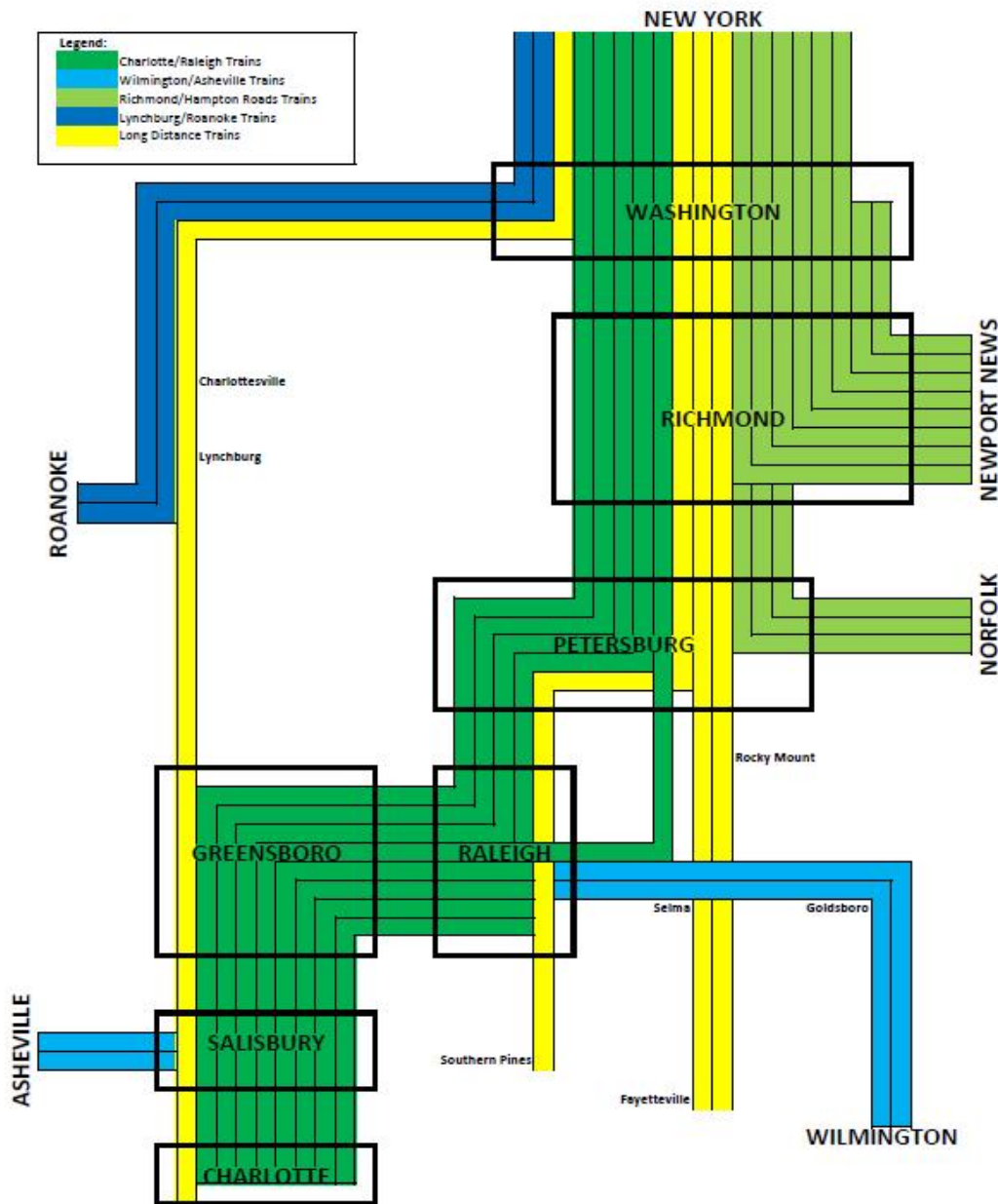


Exhibit 6.5 Full Build with Additional Service



NCDOT staff provided detailed timetables showing the specific departure/arrival times for each train at each station service. Exhibit 6.6 below summarizes the resulting train frequencies, by key market, across the service alternatives, and Exhibit 6.7 summarizes the average travel times, considering only the North Carolina and Virginia train services (the long distance trains provide generally slower and often less convenient times within the North Carolina and Virginia markets).

Exhibit 6.6 Train Frequencies by Key Market

| | <u>Current Service</u> | <u>Baseline (No Build)</u> | <u>Full Build</u> | <u>Baseline + add'l service</u> | <u>Full Build + add'l service</u> |
|--------------------------------------|------------------------|----------------------------|-------------------|---------------------------------|-----------------------------------|
| <u>Frequency (daily round trips)</u> | | | | | |
| North Carolina Trains | | | | | |
| Washington-Raleigh (via S Line) | 0 | 0 | 4 | 0 | 4 |
| Washington-Raleigh (via A Line) | 1 | 1 | 1 | 1 | 1 |
| Raleigh-Charlotte | 3 | 5 | 8 | 5 | 8 |
| Raleigh-Wilmington | 0 | 0 | 0 | 2 | 2 |
| Salisbury-Asheville | 0 | 0 | 0 | 2 | 2 |
| Virginia Trains | | | | | |
| Washington-Richmond | 5 | 5 | 5 | 8 | 8 |
| Richmond-Newport News | 3 | 2 | 2 | 8 | 8 |
| Richmond-Norfolk (thru to/from WAS) | 1 | 1 | 1 | 0 | 0 |
| Richmond-Norfolk (shuttle) | 0 | 0 | 0 | 3 | 3 |
| Washington-Lynchburg | 1 | 1 | 1 | 2 | 2 |
| Lynchburg-Roanoke | 0 | 0 | 0 | 2 | 2 |
| Amtrak Long Distance Trains | | | | | |
| Silver Star | 1 | 1 | 1 | 1 | 1 |
| Silver Meteor | 1 | 1 | 1 | 1 | 1 |
| Palmetto | 1 | 1 | 1 | 1 | 1 |
| Crescent | 1 | 1 | 1 | 1 | 1 |

Exhibit 6.7 Average Travel Times by Key Market

| | <u>Current Service</u> | <u>Baseline (No Build)</u> | <u>Full Build</u> | <u>Baseline + add'l service</u> | <u>Full Build + add'l service</u> |
|--|------------------------|----------------------------|-------------------|---------------------------------|-----------------------------------|
| <u>Average Travel Times (among NC & VA trains)</u> | | | | | |
| New York-Richmond | 6:26 | 6:20 | 5:25 | 6:06 | 5:35 |
| Washington-Richmond | 2:18 | 2:19 | 2:08 | 2:07 | 2:04 |
| New York-Raleigh | 9:57 | 9:57 | 7:38 | 9:57 | 7:38 |
| Washington-Raleigh | 5:59 | 5:59 | 4:35 | 5:59 | 4:35 |
| Richmond-Raleigh | 3:36 | 3:36 | 2:26 | 3:36 | 2:26 |
| New York-Charlotte | 13:25 | 13:25 | 10:35 | 13:25 | 10:35 |
| Washington-Charlotte | 9:27 | 9:27 | 7:33 | 9:27 | 7:33 |
| Richmond-Charlotte | 7:03 | 7:03 | 5:25 | 7:03 | 5:25 |
| Raleigh-Charlotte | 3:13 | 3:09 | 2:49 | 3:09 | 2:49 |
| Raleigh-Wilmington | no service | no service | no service | 2:30 | 2:30 |
| Salisbury-Asheville | no service | no service | no service | 3:17 | 3:17 |

All of the alternatives described above were analyzed at current Amtrak fares. Where service does not currently exist, fares were computed by extrapolating the current Amtrak pricing in similar existing markets. In addition, under the full build alternatives with SEHSR trains service, higher fares were assumed for the markets served by these trains and set at 25% more than these existing fares.

7. Ridership and Revenue Projections

Ridership and revenue forecasts were prepared for each of the four future service alternatives, described in Section 6, for future forecast year 2030, 2040, and other interim years. Exhibit 7.1 below summarizes the 2030 forecasts and Exhibit 7.2 summarizes the 2040 forecasts. Please note that all ticket revenue projections are stated in current year (2013) dollars. In addition, the Long Distance trains totals only include markets from New York through Virginia and North Carolina.

As discussed in Section 6, the Baseline (No Build) reflects current service plus two new planned frequencies between Charlotte and Raleigh. In comparison, the Full Build replaces these Baseline North Carolina trains with new Southeast High Speed Rail (SEHSR) trains utilizing the new S-Line between Petersburg and Raleigh. As expected, the corresponding ridership and ticket revenue forecasts increase significantly with the Full Build, reflecting these significant service improvements. For example, ridership associated with the North Carolina trains increases to more than twice the Baseline and ticket revenue associated with the North Carolina trains increases more than three-fold. These higher increases in ticket revenue reflect the greater level of improvement seen by long distance trips leaving North Carolina, through increased frequency and the significantly faster travel times offered by the new S-Line, and the 25% higher fares. Revenue on the Virginia service also increases, but ridership remains essentially the same because some activity shifts to the new SEHSR trains between Richmond and points north of Richmond. This revenue increase again reflects the 25% higher fares.

The Baseline with Additional Service shows the impact of providing added service to Asheville, Wilmington, Newport News, Norfolk, and Roanoke. Within Virginia in particular, this added service results in a doubling of ridership and ticket revenue among the Virginia trains. In this case, since new high speed service is not being implemented, fares remain the same so the ridership and revenue impact are relatively similar. The Full Build with Additional Service shows the combined impact of SEHSR and added service to Asheville, Wilmington, Newport News, Norfolk, and Roanoke. Not surprisingly, this alternative generates the most ridership and ticket revenue.

