APPENDIX D: TRAVEL DEMAND MODEL METHODOLOGY

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INTRODUCTION

This report documents the framework and update process of the Richmond/Tri-Cities MPO travel demand model. The travel demand model has been developed to assist in the analysis of the transportation system for the County of Henrico. This model has been developed by recalibrating the existing Richmond model, with attention to both region-wide model settings, along with more detailed refinement within the County. A secondary goal of the recalibration was to take the existing regional model and improve its performance in the County area, so that improvements can be incorporated into the "official" regional model and carried forward in subsequent updates.

The Henrico County 2026 Comprehensive Plan Update has been developed and analyzed in part using the latest regional model available for the Richmond/Tri-Cities area. This model has a base year of 2000 and a future year of 2026. For analysis within the scope of this project, the model was used to analyze traffic in 2000, 2005, and 2026 to identify transportation deficiencies and potential improvements to include in the Comprehensive Plan. For the Henrico County model, a 2005 scenario was also tested with the addition of significant roadway projects in the area, including State Route 288.

The recalibrated Richmond model was used to analyze land use and transportation changes described in Chapters 5 and 10 of this document, respectively. The benefit of using a travel demand model is its predictive capabilities, which provide insight into the effect of development build-out patterns and highway improvements on the transportation patterns throughout the region.

MODEL FOUR-STEP PROCESS

The Richmond model follows the traditional four-step process that has been used nationwide for most travel demand models over the last forty (40) years. This four-step process includes: Trip Generation, Trip Distribution, Mode Choice, and Network Assignment. The basic process of each of these steps is discussed below.

1. Trip Generation

The Richmond model employs a cross-classification-based trip production model and a regression-based trip attraction model to create person trips. There are four (4) primary internal purposes: Home-Based Work, Home-Based Work Special Generator, Home-Based Other, and Non-Home-Based. Trip production and trip attraction rates were developed from Public-Use Microdata Samples (PUMS), census data and recent household travel surveys from the southeast. External trips into and through the Richmond area are also specifically represented in the model.

2. Trip Distribution

The trip distribution model, used to determine where the trips generated in the model come from and go to, is based on the traditional gravity model. The gravity model distributes trips according to the number of productions and attractions in each zone and the impedance between the zones. Travel time and toll costs are the primary impedance variables utilized for the Richmond model.

The trip distribution step in the traditional four-step modeling process matches the person trip end (trip productions at the households and trip attractions at employment sites) estimated in trip generation to produce production-attraction person trip tables by purpose. The underlying assumption is that the trip productions and attractions are distributed in a manner that accounts for differences in accessibility and attractiveness of each zone pair reflecting the land use and transportation system characteristics.

The Richmond model uses the most common type of distribution, the gravity model. The gravity model formulation is expressed in **Equation 1**:

$$T_{ij} = P_i A_j F_{ij} K_{ij} / \sum_k A_k F_{ik} K_{ik} \quad (1)$$

where:

T_{ij} = trips produced in zone i and attracted to zone j

P_i = total trips produced by zone i

A_j = total trips attracted by zone j

F_{ij} = friction factor (function of impedance) between zones i and j

K_{ij} = trip adjustment (K) factor between zones i and j

This equation requires that friction factors and K-factors be estimated in a manner that matches observed trip length frequency distribution and travel patterns as reflected in available household and external station survey data.

The trip distribution model employs a feedback loop that incorporates congested travel times from a preliminary assignment back into trip distribution for a more accurate representation of the effects of congestion on travel patterns and destination choice.

3. Mode Choice

Mode choice uses statistically determined nested-logic equations to allocate trips between auto, transit, and non-motorized modes. Individual trip tables are created in this step for each mode, which can then be assigned to its appropriate network – streets for auto trips and transit routes for transit trips. Non-motorized trips are not carried forward past mode choice. An additional process is applied to the auto mode to identify the vehicle trips that will use toll roads in the Richmond region. Once trip modes are identified, the model then applies vehicle occupancies to convert auto-based person trips to vehicle trips, for use in trip assignment.

4. Trip Assignment

Vehicle trips were assigned to the highway network using an equilibrium assignment, which restrains capacity and represents congestion (and its effect on route choice) on the highway network. Transit assignment is based on best available route and does not have a congestion process. Output created by the highway assignment is a TP+ network that includes the assigned roadway volumes and travel times for each roadway segment in the network.

