Roanoke Rail Patronage Report

Introduction

The document presents the methodology and results of the rail patronage study for the proposed Roanoke station. The study was conducted for the City of Roanoke with the participation of the Virginia Department of Rail and Public Transportation (DRPT). The proposed service would replace the existing Smart Way Connector Bus between Lynchburg and Roanoke, with the bus continuing service from Roanoke to the Blacksburg/Virginia Tech area.

Data collected for this effort included demographic data for the Roanoke Transportation Management Area, including population and employment for years 2010 and 2040, national demographic data including population, employment, and income at the Census Division level for the entire study area for years 2010 and 2013, total ridership for the Washington-Lynchburg Amtrak route for FY13 and FY14, and total ridership for the Smart Way Connector Bus for FY12, FY13, and FY14.

The station ridership was developed using a national intercity rail model developed by AECOM for corridor analysis for Amtrak's Northeast Corridor, Southeast Corridor, Florida, and multiple corridors in the Midwest, calibrated to match the base Amtrak ridership data provided by DRPT for the Washington-Lynchburg existing service.

The inputs required for this model analysis include:

- Geographic zonal system covering the study area
- Existing rail and bus ridership
- Socio-economic data for the zone system
- Highway network connecting all of the zones and rail stations in the study area
- Rail schedules for the existing and proposed service
- Travel characteristics for auto and rail

Model Structure

The travel demand modeling approach used in this project is based on a model system developed by AECOM and used in many previous applications to evaluate proposed intercity and high speed rail services for several states and Amtrak throughout the country. The travel demand model was originally developed from extensive market research and observed travel volumes and service characteristics by mode, conducted/assembled in the various study corridor markets including Northeast, Southeast, and other regions.

The travel demand forecasting approach utilizes a two-stage model system. The first stage forecasts the growth in the total number of person trips in each market, and the second stage predicts the market share of each available mode in each market. Both stages are dependent on the service characteristics of each mode and the socio-economic characteristics of the corridor. The key markets addressed in the forecasting model system are defined by geographical location (i.e., origin-destination zone pair).

The first stage addresses the growth in the total intercity person travel volumes. This includes "natural" growth and "induced" demand. The "natural" growth component is captured by the growth in population and employment. The "induced" component is captured by including a measure of the composite level of modal service, expressed in the mode share model, within the total travel model.

The second stage of the model is the mode share component, which estimates the share of total person travel by mode. This model considers both auto and rail. Key variables in the mode share model include:

- Line haul travel time
- Access/egress time
- Travel cost or fare
- Frequency of service