Exhibits 7.3 through 7.6 summarize forecasts for years 2013 through 2040, using the following implementation schedule:

- Current Service through 2016
- Baseline Service 2017-2024
- Full Build Service 2025-2040

Exhibits 7.3 and 7.4 provide ridership and ticket revenue forecasts by year that do not include any of the additional services and Exhibits 7.5 and 7.6 provide ridership and ticket revenue forecasts by year that include the additional services starting in 2017.

Exhibit 7.1 Summary of 2030 Forecast Results

| <u>Forecast Year</u> | <u>Baseline</u> | <u>Full Build³</u> | <u>Baseline +</u> | <u>Full Build³ +</u> |
|--|-------------------|-------------------------------|----------------------------------|----------------------------------|
| | <u>(No Build)</u> | | <u>add'l service⁴</u> | <u>add'l service⁴</u> |
| | 2030 | 2030 | 2030 | 2030 |
| <u>Ridership</u> | | | | |
| North Carolina Service | | | | |
| Charlotte Trains ¹ | 996,100 | 2,075,500 | 1,039,700 | 2,124,700 |
| Wilmington Trains ¹ | 0 | 0 | 37,700 | 41,000 |
| Asheville Trains ¹ | 0 | 0 | 32,600 | 33,600 |
| Virginia Service | | | | |
| Richmond/Hampton Roads Trains | 808,300 | 805,600 | 1,426,500 | 1,383,200 |
| Lynchburg/Roanoke Trains | 241,300 | 261,600 | 656,000 | 653,000 |
| Amtrak Long Distance Trains ² | <u>241,900</u> | <u>241,900</u> | <u>243,300</u> | <u>240,100</u> |
| TOTAL - Ridership | 2,287,600 | 3,384,600 | 3,435,800 | 4,475,600 |
| <u>Ticket Revenue (2013\$)</u> | | | | |
| North Carolina Service | | | | |
| Charlotte Trains | 39,034,000 | 138,667,000 | 40,676,000 | 141,719,000 |
| Wilmington Trains | 0 | 0 | 584,000 | 745,000 |
| Asheville Trains | 0 | 0 | 491,000 | 574,000 |
| Virginia Service | | | | |
| Richmond/Hampton Roads Trains | 45,947,000 | 57,799,000 | 84,156,000 | 97,580,000 |
| Lynchburg/Roanoke Trains | 15,070,000 | 16,474,000 | 45,517,000 | 45,257,000 |
| Amtrak Long Distance Trains ² | <u>30,474,000</u> | <u>30,460,000</u> | <u>30,638,000</u> | <u>30,376,000</u> |
| TOTAL - Ticket Revenue | 130,525,000 | 243,400,000 | 202,062,000 | 316,251,000 |

Notes:

¹ Asheville & Wilm services require a cross platform transfer to Charlotte trains and are counted separately

² Activity from NEC through NC only; includes connecting buses

³ Full Build scenarios include SEHSR service for 8 round trips Chrl to Ral, w/3 continuing to NY via S-Line between Petersburg & Raleigh (and a 4th round trip that operates only Ral to NY via S-Line between Petersburg & Raleigh), and 1 (the Carolinian) continuing to NY via the A-Line

⁴ Additional services for NC include connecting service to Asheville and Wilmington; Additional services for VA include 6 add'l round trips from Newport News, with connecting round trips from Norfolk; extending Lynchburg service to Roanoke and adding 1 add'l round trip

Exhibit 7.2 Summary of 2040 Forecast Results

| <u>Forecast Year</u> | <u>Baseline</u> | <u>Full Build³</u> | <u>Baseline +</u> | <u>Full Build³ +</u> |
|--|-------------------|-------------------------------|----------------------------------|----------------------------------|
| | <u>(No Build)</u> | | <u>add'l service⁴</u> | <u>add'l service⁴</u> |
| | 2040 | 2040 | 2040 | 2040 |
| <u>Ridership</u> | | | | |
| North Carolina Service | | | | |
| Charlotte Trains ¹ | 1,234,200 | 2,526,900 | 1,287,500 | 2,586,300 |
| Wilmington Trains ¹ | 0 | 0 | 46,400 | 50,100 |
| Asheville Trains ¹ | 0 | 0 | 40,600 | 41,700 |
| Virginia Service | | | | |
| Richmond/Hampton Roads Trains | 915,200 | 911,100 | 1,604,900 | 1,555,500 |
| Lynchburg/Roanoke Trains | 278,300 | 301,200 | 746,800 | 743,300 |
| Amtrak Long Distance Trains ² | <u>280,900</u> | <u>282,400</u> | <u>282,200</u> | <u>280,100</u> |
| TOTAL - Ridership | 2,708,600 | 4,021,600 | 4,008,400 | 5,257,000 |
| <u>Ticket Revenue (2013\$)</u> | | | | |
| North Carolina Service | | | | |
| Charlotte Trains | 47,363,000 | 165,575,000 | 49,328,000 | 169,148,000 |
| Wilmington Trains | 0 | 0 | 737,000 | 927,000 |
| Asheville Trains | 0 | 0 | 609,000 | 712,000 |
| Virginia Service | | | | |
| Richmond/Hampton Roads Trains | 51,622,000 | 64,867,000 | 93,769,000 | 108,732,000 |
| Lynchburg/Roanoke Trains | 17,246,000 | 18,825,000 | 51,314,000 | 51,017,000 |
| Amtrak Long Distance Trains ² | <u>35,189,000</u> | <u>35,277,000</u> | <u>35,357,000</u> | <u>35,172,000</u> |
| TOTAL - Ticket Revenue | 151,420,000 | 284,544,000 | 231,114,000 | 365,708,000 |

Notes:

¹ Asheville & Wilm services require a cross platform transfer to Charlotte trains and are counted separately

² Activity from NEC through NC only; includes connecting buses

³ Full Build scenarios include SEHSR service for 8 round trips Chrl to Ral, w/3 continuing to NY via S-Line between Petersburg & Raleigh (and a 4th round trip that operates only Ral to NY via S-Line between Petersburg & Raleigh), and 1 (the Carolinian) continuing to NY via the A-Line

⁴ Additional services for NC include connecting service to Asheville and Wilmington; Additional services for VA include 6 add'l round trips from Newport News, with connecting round trips from Norfolk; extending Lynchburg service to Roanoke and adding 1 add'l round trip