FUTURE YEAR MODELING

Recent socioeconomic data, traffic counts and travel behavior data are used to "calibrate" the Richmond model, but the model was developed with the intention of analyzing future year scenarios. Forecasted land use from each of the land use alternatives in the capacity analysis (Trend and Alternative 2) were input into the model to test the effects on the transportation network. Improvements for the existing (E) plus committed (C) (E+C) and the transportation plan were identified as a part of the comprehensive plan update process. The updated plan used in the model was identified using analysis of the previous transportation plan, which was modeled and reviewed as part of this model update. After model analysis of the previously adopted transportation plan, a new transportation plan was developed as part of the comprehensive planning process to better address the true deficiencies in Henrico County.

RICHMOND MODEL RECALIBRATION

Recalibration of the existing Richmond Travel Demand Model was chosen over the development of a new model for several reasons. First, the shape of the County does not lend itself to a logical model study area, but is more appropriately reviewed as a part of a larger area. If the model was a stand-alone County model, a large proportion of the trips would be external, which are more manually defined in most models and less sensitive to transportation changes. Second, by recalibrating the Richmond model instead of creating a stand-alone County model, it is envisioned that changes made and errors encountered can be incorporated into subsequent updates of the regional model. If this occurs, the County will have a model that is appropriate for planning within the County and is maintained and updated by VDOT, but with more participation and involvement from the County. The are encompassed by the regional model is shown on the following page.

REGIONAL MODEL STUDY AREA MAP

While the model is robust and has the capability to model the entire region and the impacts of transportation changes made in the County, it required revision and refinement before being able to be applied for this study. The modifications, on the county-level as well as regionally, attempt to improve the performance of the model and increase sensitivity to forecasted growth and potential projects. The primary focus of county-level revisions was the review of network and housing data, while regional-level revisions focused on network settings and parameters, as discussed herein.

The model has been modified on both a regional level and on the county-level to improve the model performance. Modifications on a regional level include changes to the trip generation, trip distribution, and traffic assignment modules. Modifications on a county-level include changes to link attributes (speed, laneage) based on field trips and traffic count data.

County Modifications

Data collected for Henrico County using previous studies (such as the 2005 Richmond Regional Bicycle/Pedestrian Plan) were compared to the base year model network to determine potential miscodings in the TP+ model. The primary screening criteria were speed and laneage. Inconsistencies between field data and model data were flagged and then reviewed in the field during the summer of 2005.

Since the base year for the model is 2000, the model was also reviewed for accuracy for that time period, to ensure that projects completed since then were included in only the 2005 model and beyond, but not in 2000. This was completed by obtaining a list of completed projects from the County, and reviewing transportation maps from 2000 and 2004 to identify new and improved facilities.

Regional Modifications

In order to improve the performance of the model, modifications were made to many components of the model. The focus of model changes was to replace national data with more appropriate regional data, remove K-factors to improve model sensitivity to changes in input and network data wherever possible, and to update the model to improve performance and model accuracy. The only step of the model that was not revised was the mode choice model. The version of the model transmitted contained a compiled FORTRAN-based external executable file. To modify this portion of the model would have required the rewriting and recompiling of this code. The remainder of this section details the model setting changes to the Richmond model.

Trip Production Model Rate Replacement

The existing trip generation model has four (4) internal trip purposes: Home-Based Work (HBW), Home-Based Work Special Generator (HBWSG), Home-Based Other (HBO), and Non-Home Based (NHB). With the exception of NHB trips, trips are produced using a cross-classification matrix with the persons per household and number of vehicles available as the variables. NHB productions are generated using a regression equation which takes into account total households, retail employment, and non-retail employment. These trip production rates are based on the Census Transportation Planning Package (CTPP) and data from the previous MINUTP model. Table 1 shows this existing trip production model for the Richmond Model.

Several observations were made of the existing trip production model which was identified for replacement/correction. First, the existing trip production model is based on CTPP data and older MINUTP data, which may not be applicable for the Richmond area. Second, trip production rates appear to have too much sensitivity to the number of vehicles available. Recent survey analysis of household travel surveys in Charleston, SC, Wilmington, NC, and Goldsboro, NC show that the number of trips are more closely linked to the number of persons in the household versus the number of automobiles per household. Finally, the NHB trip production model is regression-based and ties into households and employment for the number of trips produced. The revised trip production model is a cross-classification matrix based on persons per household and automobile availability, similar to the other trip purposes.

