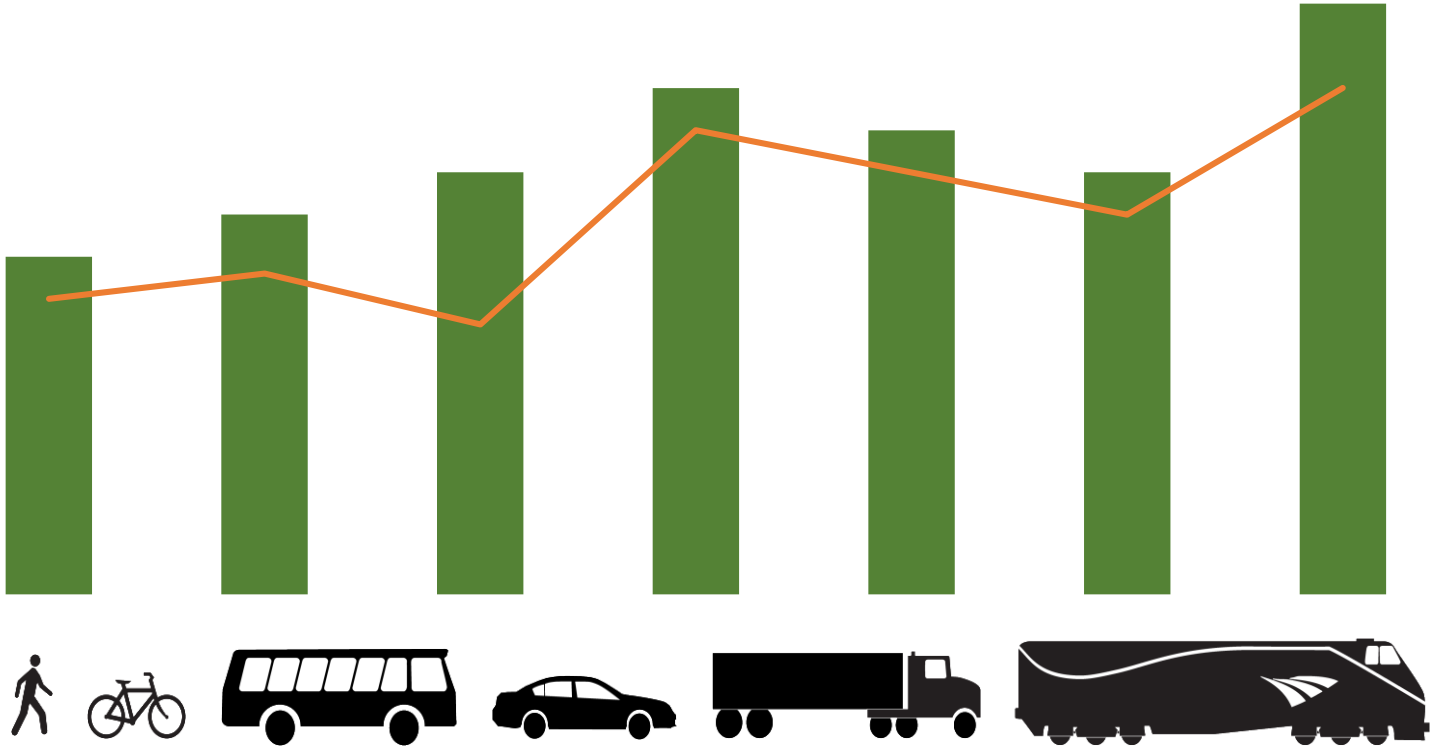
Transportation Performance Measures

Progress Report ● 2016



Final Report for RRTPO Consideration
December 1, 2016

Richmond Regional Transportation Planning Organization

The Richmond Regional Transportation Planning Organization (RRTPO) is the federal and state designated regional transportation planning organization that serves as the forum for cooperative transportation decision-making in the Richmond area. The Richmond Regional Planning District Commission is the contracting agent and staff for the RRTPO.

ACKNOWLEDGEMENT

This report was prepared in cooperation with the United States Department of Transportation, Federal Highway Administration (FHWA) and the Virginia Department of Transportation (VDOT).

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INTRODUCTION

The Richmond Regional Transportation Planning Organization (RRTPO) *Transportation Performance Measures - Progress Report 2016* documents and demonstrates progress in planning and programming projects toward the achievement of the region's transportation goals. This performance management document is a tool for looking forward, but most importantly provides a framework for looking back to consider whether past planning and programming of projects had an impact on regional transportation and to evaluate if projects can be linked to outcomes. This iterative process of performance-based planning and programming exemplifies an agency-wide approach in the RRTPO Unified Planning Work Program.