Exhibit 7.3 2013-2040 Ridership Forecasts without Additional Services

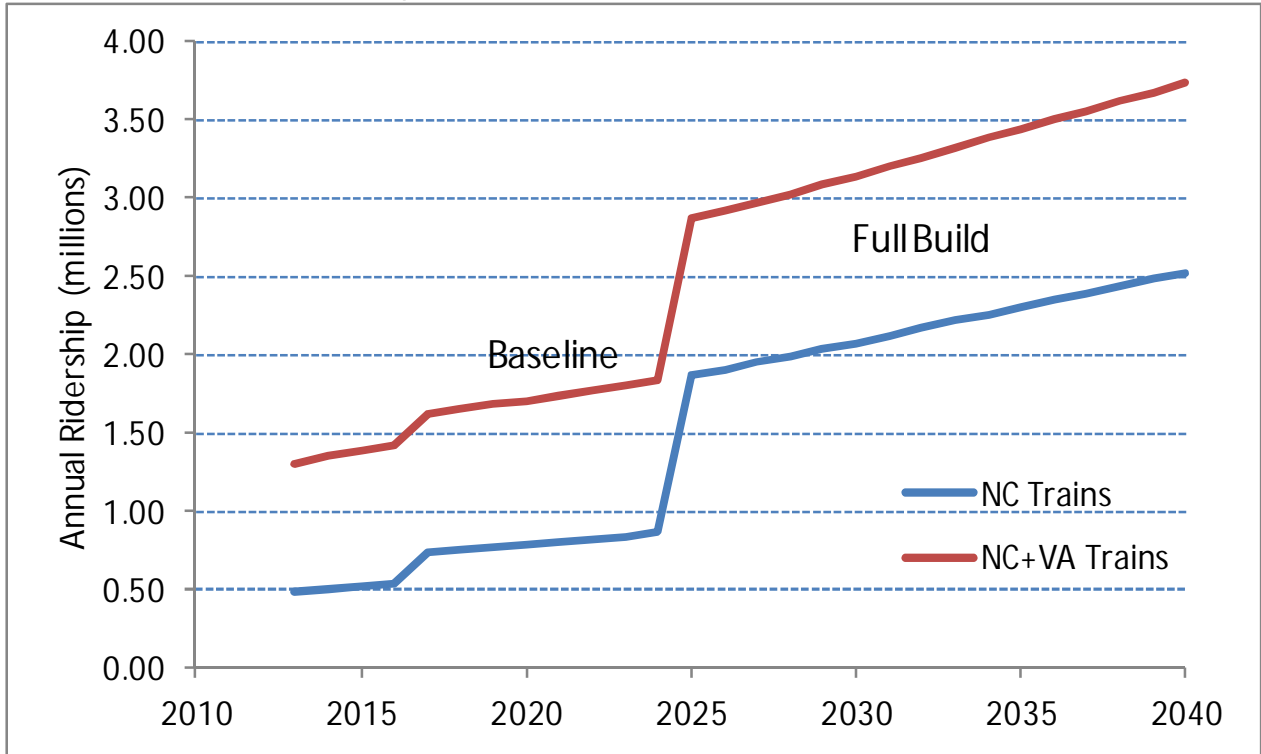


Exhibit 7.4 2013-2040 Ticket Revenue Forecasts without Additional Services

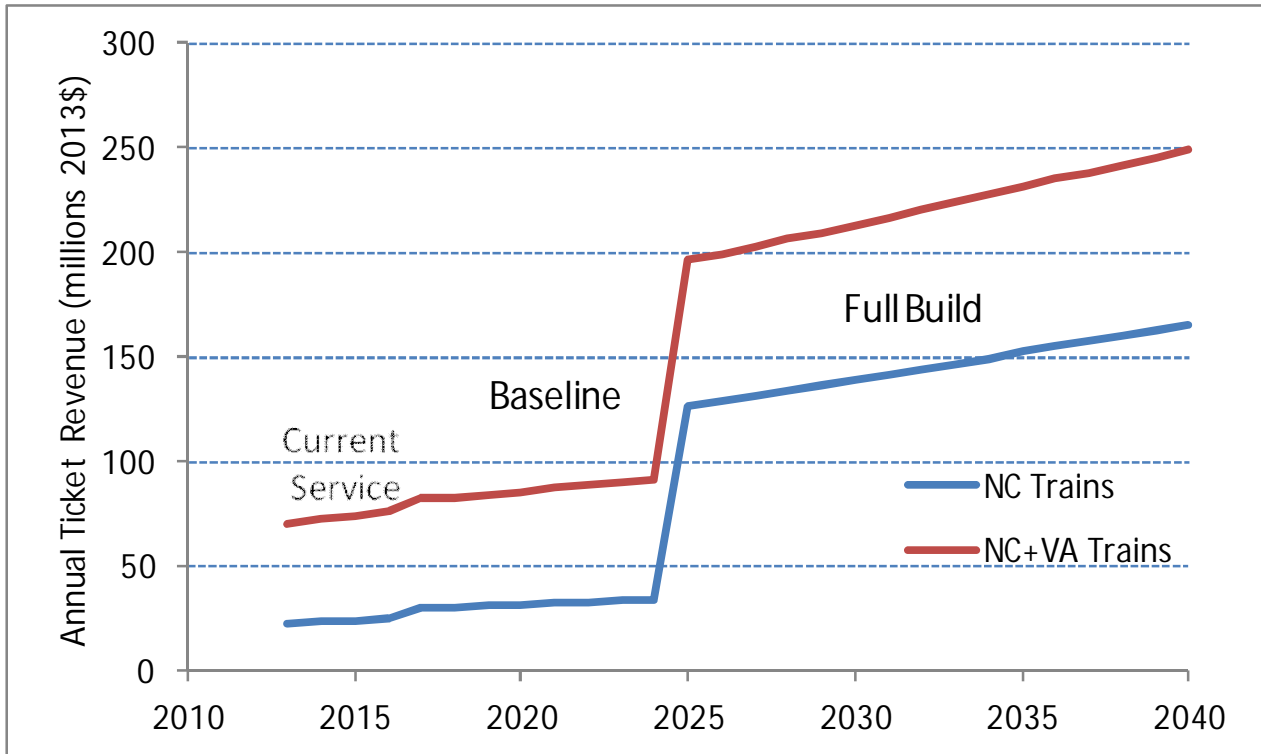


Exhibit 7.5 2013-2040 Ridership Forecasts with Additional Services

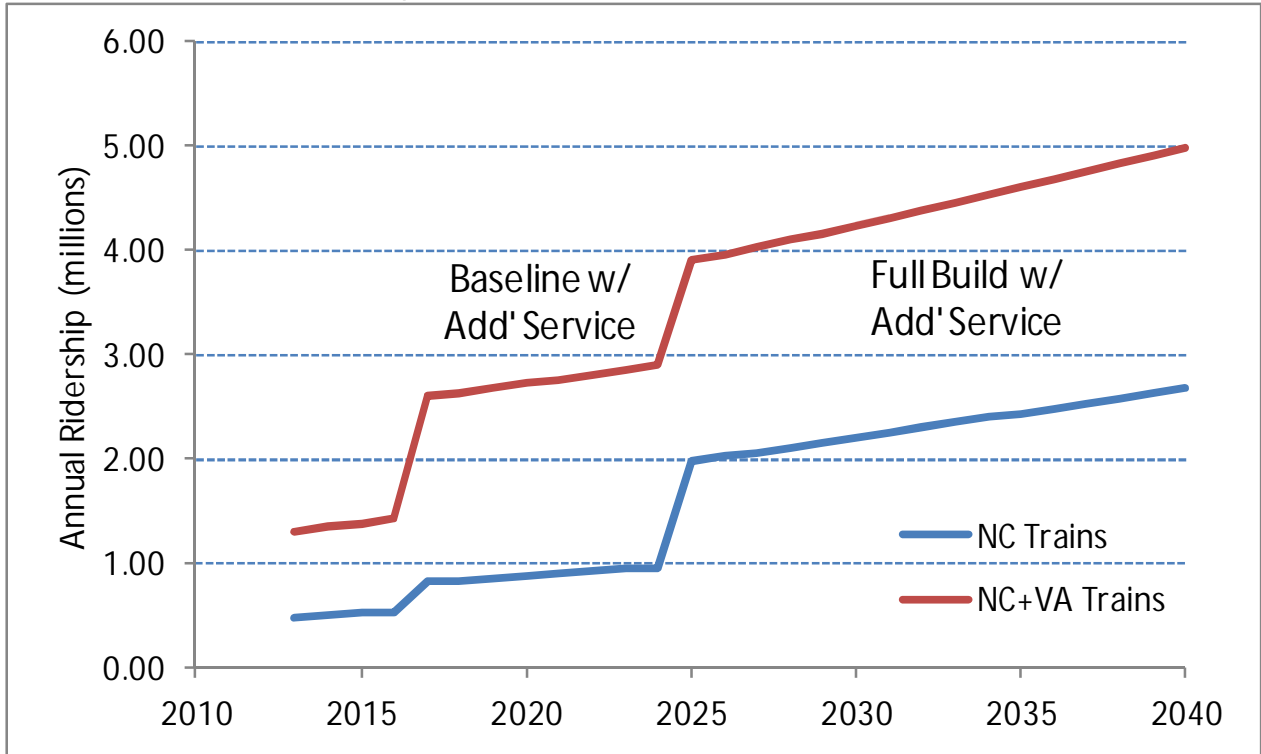
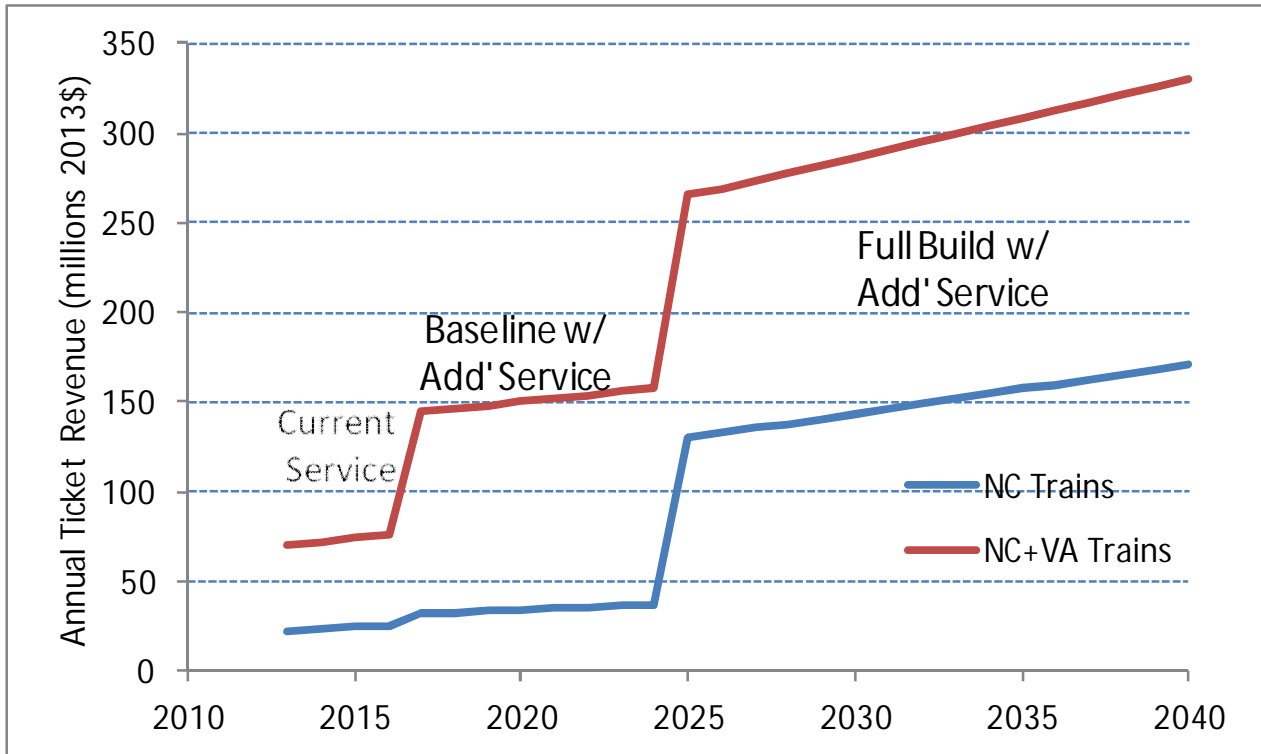