TABLE 1. EXISTING RICHMOND TRIP PRODUCTION MODELS
HOME-BASED WORK TRIPS

		Autos/HH			
		0	1	2	3+
Persons/HH	1	0.40	0.86	0.98	1.09
	2	0.86	1.13	1.79	1.91
	3	1.08	1.66	2.31	2.75
	4+	1.53	1.98	2.28	3.24

Home-Based Other Trips

		Autos/HH			
		0	1	2	3+
Persons/HH	1	1.02	1.55	2.14	2.20
	2	1.99	3.14	3.48	3.56
	3	2.03	3.78	4.39	5.24
	4+	2.88	5.69	6.20	8.21

Non-Home-Based Trips

1.2*Total Households + 0.93*Retail Employment + 0.34* Non-Retail Employment = ?

Since no current household travel surveys were available, two (2) recent household surveys administered by Kimley-Horn and Associates in coordination with NuStats, Inc., were combined and analyzed to produce new rates for the cross-classification trip production model (Charleston, SC, and Goldsboro, NC). After the new model was employed, overall trip production rates were very similar to the existing trip production model, but the new model has greater sensitivity to persons per household and less sensitivity to automobile availability. Also, the new NHB model replaces the regression model with a cross-classification model that is more sensitive to household attributes that affect the number of NHB trips produced. Table 2 shows the new trip generation rates that were utilized in the comprehensive plan update evaluation.

TABLE 2. REVISED TRIP PRODUCTION MODELS
HOME-BASED WORK TRIPS

		Autos/HH			
		0	1	2	3+
Persons/HH	1	0.53	0.92	0.97	1.32
	2	0.95	1.70	1.92	2.33
	3	0.95	1.94	2.51	3.43
	4+	1.30	2.36	2.51	3.43

Home-Based Other Trips

		Autos/HH			
		0	1	2	3+
Persons/HH	1	1.82	2.24	2.24	2.24
	2	2.68	3.70	4.26	4.16
	3	3.01	4.26	4.72	4.55
	4+	3.01	4.66	4.99	7.19

Non-Home-Based Trips

		Autos/HH			
		0	1	2	3+
Persons/HH	1	0.94	1.94	1.84	1.84
	2	0.98	2.70	3.50	3.53
	3	1.84	2.70	3.50	3.53
	4+	2.33	3.23	3.82	5.04

Friction Factor Replacement

The existing Richmond model had what can be called "flat" friction factors, meaning that the resistance to trips does not vary greatly as the length of time increases and do not reflect the characteristics of the area well with regards to the length of trips travelers take. The friction factors used in the model were revised based on friction factors from the Triangle Regional Model for the Raleigh-Durham, NC, area and its corresponding household travel survey. This change allows the model to have more sensitivity to growth and development, since drivers typically choose a closer destination if it meets the requirements of their trip.

Count Removal

Many of the links in the Richmond Model are coded with traffic counts from the VDOT traffic count program (approximately 4,370). However, there are many locations where the same count is coded on multiple links. This can be problematic where any count that is entered more than once receives more weighting during statistical analysis of model performance than a traffic count that has been entered in one location. For example, if a single traffic count is coded in three (3) locations in the model and those links load model volumes two-hundred percent (200%) higher than the traffic counts, then that traffic count will be count three (3) times in statistical analysis and artificially show that all counts are higher than actual. As part of the revision process, the model was reviewed (with primary focus placed on the County of Henrico) and revised to remove duplicate traffic count coding locations. In all, a total of three-hundred fifty-five (355) duplicate traffic counts were removed from the model, leaving a total of 4,017 traffic counts for statistical analysis and model variation.

Terminal Time Reduction

The existing Travel Demand Model uses terminal times at the beginning and end of each trip to signify travel time related to parking and walking time required at each termini of the trip. These terminal times are based on data out of the National Cooperative Highway Research Program (*NCHRP) Report 365 – Travel Estimation Techniques for Urban Planning* and vary between one (1) (Rural) and five (5) minutes (CBD – Central Business District). Reduced terminal times are proposed because the current terminal times, which are based on national data, are more significant than should be applicable in the Richmond area. For example, a trip that begins and ends in the CBD area, by default, has ten (10) minutes of terminal time added to the trip without even considering the travel time. While these terminal times may be applicable in places with major parking shortages and high urban densities, parking is more available and less costly in the Richmond region. Table 3 shows the terminal times in the existing model.