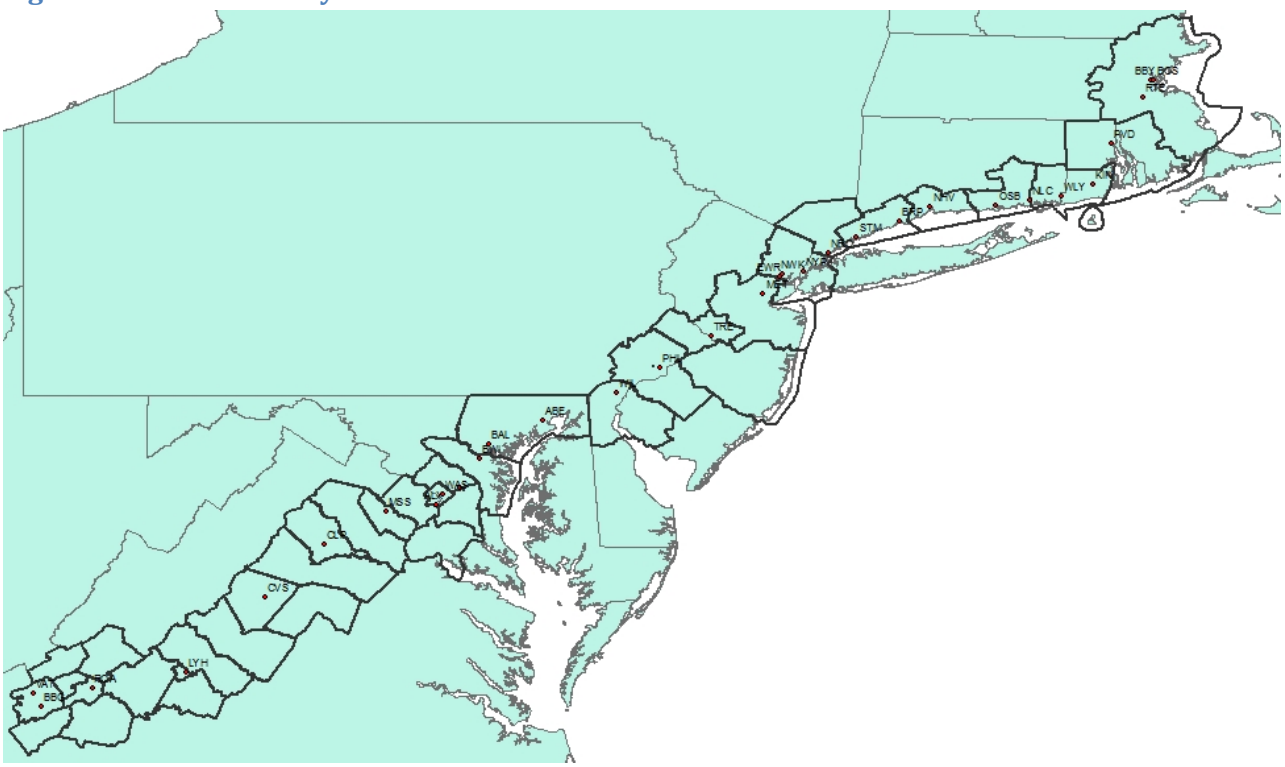
Total market-to-market frequencies were scaled based on arrival and departure times of each train serving the market. These scaling factors are based on the observed performance of trains in different departure/arrival time slots within rail corridors throughout the US. The rail utility and market share is determined by the combination of arrival and departure factors along with the time to the previous and subsequent trains, travel time, cost, access/egress times and on-time performance.

The mode choice model was calibrated to match the existing corridor by running the time, cost, and frequency characteristics of the existing Amtrak service, with current population, employment, and income data. The model parameters were then adjusted until the forecasted output corresponded with the actual ridership data.

Study Area Geography

The study area is focused on the existing Washington-Lynchburg-Roanoke corridor, but also includes connecting service up the Northeast Corridor to Boston. The zonal system was developed for the study area, and defines the geographic level of detail at which the intercity travel demand forecasting process is applied. The study area is found in Figure 1.