Exhibit 7.6 2013-2040 Ticket Revenue Forecasts with Additional Services



8. Appendix

Exhibit 8.1 Study Area Zones Description

| Zone | Description (County) |
|-------------|---|
| 1 | Worcester, MA |
| 2 | Middlesex, MA |
| 3 | Essex, MA |
| 4 | Norfolk, MA |
| 5 | Suffolk, MA |
| 6 | Bristol, MA |
| 7 | Plymouth, MA |
| 8 | Washington, RI |
| 9 | Bristol+Kent+Newport, RI |
| 10 | Providence, RI |
| 11 | Middlesex, CT |
| 12 | New Haven, CT |
| 13 | New London, CT |
| 14 | Fairfield, CT |
| 15 | Westchester, NY |
| 16 | Rockland, NY |
| 17 | Putnam, NY |
| 18 | Morris, NJ |
| 19 | Bergen, NJ |
| 20 | Passaic, NJ |
| 21 | Sussex, NJ |
| 22 | Warren, NJ |
| 23 | Essex, NJ |
| 24 | Hunterdon, NJ |
| 25 | Somerset, NJ |
| 26 | Union, NJ |
| 27 | Hudson, NJ |
| 28 | Bronx+Kings+New York+Richmond+Queens,NY |
| 29 | Nassau, NY |
| 30 | Suffolk, NY |
| 31 | Monmouth, NJ |
| 32 | Mercer, NJ |
| 33 | Middlesex, NJ |
| 34 | Bucks, PA |
| 35 | Ocean, NJ |
| 36 | Burlington, NJ |

| Zone | Description (County) |
|-------------|---------------------------------------|
| 37 | Philadelphia, PA |
| 38 | Montgomery, PA |
| 39 | Atlantic, NJ |
| 40 | Gloucester, NJ |
| 41 | Camden, NJ |
| 42 | Chester, PA |
| 43 | Delaware, PA |
| 44 | Salem, NJ |
| 45 | New Castle, DE |
| 46 | Cumberland, NJ |
| 47 | Cape May, NJ |
| 48 | Kent, DE |
| 49 | Sussex, DE |
| 50 | Cecil, MD |
| 51 | Kent, MD |
| 52 | Caroline, MD |
| 53 | Queen Annes, MD |
| 54 | Somerset, MD |
| 55 | Worcester, MD |
| 56 | Wicomico, MD |
| 57 | Dorchester, MD |
| 58 | Talbot, MD |
| 59 | Northampton, VA |
| 60 | Accomack, VA |
| 61 | Harford, MD |
| 62 | Baltimore, MD |
| 63 | Carroll, MD |
| 64 | Frederick, MD |
| 65 | Baltimore City, MD |
| 66 | Loudoun, VA |
| 67 | Howard, MD |
| 68 | Montgomery, MD |
| 69 | Washington, DC |
| 70 | Alexandria, VA |
| 71 | Arlington, VA |
| 72 | Fairfax+Fairfax City+Falls Church, VA |
| 73 | Prince Georges, MD |
| 76 | Anne Arundel, MD |
| 77 | Calvert, MD |
| 78 | St Marys, MD |

| Zone | Description (County) |
|-------------|--|
| 79 | Charles, MD |
| 80 | Prince William+Manassas Park+Manassas City, VA |
| 81 | Fauquier, VA |
| 82 | Warren, VA |
| 83 | Shenandoah, VA |
| 84 | Clarke, VA |
| 85 | Frederick+Winchester, VA |
| 86 | Culpeper, VA |
| 87 | Rappahannock, VA |
| 88 | Page, VA |
| 89 | Madison, VA |
| 90 | Pendleton, WV |
| 91 | Rockingham+Harrisonburg , VA |
| 92 | Stafford, VA |
| 93 | King George, VA |
| 94 | Westmoreland, VA |
| 95 | Spotsylvania+Fredericksburg, VA |
| 96 | Greene, VA |
| 97 | Orange, VA |
| 98 | Caroline, VA |
| 99 | Essex, VA |
| 100 | Richmond, VA |
| 101 | Northumberland, VA |
| 102 | King And Queen, VA |
| 103 | King William, VA |
| 104 | Lancaster, VA |
| 105 | Middlesex, VA |
| 106 | W.Hanover, VA |
| 107 | Central. Hanover, VA |
| 108 | W.Hanover, VA |
| 109 | Louisa, VA |
| 110 | Albemarle+Charlottesville, VA |
| 111 | W.Goochland, VA |
| 112 | Fluvanna, VA |
| 113 | Augusta+Staunton City+Waynesboro, VA |
| 114 | Highland, VA |
| 115 | Bath, VA |
| 116 | Rockbridge+Lexington City+Buena Vista, VA |
| 117 | Nelson, VA |
| 118 | Amherst, VA |

| Zone | Description (County) |
|-------------|--|
| 119 | Buckingham, VA |
| 120 | Cumberland, VA |
| 121 | Appomattox, VA |
| 122 | Prince Edward, VA |
| 123 | Nottoway, VA |
| 126 | Amelia, VA |
| 128 | S. Prince George, VA |
| 129 | Dinwiddie, VA |
| 130 | E.Goochland, VA |
| 131 | W. Powhatan, VA |
| 132 | E. Powhatan, VA |
| 133 | Richmond City+W.Henrico, +N.Chesterfield, VA |
| 134 | S.W. Henrico, VA |
| 135 | S.Chesterfield, VA |
| 144 | Hopewell City+Colonial Hghts Cty+Petersburg+N.Prince George+E.Chesterfield+N.Dinwiddie, VA |
| 149 | York+Newport News+Poquoson City+Hampton City+James City+Williamsburg, VA |
| 154 | Mathews, VA |
| 155 | Gloucester, VA |
| 156 | S.Charles City, VA |
| 157 | W.New Kent, VA |
| 158 | N.Charles City, VA |
| 159 | E.New Kent, VA |
| 160 | Gloucester, VA |
| 161 | N. James City VA |
| 163 | Surry, VA |
| 164 | Isle Of Wight, VA |
| 165 | Norfolk City+Portsmouth+N.E Chesapeake, VA |
| 166 | Virginia Beach, VA |
| 169 | Chesapeake, VA |
| 171 | N.Suffolk City, VA |
| 174 | Southampton+Franklin City, VA |
| 175 | Sussex, VA |
| 176 | Brunswick, VA |
| 177 | Greensville+Emporia City, VA |
| 178 | Lunenburg, VA |
| 179 | Mecklenburg, VA |
| 180 | Charlotte, VA |
| 181 | Halifax+South Boston, VA |

| Zone | Description (County) |
|-------------|--|
| 182 | Bedford+Bedford City, VA |
| 183 | Lynchburg City+Campbell, VA |
| 184 | Alleghany+Clifton Forge+Covington City, VA |
| 185 | Botetourt, VA |
| 186 | Craig, VA |
| 187 | Pittsylvania+Danville City, VA |
| 188 | Franklin, VA |
| 189 | Henry+Martinsville, VA |
| 190 | Roanoke+Roanoke City+Salem City, VA |
| 191 | Radford City+Montgomery, VA |
| 192 | Floyd, VA |
| 193 | Patrick, VA |
| 194 | Giles, VA |
| 195 | Pulaski, VA |
| 196 | Carroll+Galax City,VA |
| 197 | Bland, VA |
| 198 | Wythe, VA |
| 199 | Grayson, VA |
| 200 | Tazewell, VA |
| 201 | Russell, VA |
| 202 | Smyth, VA |
| 203 | Washington, VA |
| 204 | Buchanan, VA |
| 205 | Dickenson, VA |
| 206 | Wise+Norton City, VA |
| 207 | Lee, VA |
| 208 | Scott, VA |
| 209 | Ashe, NC |
| 210 | Alleghany, NC |
| 211 | Wilkes, NC |
| 212 | Watauga, NC |
| 213 | Avery, NC |
| 214 | Mitchell, NC |
| 215 | Caldwell, NC |
| 216 | Yancey, NC |
| 217 | Alexander, NC |
| 218 | Burke, NC |
| 219 | Mcdowell, NC |
| 220 | Catawba, NC |
| 221 | Madison, NC |

| Zone | Description (County) |
|-------------|-----------------------------|
| 222 | Buncombe, NC |
| 223 | Haywood, NC |
| 224 | Swain, NC |
| 225 | Jackson, NC |
| 226 | Henderson, NC |
| 227 | Graham, NC |
| 228 | Transylvania, NC |
| 229 | Macon, NC |
| 230 | Cherokee, NC |
| 231 | Clay, NC |
| 232 | Lincoln, NC |
| 233 | Gaston, NC |
| 234 | Rutherford, NC |
| 235 | Cleveland, NC |
| 236 | Polk, NC |
| 237 | Stokes, NC |
| 238 | Yadkin, NC |
| 239 | Forsyth, NC |
| 240 | Davie, NC |
| 241 | Davidson, NC |
| 242 | Rowan, NC |
| 243 | Surry, NC |
| 244 | Iredell, NC |
| 245 | S.Mecklenburg, NC |
| 247 | N.Mecklenburg, NC |
| 250 | Union, NC |
| 251 | Cabarrus, NC |
| 252 | Moore, NC |
| 253 | Montgomery, NC |
| 254 | Stanly, NC |
| 255 | Anson, NC |
| 256 | Richmond, NC |
| 257 | Guilford, NC |
| 258 | Randolph, NC |
| 259 | Rockingham, NC |
| 260 | Alamance, NC |
| 261 | Orange, NC |
| 262 | Durham, NC |
| 263 | Person, NC |
| 264 | Caswell, NC |