TABLE 3. EXISTING TERMINAL TIMES (MINUTES)

Area Type	Trip Origin	Trip Destination
CBD	5	5
CBD Fringe	4	4
Urban	3	3
Suburban	2	2
Rural	1	1

The new terminal times proposed are based on the Triangle Regional Model for the Raleigh-Durham area. These terminal times typically have greater terminal times on the attraction end than the production end, since it is usually at the destination end of the trip where delay is incurred (e.g. looking for a parking space). Table 4 shows the revised terminal times for the Richmond model.

TABLE 4. REVISED TERMINAL TIMES (MINUTES)

Area Type	Trip Origin	Trip Destination
CBD	2	4
CBD Fringe	2	3
Urban	2	2
Suburban	1	2
Rural	1	1

Volume-Delay Curve Adjustments

Like most other models the Richmond model uses volume-delay curves, to show the reduction of speed on roads due to the effects of traffic. The volume-delay curve is best described by the following equation:

$$T_n = T_O * [1 + \alpha * (V/C)^{\beta}]$$

Where:

T_n = Congested link travel time

T_O = Initial link travel time under free-flow conditions

α = Alpha setting

β = Beta settings

V = Assigned traffic volume

C = Capacity (typically Level of Service (LOS) C, D or E)

The current alpha and beta settings show some insensitivity to additional traffic volumes, meaning that the freeways and interstates have to be highly congested before speeds begin to decrease, and even so, the speeds decrease slowly. Recent observations and studies, such as that reported in *NCHRP Report 365*, recommend volume-delay curve alpha-beta settings that vary by facility type (controlled access, arterial, other). These settings reflect the differences that congestion has on speed on roadways of varying types. For example, interstates are more likely to maintain posted speed even at capacity, and then quickly "break-down" and have low travel speeds past capacity, which is best described as stop-and-go traffic. Arterials, however, are more sensitive to additional traffic at lower volumes, but do not commonly experience the full "break-down" interstates and freeway can experience. Table 5 shows the existing and revised alpha-beta settings for the Richmond model.

TABLE 5. REVISED ALPHA-BETA SETTINGS

	Original		Revised	
Link Class	Alpha	Beta	Alpha	Beta
1	0.2	6	0.83	5.5
2	0.3	5	0.83	2.7
3	0.75	3	0.83	2.7
4	0.15	4	0.71	2.1
5	0.15	4	0.71	2.1
6	0.15	4	0.71	2.1

Capacity Table Adjustments

Roadway capacities were adjusted to better reflect differences in capacities between interstates/freeways and arterials in the model. The model in its original state has very little distinction in capacity for a freeway/interstate and an arterial – for example, a typical interstate has a capacity of 1,300 vehicles-per hour-per lane (vphpl) while an arterial can have a capacity of 1,200 vphpl. In very rare instances can arterial achieve a similar capacity as an interstate, primarily due to traffic signals, turning conflicts, driveway access, and their associated impacts on traffic. Model capacities were revised to provide more distinction between higher class facilities (interstates, freeways) and arterials, collectors, and local roads. Table 6 shows the original and revised capacities for the Richmond model by capacity classification.

TABLE 6. ORIGINAL AND REVISED CAPACITY SETTINGS

Capacity Classification	Original Capacity (vphpl)	Revised Capacity (vphpl)
1	1300	1600
2	1300	1600
3	1300	1600
4	1300	1600
5	1300	1600
6	1200	1500
7	1200	1500
8	1200	1500
9	1200	1500
10	1200	1500
11	1200	1100
12	1200	1100
13	1200	1100
14	1200	1100
15	1200	1200
16	1200	1000
17	1200	1000
18	1200	1000
19	1200	1100
20	1200	1100
21	800	800
22	800	800
23	1100	1000

Capacity Classification	Original Capacity (vphpl)	Revised Capacity (vphpl)
24	1100	1050
25	1200	1100
26	700	700
27	700	700
28	1000	1000
29	1000	1000
30	1100	1000
31	800	800
32	820	820
33	860	860
34	990	990
35	1150	1150
36	300	300
37	300	300
38	320	320
39	340	340
40	360	360
41	600	600
42	600	600
43	800	800