Figure 1. Roanoke Study Area



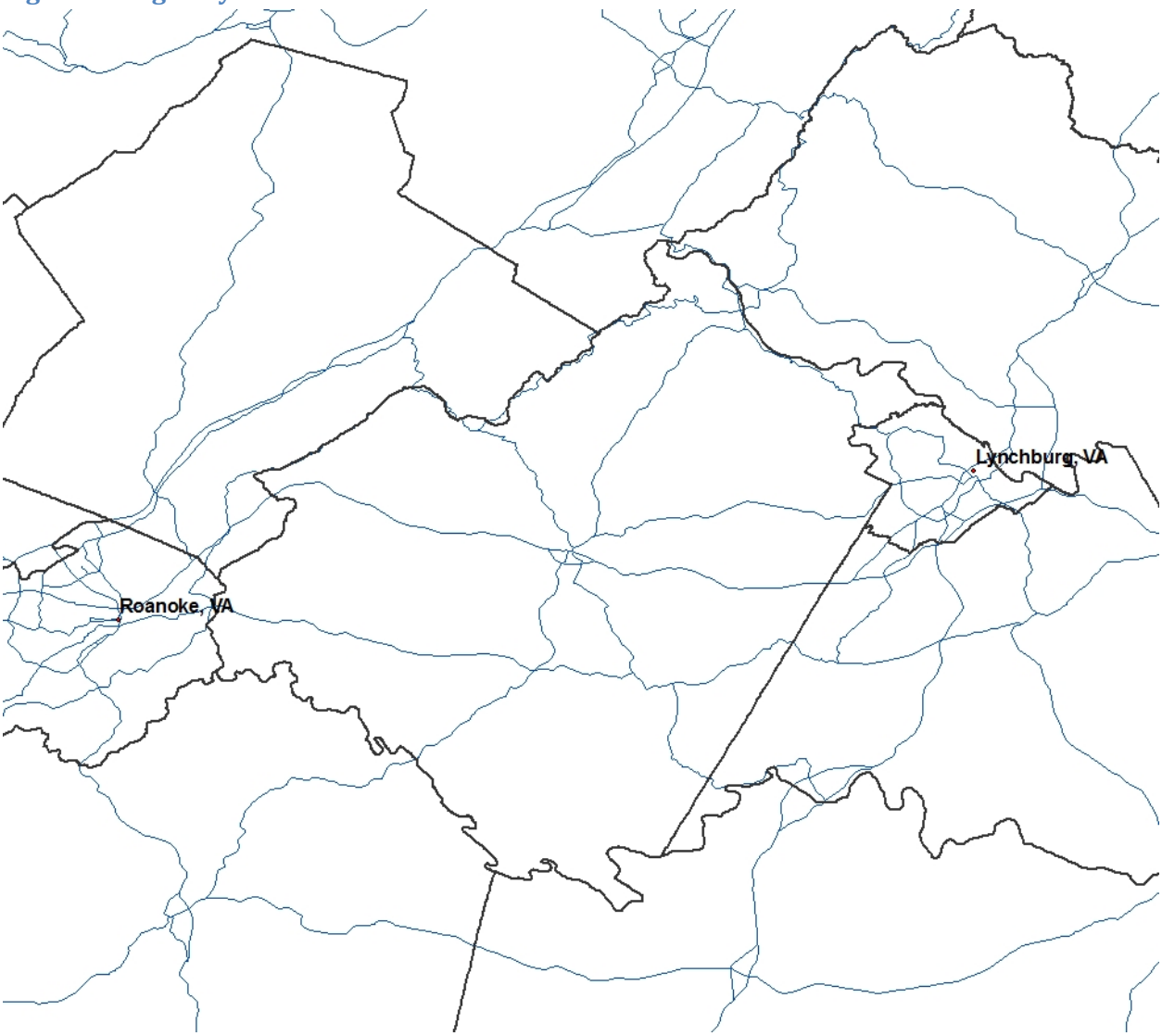
Network and Service Characteristics

Service characteristics are the key independent variables for the mode choice modeling process. The model in the project uses the following service characteristics:

- Travel time (minutes)
- Travel cost (dollars)
- Frequency (rail departures per day)

The auto service characteristics for each study area zone pair, including time, distance, and cost, were developed using a GIS-based intercity highway network. The network was derived from the Oak Ridge National Highway Network, of which an example is shown in Figure 2.

Figure 2. Highway Network



In order to create zone-to-zone travel times, a set of network skims were produced using ArcGIS by creating the minimum travel time path to/from each zone centroid in the study area based on congested travel time. Each minimum path calculation produces the time, distance and toll costs associated with the trip. In additional to tolls, auto cost is calculated at a per-mile basis of $0.54 per mile for business travel (full reimbursement cost), and $0.15 per mile for non-business travel (incremental cost of fuel).

Service characteristics for rail travel were also developed for each study area zone pair. These were based on published time tables for existing service and the highway network. The key characteristics include line haul time, frequency of service, fares, terminal times, access/egress times and costs, and rail on-time performance.