| Zone | Description (County) |
|-------------|-----------------------------|
| 265 | Chatham, NC |
| 266 | Lee, NC |
| 267 | Warren, NC |
| 268 | Vance, NC |
| 269 | Granville, NC |
| 270 | Franklin, NC |
| 271 | Central Wake, NC (Raleigh) |
| 272 | S.E Wake, NC |
| 273 | Johnston, NC |
| 274 | Harnett, NC |
| 275 | Cumberland, NC |
| 276 | Hoke, NC |
| 277 | Scotland, NC |
| 278 | Halifax, NC |
| 279 | Nash, NC |
| 280 | Edgecombe, NC |
| 281 | Wilson, NC |
| 282 | Northampton, NC |
| 283 | Hertford, NC |
| 284 | Bertie, NC |
| 285 | Pitt, NC |
| 286 | Beaufort, NC |
| 287 | Greene, NC |
| 288 | Wayne, NC |
| 289 | Lenoir, NC |
| 290 | Craven, NC |
| 291 | Sampson, NC |
| 292 | Jones, NC |
| 293 | Duplin, NC |
| 294 | Onslow, NC |
| 295 | Robeson, NC |
| 296 | Bladen, NC |
| 297 | Pender, NC |
| 298 | Columbus, NC |
| 299 | New Hanover, NC |
| 300 | Brunswick, NC |
| 301 | Gates, NC |
| 302 | Camden, NC |
| 303 | Currituck, NC |
| 304 | Pasquotank, NC |

| Zone | Description (County) |
|-------------|-----------------------------------|
| 305 | Perquimans, NC |
| 306 | Chowan, NC |
| 307 | Dare, NC |
| 308 | Martin, NC |
| 309 | Tyrrell, NC |
| 310 | Washington, NC |
| 311 | Pamlico, NC |
| 312 | Hyde, NC |
| 313 | Carteret, NC |
| 314 | Oconee, SC |
| 315 | Spartanburg, SC |
| 316 | Laurens, SC |
| 317 | Anderson, SC |
| 318 | Pickens, SC |
| 319 | Greenville, SC |
| 320 | Union, SC |
| 321 | Newberry, SC |
| 322 | Edgefield, SC |
| 323 | Abbeville+Greenwood+McCormick, SC |
| 324 | Cherokee, SC |
| 325 | Saluda, SC |
| 326 | Richland, SC |
| 327 | Lexington, SC |
| 328 | Calhoun, SC |
| 329 | Orangeburg, SC |
| 330 | Barnwell, SC |
| 331 | Aiken, SC |
| 332 | Bamberg, SC |
| 333 | Kershaw, SC |
| 334 | Lancaster, SC |
| 335 | York, SC |
| 336 | Chester, SC |
| 337 | Fairfield, SC |
| 338 | Dillon, SC |
| 339 | Marlboro, SC |
| 340 | Chesterfield, SC |
| 341 | Darlington, SC |
| 342 | Florence, SC |
| 343 | Clarendon, SC |
| 344 | Sumter, SC |

| Zone | Description (County) |
|-------------|--|
| 345 | Lee, SC |
| 346 | Horry, SC |
| 347 | Marion, SC |
| 348 | Williamsburg, SC |
| 349 | Georgetown, SC |
| 350 | Berkeley+Charleston, SC |
| 351 | Dorchester, SC |
| 352 | Colleton, SC |
| 353 | Hampton, SC |
| 354 | Beaufort, SC |
| 355 | Jasper, SC |
| 356 | Allendale, SC |
| 357 | Whitfield+Catoosa+Walker+Dade, GA |
| 358 | Murray+Gordon, GA |
| 359 | Rabun+Townsend+Fannin+Union+Gilmer, GA |
| 360 | Greene, GA |
| 361 | Morgan, GA |
| 362 | Fulton+De Kalb, GA |
| 363 | Cobb, GA |
| 364 | Gwinnett, GA |
| 365 | Douglas, GA |
| 366 | Haralson+Carroll, GA |
| 367 | Chattooga+Floyd+Polk, GA |
| 368 | Bartow, GA |
| 369 | Cherokee, GA |
| 370 | Lumpkin+Dawson, GA |
| 371 | Habersham+White, GA |
| 372 | Oconee, GA |
| 373 | Walton, GA |
| 374 | Rockdale+Newton, GA |
| 375 | Henry, GA |
| 376 | Clayton+Fayette, GA |
| 377 | Jackson+Barrow, GA |
| 378 | Hall, GA |
| 379 | Forsyth, GA |
| 380 | Paulding, GA |
| 381 | Banks, GA |
| 382 | Stephens, GA |
| 383 | Franklin, GA |
| 384 | Madison, GA |

| Zone | Description (County) |
|-------------|---|
| 385 | Clarke, GA |
| 386 | Oglethorpe, GA |
| 387 | Hart, GA |
| 388 | Elbert, GA |
| 389 | Wilkes+Lincoln, GA |
| 390 | Butts+Spalding+Pike+Lamar+Monroe+Upson, GA |
| 391 | Coweta+Heard+Meriwether+Troup+Harris, GA |
| 392 | Twiggs+Laurens+Bleckley+Dodge+Wheeler+Telfair, GA |
| 393 | Glascocock+Jefferson+Washington+Johnson, GA |
| 394 | Wilkinson, GA |
| 395 | Jasper+Putnam+Baldwin+Jones, GA |
| 396 | Hancock, GA |
| 397 | Taliaferro+Warren, GA |
| 398 | Bibb, GA |
| 399 | Richmond, GA |
| 400 | Columbia, GA |
| 401 | Mcduffie, GA |
| 402 | Crawford+Peach+Houston+Pulaski+Dooly+Wilcox+Crisp, GA |
| 403 | Talbot+Marion+Taylor+Schley, GA |
| 404 | Muscogee+Chattahoochee, GA |
| 405 | Toombs+Montgomery+Tattnall+Evans, GA |
| 406 | Wayne, GA |
| 407 | Jeff Davis+Appling+Coffee+Bacon+Pierce+Ware+Atkinson, GA |
| 408 | Turner+Ben Hill+Worth+Irwin+Tift+Berrien+Cook+Colquitt,GA |
| 409 | Charlton, GA |
| 410 | Miller+Early+Baker+Mitchell+Decatur+Grady+Thomas+Seminole, GA |
| 411 | Lee+Dougherty, GA |
| 412 | Webster+Stewart+Sumter+Quitman+Terrell+Randolph+Clay+Calhoun,GA |
| 413 | Clinch+Lanier+Lowndes+Echols+Brooks, GA |
| 414 | Brantley, GA |
| 415 | Burke, GA |
| 416 | Screven, GA |
| 417 | Emanuel+Bulloch+Candler+Treutlen, GA |
| 418 | Jenkins, GA |
| 419 | Chatham, GA |
| 420 | Effingham, GA |
| 421 | Bryan, GA |
| 422 | Liberty, GA |
| 423 | Mcintosh, GA |
| 424 | Long, GA |

| Zone | Description (County) |
|-------------|-----------------------------|
| 425 | Glynn, GA |
| 426 | Camden, GA |
| 427 | S.W Wake, NC |
| 428 | N. Wake, NC |

Exhibit 8.2 Airport Codes and Names

| Code | Name |
|-------------|---------------------|
| ACY | Atlantic City, NJ |
| ATL | Atlanta, GA |
| BOS | Boston, MA |
| BWI | Baltimore, MD |
| CHO | Charlottesville, VA |
| CHS | Charleston, SC |
| CLT | Charlotte , NC |
| DCA | Arlington, VA |
| EWR | Newark, NJ |
| GSO | Greensboro, NC |
| HFD | Hartford, CT |
| HVN | New Haven, CT |
| IAD | Dulles, VA |
| ILG | Wilmington, DE |
| ILM | Wilmington, NC |
| JFK | New York-JFK, NY |
| LGA | New York-LGA, NY |
| LNS | Lancaster, PA |
| LYH | Lynchburg, VA |
| MCN | Macon, GA |
| PGV | Greenville, NC |
| PHL | Philadelphia, PA |
| PVD | Providence, RI |
| RDU | Raleigh/Durham, NC |
| RIC | Richmond, VA |
| SAV | Savannah, GA |
| SPA | Spartanburg, SC |

Exhibit 8.3 Rail Station Codes and Names

| Code | Station | Code | Station |
|------|-----------------------------|------|---------------------------|
| ALX | ALEXANDRIA, VA | MRN | MARION, NC |
| ASH | ASHEVILLE, NC | MET | METROPARK, NJ |
| ASD | ASHLAND, VA | MRH | MOREHEAD CITY, NC |
| ATL | ATLANTA, GA | MGN | MORGANTON, NC |
| BAL | BALTIMORE, MD | MYS | MYSTIC, CT |
| BWI | BALT-WASH INTL. AIRPORT, MD | NBN | NEW BERN, NC |
| BMT | BLACK MOUNTAIN, NC | NCR | NEW CARROLLTON, MD |
| BBY | BOSTON - BACK BAY, MA | NHV | NEW HAVEN, CT |
| BOS | BOSTON (SO. STA), MA | NLC | NEW LONDON, CT |
| BRP | BRIDGEPORT, CT | NRO | NEW ROCHELLE, NY |
| BRG | BURGAW, NC | NYP | NEW YORK (PENN STA), NY |
| BCV | BURKE CENTER, VA | EWR | NEWARK AIRPORT, NJ |
| BNC | BURLINGTON, NC | NWK | NEWARK, NJ |
| CAM | CAMDEN, SC | NPN | NEWPORT NEWS, VA |
| CYN | CARY, NC | NPD | NEWPORT NEWS-DT, VA |
| CHS | CHARLESTON, SC | NFK | NORFOLK, VA |
| CLT | CHARLOTTE, NC | OFT | OLD FORT, NC |
| CVS | CHARLOTTSVILLE, VA | OSB | OLD SAYBROOK, CT |
| CSN | CLEMSON, SC | PMB | PEMBROKE, NC |
| CLB | COLUMBIA, SC | PTB | PETERSBURG, VA |
| CNV | CONOVER, NC | PHL | PHILADELPHIA 30TH ST, PA |
| CLP | CULPEPER, VA | PVD | PROVIDENCE, RI |
| DAN | DANVILLE, VA | QAN | QUANTICO, VA |
| DNK | DENMARK, SC | RGH | RALEIGH, NC |
| DIL | DILLON, SC | RVM | RICHMOND-MAIN ST, VA |
| DNC | DURHAM, NC | RVR | RICHMOND-STAPLES MILL, VA |
| FAY | FAYETTEVILLE, NC | RNK | ROANOKE, VA |
| FLO | FLORENCE, SC | RMT | ROCKY MOUNT, NC |
| FBG | FREDERICKSBURG, VA | RTE | ROUTE 128 (BOSTON), MA |
| GNS | GAINESVILLE, GA | SAL | SALISBURY, NC |
| GAS | GASTONIA, NC | SAV | SAVANNAH, GA |
| GBO | GOLDSBORO, NC | SSM | SELMA/SMITHFIELD, NC |
| GRO | GREENSBORO, NC | SOP | SOUTHERN PINES, NC |
| GNV | GREENVILLE, NC | SPB | SPARTANBURG, SC |
| GRV | GREENVILLE, SC | STM | STAMFORD, CT |
| HAM | HAMLET, NC | SVN | STATESVILLE, NC |
| HLK | HAVELOCK, NC | SUF | SUFFOLK, VA |
| HNC | HENDERSON, NC | TCA | TOCCOA, GA |