Capacity Classification	Original Capacity (vphpl)	Revised Capacity (vphpl)
44	800	800
45	1000	1000
46	300	300
47	300	300
48	400	400
49	400	400
50	500	500
51	600	600
52	600	600
53	800	800
54	800	800
55	1000	1000
56	3200	3200
57	3200	3200
58	3200	3200
59	3200	3200
60	3200	3200

K-Factor Adjustment

The existing Richmond model contained numerous K-factors that were used to adjust the model by area type and jurisdiction. The main critique of the existing K-factors was that they were too plentiful and may have been of an inappropriately large scale. The K-factors, which ranged between 0.7 and 1.75, should be used more sparingly and of smaller scale so that the model retains sensitivity to changes in households and the transportation system. For example, a new job forecasted in Prince George County (which has a K-Factor of 1.75 on home-based work attractions) would attract almost twice as many workers than if it were in Hanover County (which has a K-factor of 0.91 for home-based work attractions).

As part of the recalibration process, all K-factors were removed from the modeling process to see how the model would perform if allowed to run "naturally." New, smaller K-factors were then input more sparingly where needed to address modeling issues that could not be addressed in the other revisions to the model. Table 7 shows the revised area type K-factors proposed to be used for analysis of the comprehensive plan update. Table 8 shows the revised jurisdictional home-based factors proposed for analysis.

TABLE 7. ORIGINAL AND REVISED AREA TYPE K-FACTORS
HOME-BASED WORK TRIPS

Area Type	Original Production Factor	Revised Production Factor	Original Attraction Factor	Revised Attraction Factor
CBD	0.95	1.00	0.95	1.00
CBD Fringe	0.95	1.00	0.95	1.00
Urban	0.98	1.10	0.98	1.00
Suburban	1.01	1.05	1.01	1.00
Rural	1.03	0.95	1.03	1.00

Home-Based Other Trips

Area Type	Original Production Factor	Revised Production Factor	Original Attraction Factor	Revised Attraction Factor
CBD	1	1.00	0.95	1.00
CBD Fringe	1	1.00	0.95	1.00
Urban	1.15	1.10	0.98	1.00
Suburban	1.25	1.05	1.01	1.00
Rural	1.25	0.95	1.03	1.00

Non-Home-Based Trips

Area Type	Original Production Factor	Revised Production Factor	Original Attraction Factor	Revised Attraction Factor
CBD	0.95	1.00	0.95	1.00
CBD Fringe	0.95	1.00	0.95	1.00
Urban	0.98	1.10	0.98	1.00
Suburban	1.01	1.05	1.01	1.00
Rural	1.03	0.95	1.03	1.00

TABLE 8. ORIGINAL AND REVISED JURISDICTION K-FACTORS
HOME-BASED WORK TRIPS

Jurisdiction	Original Production Factor	Revised Production Factor	Original Attraction Factor	Revised Attraction Factor
Henrico	1.00	1.00	0.98	1.00
Richmond	1.06	1.00	0.99	1.00
Chesterfield	1.02	1.00	1.10	1.00
Powhatan	0.94	1.00	1.46	1.00
Goochland	0.95	1.00	0.93	1.00
Hanover	0.96	1.00	0.91	1.00
Petersburg	0.85	1.00	0.87	1.00
Colonial Heights	1.28	1.00	0.98	1.00
Hopewell	0.97	1.00	0.96	1.00
Prince George	0.96	1.00	1.75	1.00
Dinwiddie	1.02	1.00	0.82	1.00
New Kent	0.79	1.00	0.75	1.00
Charles City	0.77	1.00	0.70	1.00
External	1.00	1.00	0.98	1.00

MODEL PERFORMANCE COMPARISON

The final step of the model revision process was to validate the model results to show that the model performs as well or better for the region and for Henrico County. Table 9 shows the original model results compared to traffic counts, while Table 10 shows the revised model results. A few observations can be made from the tables – first and foremost, the revised model is within two percent (2%) of the aggregated traffic counts in the revised model, while it was twelve percent (12%) low in the original model. Also, the % Root Mean Square Error (RMSE), a measure of accuracy of each link observation, improved from thirty-eight percent (38%) to thirty-three (33%) after the model revisions – a significant improvement in accuracy. The regional model also improved from forty-five percent (45%) to forty-two (42%) due to the model revisions. From these results, it can be concluded that the revised Richmond model can better model the effects of growth in Henrico County for the development of the Comprehensive Plan. The changes in the model settings will allow the model to have more sensitivity to land use and network changes affecting the transportation system between now and 2026. This will help the model provide useful analysis in what the transportation system will need to accommodate future growth