Published Amtrak timetables provided the basis for quantifying the line haul time and frequency of service. Average rail fares were obtained from previous rail studies in the corridor. The access/egress

times and costs include the time/cost traveling from the origin zone to the boarding rail station, the time associated with the station, including waiting/boarding times, and the time/cost traveling from the destination station to the final destination zone. Access/egress times and costs for travel between zones and stations were developed using the same network procedure and cost per mile rates described above and used for the auto zone-to-zone travel characteristics. The existing Washington to Lynchburg service has one round-trip per day, and the Roanoke analysis extended this service to the Roanoke station for the future analysis. Travel times and costs for the extended service were based on the speed and distance/cost relationships of the other station pairs in the corridor.

Demographic Data

Socio-economic data are used both to develop the base trip table as well as estimate market growth. The market growth in this case is a small portion, as it is only to factor the 2010 demographic data provided by the Roanoke Valley-Alleghany Regional Commission up to the base of 2013. The other major source of demographic data is Economy.com's national database at the county-level, which includes population, employment and per capital income for the years 2010 and 2013, which are based on Census numbers. Table 1 provides a summary of the 2010 and 2013 socio-economic data for selected major markets in the study area. These markets include the metropolitan areas surrounding the cities.

Table 1: Summary of Socio-Economic Data

	2010			2013		
	Population	Employment	Per Capita Income (2005$)	Population	Employment	Per Capita Income (2005$)
Blacksburg, VA	110,974	45,051	24,419	112,422	47,410	25,535
Roanoke, VA	194,682	121,710	34,779	196,906	124,884	34,930
Lynchburg, VA	75,709	40,634	27,781	77,440	41,245	27,944
Charlottesville, VA	142,753	87,482	40,490	148,364	89,404	39,853
Culpepper, VA	54,362	18,099	31,540	56,586	18,839	31,826
Manassas, VA	459,146	117,138	38,898	494,191	126,732	38,689
Washington, DC	3,746,666	2,284,090	90,719	3,912,659	2,348,886	91,305

Base Travel Market Data

The base trip table was developed for the three trip purposes: business, recreation, and other. The first step was to determine the total annual travel between all zonal pairs in the study area. This was done by applying standard market formulas from other nationwide studies using the socio-economic characteristics such including population, employment, and income, and travel related service characteristics including distance and travel time, and then calibrating it to match known data from various sources, including rail ridership from Amtrak (FY13 ridership for the Washington-Lynchburg train) and estimates of auto travel from the NEC Intercity Auto Origin-Destination study by the Northeast Corridor Commission. The total trips were then split by purpose for each zonal pair using the trip purpose split from the NEC Intercity Auto OD study. Table 2 provides a summary of base trips to

and from selected major markets in the study area. These markets include the metropolitan areas surrounding the cities.

Table 2: Summary of Estimated Annual Person Trips by Purpose for Major Markets

	Business	Recreation	Other	Total
Blacksburg, VA	577,805	622,896	1,994,527	3,195,228
Roanoke, VA	1,299,200	1,400,590	4,484,717	7,184,508
Lynchburg, VA	652,610	703,540	2,252,750	3,608,900
Charlottesville, VA	992,329	1,069,770	3,425,425	5,487,524
Culpepper, VA	1,200,406	1,294,086	4,143,688	6,638,180
Manassas, VA	1,408,815	1,518,759	4,863,098	7,790,672
Washington, DC	3,223,035	3,474,560	11,125,612	17,823,208

Forecast Results

The ridership forecast was prepared based on 2013 demographics and FY2013 Amtrak base ridership. Table 3 provides the annual boardings and alightings for the Roanoke extension for the proposed Roanoke station and the connecting Blacksburg bus service for trips entirely south of Washington and trips which travel through Washington and connect to the Northeast Corridor.

Table 3: Annual Rail Boardings/Alightings for Roanoke Extension

	South of Washington	Through Washington	Total
Roanoke	20,076	28,209	48,246
Blacksburg (connecting bus service)	6,134	11,114	17,248
Total Boardings/Alightings	26,210	39,323	65,534