| Code | Station | Code | Station |
|-------------|------------------|-------------|------------------|
| HIC | HICKORY, NC | TRE | TRENTON, NJ |
| HPT | HIGH POINT, NC | VLD | VALDESE, NC |
| HLB | HILLSBOROUGH, NC | WLC | WALLACE, NC |
| JKV | JACKSONVILLE, NC | WAR | WARSAW, NC |
| JSP | JESUP, GA | WAS | WASHINGTON, DC |
| KAN | KANNAPOLIS, NC | WLY | WESTERLY, RI |
| KIN | KINGSTON, RI | WBG | WILLIAMSBURG, VA |
| KTR | KINGSTREE, SC | WIL | WILMINGTON, DE |
| KNS | KINSTON, NC | WMN | WILMINGTON, NC |
| LCS | LA CROSSE, VA | WLN | WILSON, NC |
| LYH | LYNCHBURG, VA | WDB | WOODBRIIDGE, VA |
| MSS | MANASSAS, VA | YEM | YEMASSEE, SC |

Exhibit 8.4 Auto Survey Program

Southeast High Speed Rail Highway Survey

General Information

Survey Location: Surveyor Initials: 7/5/2012 2:29:18 PM

Hello, we are conducting a survey of travelers in the **I-85** corridor for the North Carolina Department of Transportation and Virginia Department of Rail and Public Transportation. I would like to ask you some questions about your **Northbound** trip on **I-85** today.

| | |
|---|--|
| <p>Not Completing survey because:</p> <p>Does not speak English <input type="checkbox"/> Other Refusal <input type="checkbox"/></p> | <p>Including yourself how many people are traveling with you today?</p> <p>Adults <input type="text" value="3"/> Children <input type="text" value="1"/></p> |
|---|--|

Southeast High Speed Rail Highway Survey

OD Information

Where are you coming from?

Corridor Direction


| | |
|---|---|
| <p>What type of place is your origin?</p> <p><input type="text" value="My Home"/></p> | <p>What type of place is your destination?</p> <p><input type="text" value="Another Person's Home"/></p> |
| <p>Where is this place (Origin) located?</p> <p>State: <input type="text" value="NC"/></p> <p>Origin Name: <input type="text" value="Charlotte, NC"/></p> <p>Origin Zip: <input type="text"/></p> | <p>Where is this place (Destination) located?</p> <p>State: <input type="text" value="VA"/></p> <p>Destination Name: <input type="text" value="Richmond, VA"/></p> <p>Destination Zip: <input type="text"/></p> |

↓

- My Home
- My Workplace
- Another Person's Home
- Another Person's Workplace
- My Hotel
- Recreation Attraction (theme park, etc.)
- Airport (departing/arriving air passenger)
- Other

Southeast High Speed Rail Highway Survey

Two nights

Southeast High Speed Rail Highway Survey 

Question 1

A New Train service has been proposed for the Southeast serving

CHARLOTTE, NC Station → **RICHMOND, VA-MAIN ST Station**

and other stops. Now suppose that could continue to travel by car/van/truck at the same cost and time **5:30** it takes you today or, by using this New Train, you could travel from

Charlotte, NC → **Richmond, VA**


in **5:00**

at a cost of **\$ 55** including access to/from the stations

with departures provided **3 times/day**

1 Definitely use New Train
 2 **Probably use New Train**
 3 May or may not use New Train
 4 Probably not use New Train
 5 Definitely not use New Train

Back Next

Southeast High Speed Rail Highway Survey 

Question 2

A New Train service has been proposed for the Southeast serving

CHARLOTTE, NC Station → **RICHMOND, VA-MAIN ST Station**

and other stops. Now suppose that could continue to travel by car/van/truck at the same cost and time **5:30** it takes you today or, by using this New Train, you could travel from

Charlotte, NC → **Richmond, VA**


in **5:00**

at a cost of **\$ 55** including access to/from the stations

with more departures provided **4 times/day**

1 Definitely use New Train
 2 **Probably use New Train**
 3 May or may not use New Train
 4 Probably not use New Train
 5 Definitely not use New Train

Back Next

Southeast High Speed Rail Highway Survey 

Question 3

A New Train service has been proposed for the Southeast serving

CHARLOTTE, NC Station → **RICHMOND, VA-MAIN ST Station**

and other stops. Now suppose that could continue to travel by car/van/truck at the same cost and time **5:30** it takes you today or, by using this New Train, you could travel from

Charlotte, NC → **Richmond, VA**


in a longer time of **8:10**

at a cost of **\$ 55** including access to/from the stations

with departures provided **4 times/day**

1 Definitely use New Train
 2 Probably use New Train
 3 May or may not use New Train
 4 Probably not use New Train
 5 **Definitely not use New Train**

Back Next

Southeast High Speed Rail Highway Survey 

Question 4

A New Train service has been proposed for the Southeast serving

CHARLOTTE, NC Station → **RICHMOND, VA-MAIN ST Station**

and other stops. Now suppose that you could continue to travel by car/van/truck at the same cost and time **5:30** it takes you today or, by using this New Train, you could travel from

Charlotte, NC → **Richmond, VA**


in **8:10**

at a cost of **\$ 55** including access to/from the stations

with less departures provided **2 times/day**

1 Definitely use New Train
 2 Probably use New Train
 3 May or may not use New Train
 4 Probably not use New Train
 5 Definitely not use New Train

Back Next

Southeast High Speed Rail Highway Survey 

Question 5

A New Train service has been proposed for the Southeast serving

CHARLOTTE, NC Station → **RICHMOND, VA-MAIN ST Station**

and other stops. Now suppose that you could continue to travel by car/van/truck at the same cost but it would now take **6:35** or, by using this New Train, you could travel from

Charlotte, NC → **Richmond, VA**


in **8:10**

at a cost of **\$ 55** including access to/from the stations

with departures provided **2 times/day**

1 Definitely use New Train
 2 Probably use New Train
 3 May or may not use New Train
 4 Probably not use New Train
 5 Definitely not use New Train

Back Next

Southeast High Speed Rail Highway Survey 

Question 6

A New Train service has been proposed for the Southeast serving

CHARLOTTE, NC Station → **RICHMOND, VA-MAIN ST Station**

and other stops. Now suppose that you could continue to travel by car/van/truck at the same cost but it would now take **6:35** or, by using this New Train, you could travel from

Charlotte, NC → **Richmond, VA**


in **8:10**

at a cost of **\$ 55** including access to/from the stations

with more departures provided **4 times/day**

1 Definitely use New Train
 2 Probably use New Train
 3 May or may not use New Train
 4 Probably not use New Train
 5 Definitely not use New Train

Back Next

Southeast High Speed Rail Highway Survey 

Personal Information

Into which of the following categories does your age fall?


- 18-24
- 25-34
- 35-44**
- 45-54
- 55-64
- 65 or older

What is your current employment status? Are you

- Employed full-time**
- employed half-time
- A student
- Retired
- A homemaker
- Not currently employed

I have one final question. Would you be willing to pay an increased tax to support faster speed trains than the ones we have today?

Yes
 No

Southeast High Speed Rail Highway Survey 

OD Information

Where are you coming from?

Corridor: Direction:

What type of place is your origin?

-
-
-
-
-
-
-
-
-

What type of place is your destination?

Where is this place (Destination) located?

State:

Destination Name:

Destination Zip:

Exhibit 8.5 Airport Survey Program

Southeast High Speed Rail - Airport Survey

General Information

Flight Number: AA4578 Surveyor Initials: AS 7/23/2012 2:39:55 PM

Hello, we are conducting a survey of travelers on **AA4578** today for the North Carolina Department of Transportation and Virginia Department of Rail and Public Transportation. I would like to ask you some questions about your trip today.

Not Completing survey because: Does not speak English Other Refusal

Including yourself how many people are traveling with you today? Adults: 1 Children: 0

Are you connecting from another flight or will be connecting to another flight? NO

Charlotte, NC → **New York, NY**

What is the total one-way fare for you on this flight today? \$150.00

Next

Southeast High Speed Rail - Airport Survey

Origin Information

Now, I'd like to ask you about your ground trip to the **CLT** and your ground trip from **LGA** to your final destination.