The following report includes statistics on highway usage and congestion, pavement and bridge conditions, commuting patterns, safety and air quality over time, as well as comparisons of the Richmond region's performance with peer and similarly sized regions. The measures in this report are informed by and in some cases inform various programs undertaken by the RRTPO, including: Congestion Management Process; Bridge & Culvert Structural Assessment Inventory; Socioeconomic Data Forecast; Regional Travel Demand Modeling; Transportation Improvement Program; and Metropolitan Transportation Plan.

The *Transportation Performance Measures - Progress Report 2016* consists of two sections: a summary table of all performance measures tracked by the RRTPO; and an accompanying analysis of the trends that define the region's multimodal transportation system performance and how these trends demonstrate progress toward plan2040 goals.

The "Transportation Performance Measures Summary Table" beginning on page 8, is a compilation of all tracked measures as directed by the RRTPO. Each annual report evaluates new data sources, best practices or legislative directives to evaluate additional measures to track, allowing for a dynamic performance management process. In the 2015 report new additional measures were recommended and subsequently added, however, please note that no additional measures were recommended in the 2016 report.

The "Transportation Performance Measures Analysis Report" beginning on page 13, includes a description of selected data points and sources, and evaluation of trends. Each section also highlights RRTPO programs and transportation projects underway in the Richmond region.

The following introduction section describes the state and federal requirements that prompted the RRTPO to begin tracking performance measures. The introduction also provides a discussion of trends and targets – with new federal rulemaking the RRTPO will be required to work collaboratively with VDOT to establish specific targets for performance measures in the areas of safety, pavement condition, system performance and freight movement.

Why Track Performance Measures?

The RRTPO began measuring transportation and land use performance data in response to legislative directives from the Virginia General Assembly. Recent federal legislation has increased the prominence of performance measurement within the RRTPO Unified Planning Work Program.

In 2009, the Virginia General Assembly passed legislation granting the Commonwealth Transportation Board (CTB) authority to require that appropriate regional organizations develop quantifiable measures and achievable goals related to transportation system performance. The General Assembly took another step in 2010 by requiring that large MPO's (population greater than 200,000) have region-specific performance measures approved by the CTB. These measures were tied to state match for Regional Surface Transportation Program (RSTP) funds, with successful CTB approval required by a deadline date of July 1, 2011.

The passage of the 2009 & 2010 legislation (see VA Code §2.2-229, §33.2-353) codified regional performance measurement and the RRTPO coordinated with other MPO's around Virginia to develop a list of Regional Transportation and Land Use Performance Measures. The RRTPO took action on March 17, 2011 to adopt the *Regional Performance Measures for Richmond Area MPO,* and submitted the document to the Secretary of Transportation and the CTB for approval. Since 2011, this set of approved measures and desired trends have been summarized in annual *Transportation Performance Measures Progress Report* and posted on the RRTPO website as required by the Secretary's Office of Intermodal Planning and Investment (OIPI).

In addition to state requirements, the 2012 *Moving Ahead for Progress in the 21st Century* (MAP-21) federal transportation bill emphasized performance measurement. MAP-21 calls on states and MPOs to adopt a "Performance-Based Planning and Programming" (PBPP) approach:

> *"Performance-based planning and programming includes using transportation performance measures, setting targets, reporting performance, and programming transportation investments towards the achievement of transportation system performance outcomes." (FHWA, PBPP Guidebook)*

Additionally, MAP-21 calls for states, regions and localities to invest resources in projects that collectively make progress toward seven national goals:

(1) Safety – To achieve a significant reduction in traffic fatalities and serious injuries on public roads.

(2) Infrastructure condition – To maintain the highway infrastructure asset system in a state of good repair.

(3) Congestion reduction – To achieve a significant reduction in congestion on the National Highway System.

(4) System Reliability – To improve efficiency of the surface transportation system.

(5) Freight movement and economic vitality – To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.

(6) Environmental sustainability – To enhance the performance of the transportation system while protecting and enhancing the natural environment.

(7) Reduced project delivery delays – To reduce project costs, promote jobs and the economy and expedite the movement of people an goods by accelerating project completion through eliminating delays in project development and delivery process, including regulatory burdens and improving agencies' work practices.

The RRTPO is working to advance the integration of PBPP and new federal requirements into the RRTPO's Unified Planning Work Program (UPWP).

Program Highlights

Since adoption of MAP-21, the PBPP approach has been applied in the following RRTPO program areas:

Planning

- Development of plan2040 goals which closely align to federal and statewide goals (See Appendix I – Correlation of Federal, State and Regional Performance Goals).
- Application of plan2040 goals as criteria in quantitative evaluation, scoring and ranking of candidate projects for the fiscally-constrained plan.

Programming

- Project selection and allocation of CMAQ and RSTP funding to regional projects in accordance with the goals and requirements of each federal program.
- Oversight and monitoring of projects in Transportation Improvement Program (TIP).