TABLE 9. ORIGINAL MODEL RESULTS

Performance by Functional Class – Entire Region

Functional Class	Description	%RMSE	Assigned/ Observed	Counts
1	Urban Interstate	19.8	1.00	132
2	Rural Interstate	20.3	1.00	26
3	Urban Freeways and Expressways	26.6	1.14	55
5	Urban Principal Arterial	33.4	0.89	893
6	Rural Principal Arterial	24.5	1.04	26
7	Urban Minor Arterial	50.3	0.84	1455
8	Rural Minor Arterial	70.0	1.26	94
9	Urban Collector	84.4	1.00	1110
10	Rural Major Collector	101.5	1.37	344
11	Rural Minor Collector	205.6	2.25	128
0	Unclassified	30.0	1.04	109
Total	All Links	45.3	0.94	4372

Performance by Functional Class – Henrico County

Functional Class	Description	%RMSE	Assigned/ Observed	Counts
1	Urban Interstate	19.7	1.02	47
2	Rural Interstate	25.1	1.14	2
5	Urban Principal Arterial	28.7	0.88	158
7	Urban Minor Arterial	44.3	0.78	340
9	Urban Collector	69.5	0.91	215
10	Rural Major Collector	61.7	1.51	6
Total	All Links	38.1	0.88	768

Performance by Area Type – Entire Region

Area Type	Description	%RMSE	Assigned/ Observed	Counts
1	Central Business District	48.4	1.00	339
2	Outlying Business	-	0.94	1
3	Suburban (High Density)	43.5	0.90	2845
4	Suburban (Low Density)	43.2	1.00	642
5	Rural	56.3	1.13	545
Total	All Links	45.3	0.94	4372

Performance by Area Type – Henrico County

Area Type	Description	%RMSE	Assigned/ Observed	Counts
1	Central Business District	36.2	0.84	563
2	Outlying Business	40.7	0.99	168
3	Suburban (High Density)	83.3	1.17	37
Total	All Links	38.1	0.88	768

R-SQUARED = 0.867

TABLE 10. REVISED MODEL RESULTS

Performance by Functional Class – Entire Region				
Functional Class	Description	%RMSE	Assigned/ Observed	Counts
1	Urban Interstate	19.6	0.93	130
2	Rural Interstate	20.7	0.98	26
3	Urban Freeways and Expressways	20.4	1.03	55
5	Urban Principal Arterial	31.3	0.96	861
6	Rural Principal Arterial	23.9	1.10	20
7	Urban Minor Arterial	46.4	0.95	1379
8	Rural Minor Arterial	49.1	1.14	90
9	Urban Collector	86.3	1.11	1065
10	Rural Major Collector	69.4	1.25	276
11	Rural Minor Collector	139.6	1.76	94
0	External Stations	63.8	1.29	21
Total	All Links	42.2	0.98	4017

Performance by Functional Class – Henrico County				
Functional Class	Description	%RMSE	Assigned/ Observed	Counts
1	Urban Interstate	19.0	0.93	45
2	Rural Interstate	30.4	1.17	2
5	Urban Principal Arterial	22.9	1.00	140
7	Urban Minor Arterial	36.2	0.97	308
9	Urban Collector	64.0	1.09	203
10	Rural Major Collector	36.6	1.27	6
Total	All Links	32.8	0.98	704

Performance by Area Type – Entire Region				
Area Type	Description	%RMSE	Assigned/ Observed	Counts
1	Central Business District	48.4	1.06	339
2	Outlying Business	-	0.87	1
3	Suburban (High Density)	40.7	0.96	2748
4	Suburban (Low Density)	36.6	0.97	544
5	Rural	52.7	1.08	385
Total	All Links	42.2	0.98	4017

Performance by Area Type – Henrico County				
Area Type	Description	%RMSE	Assigned/ Observed	Counts
1	Central Business District	31.0	0.98	525
2	Outlying Business	36.8	0.99	144
3	Suburban (High Density)	65.3	1.01	35
Total	All Links	32.8	0.98	704
		R-SQUARED = 0.879		