What type of place is your origin? My Home

Where is this place (Origin) located? State: NC Zip: Origin Name: Charlotte, NC

What was the primary mode of travel that you used to get to station today? Taxi

Approximately how long did it take to get from **Charlotte, NC** **CLT** Hours: Minutes: 25

What type of place is your final destination? Another Person's Home

Where is this place (Destination) located? State: NY Zip: Destination Name: New York, NY

What is the primary mode of travel that you will use to get to your final destination? Taxi

Approximately how long do you estimate it'll take to get from **LGA** **New York, NY** Hours: Minutes: 35

Back Next

Private Car - Parked at the airport
Private Car - Dropped off at the airport
Rental car
Hotel Bus/Van/Shuttle
Taxi
Local Bus or Rail Transit
Other including walk

Private Car - Parked at the airport
Private Car - Picked up at the airport
Rental car
Hotel Bus/Van/Shuttle
Taxi
Local Bus or Rail Transit
Other including walk

Southeast High Speed Rail - Airport Survey

Trip Information

Charlotte, NC → New York, NY

What is the main purpose of your trip?

Regular Commute to/from Work
 Work Related Business Travel
 Vacation/Recreation
 Other (Visit Friends, Family, Personal Business, School, Shopping)

If air service were not available for your trip today, what would you have done?

Traveled by car instead

Are you making a round trip? Yes

About how many nights will be spend away from home on your round trip? Two nights

Where is your home located?

State: NC
 Home Location: Charlotte, NC
 Home Zip:
 Where is your home?
 Charlotte, NC

Back
Next

Southeast High Speed Rail - Airport Survey

Question 1

A New Train service has been proposed for the Southeast serving

CHARLOTTE, NC Station → NEW YORK, NY Station

and other stops. Now suppose that could continue to travel by plane that takes the same time and cost **\$150** it takes you today or, by using this New Train, you could travel from

Charlotte, NC → New York, NY

in **12:40**


at a cost of **\$144** including access to/from the stations

with departures provided **4 times/day**

Back

1 Definitely use New Train
 2 Probably use New Train
 3 May or may not use New Train
4 Probably not use New Train
 5 Definitely not use New Train

Next

Southeast High Speed Rail - Airport Survey 

Question 2

A New Train service has been proposed for the Southeast serving

CHARLOTTE, NC Station → **NEW YORK, NY Station**

and other stops. Now suppose that could continue to travel by plane that takes the same time and cost **\$150** it takes you today or, by using this New Train, you could travel from


Charlotte, NC → **New York, NY**

in a shorter time of **9:00**

at a cost of **\$144** including access to/from the stations

with departures provided **3 times/day**

1 Definitely use New Train
2 Probably use New Train
3 May or may not use New Train
4 **Probably not use New Train**
5 Definitely not use New Train

Southeast High Speed Rail - Airport Survey 

Question 3

A New Train service has been proposed for the Southeast serving

CHARLOTTE, NC Station → **NEW YORK, NY Station**

and other stops. Now suppose that could continue to travel by plane that takes the same time and cost **\$150** it takes you today or, by using this New Train, you could travel from

Charlotte, NC → **New York, NY**

in **9:00**

at a lower cost of **\$71** including access to/from the stations

with departures provided **3 times/day**

1 Definitely use New Train
2 Probably use New Train
3 **May or may not use New Train**
4 Probably not use New Train
5 Definitely not use New Train

Southeast High Speed Rail - Airport Survey

Question 4

A New Train service has been proposed for the Southeast serving

CHARLOTTE, NC Station → NEW YORK, NY Station

and other stops. Now suppose that could continue to travel by plane that takes the same time and cost **\$150** it takes you today or, by using this New Train, you could travel from

Charlotte, NC → New York, NY

in a longer time of **16:10**

at a cost of **\$ 71** including access to/from the stations

with departures provided **3 times/day**

1 Definitely use New Train

2 Probably use New Train

3 May or may not use New Train

4 Probably not use New Train

5 Definitely not use New Train

Southeast High Speed Rail - Airport Survey

Question 5

A New Train service has been proposed for the Southeast serving

CHARLOTTE, NC Station → NEW YORK, NY Station

and other stops. Now suppose that could continue to travel by plane that takes the same time but cost **\$180** or, by using this New Train, you could travel from

Charlotte, NC → New York, NY

in **16:10**

at a cost of **\$ 71** including access to/from the stations

with departures provided **3 times/day**


1 Definitely use New Train

2 Probably use New Train

3 May or may not use New Train

4 Probably not use New Train

5 Definitely not use New Train

Southeast High Speed Rail - Airport Survey 

Question 6

A New Train service has been proposed for the Southeast serving

CHARLOTTE, NC Station → **NEW YORK, NY Station**

and other stops. Now suppose that could continue to travel by plane that takes the same time but cost **\$180** or, by using this New Train, you could travel from

Charlotte, NC → **New York, NY**


in a shorter time of **9:00**

at a cost of **\$ 71** including access to/from the stations

with departures provided **3 times/day**

- 1 Definitely use New Train
- 2 Probably use New Train**
- 3 May or may not use New Train
- 4 Probably not use New Train
- 5 Definitely not use New Train

Back
Next

Southeast High Speed Rail - Airport Survey 

Personal Information

Into which of the following categories does your age fall?

- 18-24
- 25-34
- 35-44**
- 45-54
- 55-64
- 65 or older

What is your current employment status? Are you



- Employed full-time**
- employed half-time
- A student
- Retired
- A homemaker
- Not currently employed

I have one final question. Would you be willing to pay an increased tax to support faster speed trains than the ones we have today?

Yes
No

Back
Backup Survey
Save Survey

Exhibit 8.6 Rail Survey Program

Southeast High Speed Rail - Rail Survey

General Information

Train Name/Number: Surveyor Initials:


Hello, we are conducting a survey of travelers on **Carolinian_79** today for the North Carolina Department of Transportation and Virginia Department of Rail and Public Transportation. I would like to ask you some questions about your train trip today.

| | |
|---|--|
| <p>Not Completing survey because:</p> <p>Does not speak English <input type="checkbox"/> Other Refusal <input type="checkbox"/></p> | <p>Including yourself how many people are traveling with you today?</p> <p>Adults <input type="text" value="1"/> Children <input type="text" value="0"/></p> |
| <p>Where did you board this train?</p> <p><input type="text" value="PHILADELPHIA, PA Station"/></p> | <p>Where will you get off this train?</p> <p><input type="text" value="ROCKY MOUNT, NC Station"/></p> |

PHILADELPHIA, PA Station
→
ROCKY MOUNT, NC Station

What is the total one-way fare for you on the train today? \$

Southeast High Speed Rail - Rail Survey



OD Information

Now, I'd like to ask you about your ground trip to the **PHILADELPHIA, PA Station** and your ground trip from **ROCKY MOUNT, NC Station** to your final destination.

| | |
|---|---|
| <p>What type of place is your origin?</p> <p>My Workplace</p> <p>Where is this place (Origin) located?</p> <p>State: PA</p> <p>Origin Name: Philadelphia, PA</p> <p>Origin Zip:</p> <p>What was the primary mode of travel that you used to get to station today?</p> <p>Taxi</p> <p>Approximately how long did it take to get from Philadelphia, PA to PHILADELPHIA, PA Station</p> <p>Hours: Minutes: 20</p> | <p>What type of place is your final destination?</p> <p>Another Person's Workplace</p> <p>Where is this place (Destination) located?</p> <p>State: NC</p> <p>Destination Name: Rocky Mount, NC</p> <p>Destination Zip:</p> <p>What is the primary mode of travel that you will use to get to your final destination?</p> <p>Taxi</p> <p>Approximately how long do you estimate it'll take to get from ROCKY MOUNT, NC Station to Rocky Mount, NC</p> <p>Hours: Minutes: 45</p> |
|---|---|


Back

- My Home
- My Workplace**
- Another Person's Home
- Another Person's Workplace
- My Hotel
- Recreation Attraction (theme park, etc.)
- Airport (departing/arriving air passenger)
- Other

- Private Car - Picked up at the station
- Private Car - dropped off at station
- Rental car
- Hotel Bus/Van/Shuttle
- Taxi**
- Local Bus or Rail Transit
- Other including walk

Next

Southeast High Speed Rail - Rail Survey



Trip Information

Philadelphia, PA → Rocky Mount, NC

| | |
|---|---|
| <p>What is the main purpose of your trip?</p> <p>Regular Commute to/from Work</p> <p>Work Related Business Travel</p> <p>Vacation/Recreation</p> <p>Other (Visit Friends, Family, Personal Business, School, Shopping)</p> <p>Are you making a round trip? Yes</p> <p>About how many nights will be spend away from home on your round trip? One night</p> | <p>If train service were not available for your trip today, what would you have done?</p> <p>Traveled by car instead</p> <p>Traveled by car instead</p> <p>Where is your home located?</p> <p>State: PA</p> <p>Home Location: Chester, PA</p> <p>Home Zip:</p> <p>Where is your home?</p> <p>Chester, PA</p> |
|---|---|

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Southeast High Speed Rail - Rail Survey

Question 1

A New Train service has been proposed for the Southeast serving

PHILADELPHIA, PA Station
➔
ROCKY MOUNT, NC Station

and other stops. Now suppose that could continue to travel by car/van/truck at the same cost and time 7:20 it takes you today or, by using this New Train, you could travel from

Philadelphia, PA
➔
Rocky Mount, NC

in 7:00

at a cost of \$ 42 including access to/from the stations

with departures provided 4 times/day

- 1 Definitely use New Train
- 2 Probably use New Train
- 3 May or may not use New Train
- 4 Probably not use New Train
- 5 Definitely not use New Train

Southeast High Speed Rail - Rail Survey

Question 1

A New Train service has been proposed for the Southeast serving

PHILADELPHIA, PA Station
➔
ROCKY MOUNT, NC Station

and other stops. Now suppose that could continue to travel by car/van/truck at the same cost and time 7:20 it takes you today or, by using this New Train, you could travel from