Implementation and Evaluation

- Reporting of regional performance measures in accordance with state and federal requirements.
- Development of various technical reports related to plan2040 goals: *Congestion Management Process Technical Report*; *Regional Bridge & Culvert Structural Assessment*; etc.

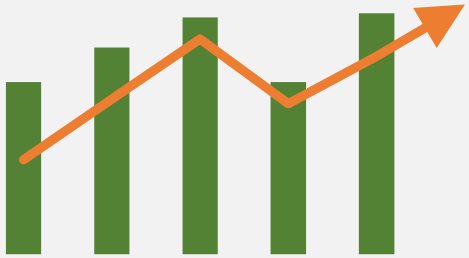
Trends and Targets

While a performance measure provides a metric for comparison, an effective Performance-Based Planning and Programing process requires identification of desired trends (e.g., reduce, increase, maintain) or targets (specific numerical figures) associated with the performance measure in order to provide strategy direction, and a basis to analyze project alternatives.

As reflected in the "Performance Measures Summary Table" beginning on page 10, the RRTPO has adopted desired trends for measures where applicable. This report compares desired trends to 1-year and 5-year trends. The tracking of measures and trends is the core of RRTPO's performance monitoring efforts at present.

The RRTPO will be working to identify targets and to tie policy or programming decisions to the anticipated impacts of a project on the transportation performance measures. In order to comply with new federal regulations and the PBPP approach, the RRTPO's performance monitoring efforts will include a process for target-setting, the development of strategies, analysis of alternatives, and prioritization of investments that move the region toward meeting those targets.

In general, the tracking of trends is useful because it allows policy-makers to react and base decisions on real transportation system performance data. The setting of targets takes a step further, allowing policy-makers to be proactive in defining where the region's transportation system performance should be, and committing to strategies, and investments that aim efforts toward achievement of those goals.



What is a Trend?

- Tendency
- Movement
- Course
- Direction
- Progression
- Inclination

What is a Target?

- Objective
- Goal
- Aim
- End
- Intent
- Aspiration

The RRTPO approach to performance monitoring will transition from trends to targets in future work programs. But how is target-setting done? In order to develop a target, analysis of baseline data must be a first step to understand past trends in performance, as well as analysis of expected future performance to account for multiple factors and scenarios.

Coordination with VDOT will be essential to setting future targets. According to FHWA, there is no right or wrong way to establish targets. FHWA recognizes value in starting with a directional or aspirational target, recognizing that there are many factors that affect the ability to meet targets beyond the control of transportation agencies in the short-term. As more data becomes available and strategies begin taking effect, more realistic targets may be developed. As agencies go through multiple iterations of planning, the agency will have more information to develop realistic targets.

Other considerations in setting targets include whether the target should be: a specific number, a percentage reduction/increase from a baseline (e.g., to 10% below current levels), or set to a particular benchmark (e.g., to national average, to year 2000 levels).

How to set Targets?

Research from the NCHRP 666 described a wide range of approaches used to set targets for performance-based resource allocation by transportation agencies. The commonly used approaches include:

Policy-driven – Targets are established in a top-down manner by a policy board or executive management, typically in the context of larger transportation goals or policies.

Modeling – Targets based on what is possible given the resource or funding constraints, to determine what strategies or funding is needed to achieve the target through an iterative revision process.

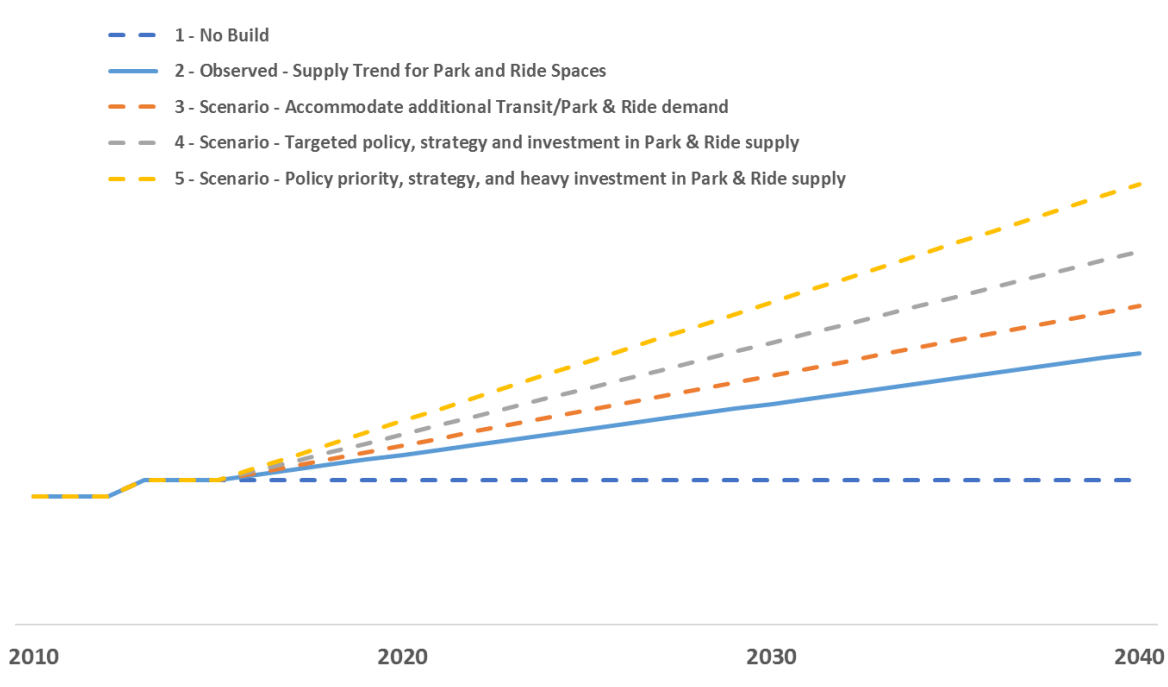
Consensus-based – Targets are established collaboratively with a variety of transportation stakeholders. An analysis of the planning context and constraints on possible investment performance is applied.