Philadelphia, PA
➔
Rocky Mount, NC

in 7:00

at a cost of \$ 42 including access to/from the stations

with departures provided 4 times/day

- 1 Definitely use New Train
- 2 Probably use New Train
- 3 May or may not use New Train
- 4 Probably not use New Train
- 5 Definitely not use New Train

Southeast High Speed Rail - Rail Survey

Question 1

A New Train service has been proposed for the Southeast serving

PHILADELPHIA, PA Station → ROCKY MOUNT, NC Station

and other stops. Now suppose that could continue to travel by car/van/truck at the same cost and time **7:20** it takes you today or, by using this New Train, you could travel from

Philadelphia, PA → Rocky Mount, NC

_____ in **7:00**

_____ at a cost of **\$ 42** including access to/from the stations

_____ with departures provided **4 times/day**

1 Definitely use New Train

2 Probably use New Train

3 May or may not use New Train

4 Probably not use New Train

5 Definitely not use New Train

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Southeast High Speed Rail - Rail Survey

Question 4

A New Train service has been proposed for the Southeast serving

PHILADELPHIA, PA Station → ROCKY MOUNT, NC Station

and other stops. Now suppose that could continue to travel by car/van/truck at the same cost and time **7:20** it takes you today or, by using this New Train, you could travel from

Philadelphia, PA → Rocky Mount, NC

_____ in **8:50**

_____ at a cost of **\$ 94** including access to/from the stations

_____ with less departures provided **3 times/day**

1 Definitely use New Train


2 Probably use New Train

3 May or may not use New Train

4 Probably not use New Train

5 Definitely not use New Train

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Southeast High Speed Rail - Rail Survey 

Question 5

A New Train service has been proposed for the Southeast serving

PHILADELPHIA, PA Station → **ROCKY MOUNT, NC Station**

and other stops. Now suppose that you could continue to travel by car/van/truck at the same cost but it would now take **8:50** or , by using this New Train, you could travel from


Philadelphia, PA → **Rocky Mount, NC**

in **8:50**

at a cost of **\$ 94** including access to/from the stations

with departures provided **3 times/day**

1 Definitely use New Train
2 Probably use New Train
3 May or may not use New Train
4 Probably not use New Train
5 Definitely not use New Train

Southeast High Speed Rail - Rail Survey 

Question 6

A New Train service has been proposed for the Southeast serving

PHILADELPHIA, PA Station → **ROCKY MOUNT, NC Station**

and other stops. Now suppose that you could continue to travel by car/van/truck at the same cost but it would now take **8:50** or , by using this New Train, you could travel from



Philadelphia, PA → **Rocky Mount, NC**

in **8:50**

at a cost of **\$ 94** including access to/from the stations

with departures provided **3 times/day**

1 Definitely use New Train
2 Probably use New Train
3 May or may not use New Train
4 Probably not use New Train
5 Definitely not use New Train

 Southeast High Speed Rail - Rail Survey 

Personal Information

Into which of the following categories does your age fall?

- 18-24
- 25-34
- 35-44**
- 45-54
- 55-64
- 65 or older

What is your current employment status? Are you

- Employed full-time**
- employed half-time
- A student
- Retired
- A homemaker
- Not currently employed

I have one final question. Would you be willing to pay an increased tax to support faster speed trains than the ones we have today?

- Yes**
- No

SEHSR Passenger Services (full build SEHSR trains only)

| | | | | 19 | 29 | |
|---|--|---------------|-----------------------------|-----------------------------------|--------------|-------------|
| | | | | 2030 | 2040 | |
| Full Build | | | | | | |
| RESULTS OF OPERATIONS | | | | | | |
| Key Metrics | | | | | | |
| Inflated | YOY NON DEF. COMPOSITE GDP INFLATOR | | | 2.4% | 2.4% | |
| Frequency | AVG. DAILY ROUND TRIPS - ALL SERVICES | | | 9 | 9 | |
| Ridership | | | | | | |
| | Carolinian | | | 480,000 | 579,200 | |
| | Piedmont | | | 379,800 | 483,000 | |
| ON | SEHSR | | | 1,215,700 | 1,464,700 | |
| OFF | Regional | | | 0 | 0 | |
| | | | | 2,075,500 | 2,526,900 | |
| TOTAL REVENUES incl. Food & Beverage (in millions) | | | | 206.6 | 313.1 | |
| OPERATION & MAINTENANCE EXPENSE (in millions) | | | | | | |
| | | Factor | Driver | | | |
| Direct & Allocated AMTRAK Expenses: | | | | | | |
| | Train & Engine Labor | \$ 1,765.00 | Train Starts (Adjusted) | 19.1 | 24.2 | |
| | Fuel (Carolinian) | \$ 3.50 | Train Mile & Fuel Matrix | 3.5 | 4.4 | |
| | Onboard Service Labor (ex F&B supplies) | \$ 585.00 | Train Starts | 6.8 | 8.5 | |
| | F&B Supplies | \$ 0.73 | Carolinian + SEHSR Riders | 2.7 | 4.1 | |
| | Advert. Reservations, Sales & Commissions | \$ 4.50 | Riders | 13.9 | 21.4 | |
| | Amtrak Stations Expense | \$ 8.04 | Riders | 13.3 | 20.5 | |
| | Yard Expense - MOE turns + yard ops. | \$ 1,068.00 | Train Starts | 3.4 | 4.3 | |
| | Regional Security & Police Allocation | \$ 131.50 | Train Starts | 0.8 | 1.0 | |
| | Insurances | \$ 0.78 | Carolinian + SEHSR Riders | 2.8 | 4.3 | |
| | Amtrak Alloc. Equipment Maintenance | \$ 4,114.00 | Carolinian Train Starts | 2.7 | 3.4 | |
| | NEC Access Charge | \$ 0.25 | Carolinian+ SEHSR Psgr. Mi. | 40.8 | 59.9 | |
| | Foreign RR On Time Incentives | \$ 2.00 | Train Miles | 4.7 | 5.9 | |
| Total Amtrak "Route Costs" | | | | 114.3 | 161.9 | |
| North Carolina Expenses: | | | | | | |
| | NCDOT Ticketing machines | 300,000 | Flat est. | 0.9 | 1.1 | |
| | NCDOT Stations Exp. | 650,000 | Flat est. | 2.7 | 3.0 | |
| | Fuel Piedmont | \$ 3.50 | Train Mile & Fuel Matrix | 4.7 | 6.0 | |
| ON | Fuel SEHSR | \$ 3.50 | Train Mile & Fuel Matrix | 14.5 | 18.4 | |
| ON | Richmond - Washington Track Fees | \$ 3.00 | Per Train Mile 118 Miles | 1.8 | 2.2 | |
| | Allocated. NSRR/NCRR Track Maintenance Expense | | Per contract | 2.2 | 2.8 | |
| ON | Recurring Maintenance Raleigh to Petersburg | \$ 35,000 | Per Mile 207 Trk. Miles | 10.8 | 13.6 | |
| ON | Recurring Maintenance Petersburg to Richmond | \$ 35,000 | Per Mile 30 Trk. Miles | 1.6 | 2.0 | |
| | Recurring Maintenance of Rolling Stock: | | | 0.0 | 0.0 | |
| | Base Labor | \$ 132,685 | Per Maintained Unit | 13.2 | 16.7 | |
| | Extra Labor | \$ 194,000 | Flat Est. | 0.7 | 0.9 | |
| | Parts | \$ 46,342 | Per Maintained Unit | 4.6 | 5.8 | |
| | Insurances | \$ 34,646 | Per Maintained Unit | 2.3 | 2.3 | |
| Total North Carolina Direct Expense | | | | 60.0 | 75.0 | |
| Indirect / Overhead Expenses: | | | | | | |
| | Train & Engine Labor | 33.5% | T & E Expense | 6.4 | 8.1 | |
| | Maintenance of Equipment | 27.1% | Car & Loco Mtce and tur | 1.6 | 2.1 | |
| | On Board Service | 10.0% | Onboard labor and provi | 2.6 | 3.4 | |
| | Police | \$ 0.005 | per passenger mile | 0.7 | 0.9 | |
| | Marketing (Carolinian route on NEC) | 2.8% | Total Revenue | 5.5 | 8.2 | |
| | Marketing (Piedmont) | 1.9% | Total Revenue | 0.2 | 0.4 | |
| | General & Administrative | 2.0% | Route Costs | 2.3 | 3.2 | |
| Total Amtrak Additives | | | | 19.3 | 26.3 | |
| Total O&M Expense | | | | 193.6 | 263.2 | |
| Revenue from SEHSR Track Fees Charged | | | | | | |
| ON | Track Fees - CSXT | 0.490 | Wt. Avg. Per Rev. Car Mile | 7.1 | 9.0 | |
| ON | Track Fees - Amtrak | 0.750 | Per Revenue Car Mile | 2.5 | 3.1 | |
| Operating Surplus / (Shortfall) | | | | Revenue minus O&M Exp. | 22.6 | 62.1 |

Summary SEHSR Service Net Operating Income (using Vanness Model)

| ON | FRA Captial Asset Renewal (depreciation) | | | | |
|------|---|------------------------------|---------------------|---------------|---------------|
| | Piedmont Equipment Renewal Capital | Per Expansion | As Assets activated | (6.0) | (6.0) |
| | SEHSR Infrastructure Renewal | Replacement | As Assets activated | (5.7) | (5.7) |
| | SEHSR Equipment Renewal | Renew/Replace | As Assets activated | (5.2) | (5.2) |
| | | Total Capital Renewal | | (16.8) | (16.8) |
| | Financial Operating Income (Loss) after Depreciation | | | 5.8 | 45.3 |
| | Fare Box Coverage Ratio (Total Revenues / Total O&M Expense) | | | 107% | 119% |
| Date | May 20, 2014 | | | | |