Reliance on formal or informal user feedback – Transportation system user feedback on system performance and objectives is gathered through a variety of survey and outreach methods to set targets.

Use of benchmarks from peer agencies – Targets are established based on review of similar investment approaches and results for performance measures of interest as experienced by other transportation agencies.

Source: NCHRP 666, Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies

Policy Driven Example: Park & Ride Spaces in the Richmond Region



Step 1: Analyze baseline data (observed trend) and develop assumptions

Step 2: Consider multiple policy, economic, technical, and financial scenarios

Step 3: Set target consistent with policy board preferred scenario, develop strategy for achieving target, track progress over time, and reevaluate target.

The first step in policy driven target setting is to fully analyze observed trends over time. An example is depicted at left, with the observed trend for the supply of Park & Ride spaces in the Richmond Region shown in the solid blue line. In Step 2, multiple scenarios for policy or user preference possibilities are depicted as dashed lines. With the observed trend and various future scenarios to react to, the RRTPO would select a preferred future direction, set a specific target, develop a strategy to achieve that target, and continually track progress over time to revaluate the target.

It is important to understand that policy and strategies can directly impact supply, however external factors can impact demand for a capacity constrained transportation resource, such as park and ride spaces.

TRANSPORTATION PERFORMANCE MEASURES
SUMMARY TABLE

TRANSPORTATION PERFORMANCE MEASURES SUMMARY TABLE

The following summary table includes all transportation performance measures currently tracked by the RRTPO. A few notes on the summary table:

- Measures denoted with an asterisk (*) in the summary table are reviewed in more detail in the "Transportation Performance Measures Analysis Report."
- "n.a." denotes instances where data was not available, or for which a change in methodology made data inconsistent with the other reporting years.
- Geography of Data Collection (RRPDC area, RRTPO area, Richmond MSA, Richmond VDOT District) varies by each measure depending on data availability. Refer to the table footnotes (pg. 9) for clarification on level of geography.
- Measures were sorted into goal categories which align with the plan2040 goals as approved by the RRTPO.
- All measures and desired trends appearing in this table have been approved for use in the annual progress report.

Transportation Performance Measures Summary Table

Goals	Measure	2009	2010	2011	2012	2013	2014	2015	Desired Trend	1-year Trend	5-year Trend
Congestion Mitigation & System Reliability	*Delay per peak period commuter[1], annual hours	33	33	33	33	34	34	n.a.	↘	→	↗
	Fuel Loss per peak period commuter[2], gallons	13	13	13	14	14	14	n.a.	↘	→	↗
	*Peak period travel time index[3]	1.12	1.12	1.12	1.12	1.13	1.13	n.a.	↘	→	↗
	Congestion costs[4], annual per peak period commuter	$746	$754	$733	$727	$736	$729	n.a.	↘	↘	↘
Transportation and Land Use Integration	*Daily VMT[5], per capita	n.a.	27.9	27.7	27.6	27.4	28	n.a.	n.a.	↗	↗
	*Jobs/Housing Ratio[6]	n.a.	n.a.	n.a.	1.28	n.a.	n.a.	n.a.	→	n.a.	n.a.
	*Jobs/Housing Dissimilarity Index[7]	0.066	0.0596	0.061	0.0555	0.0485	0.0472	n.a.	< .5	✓	✓
	% Workers working in jurisdiction in which they live[8]	48.5%	48.8%	49.1%	48.9%	48.6%	48.2%	n.a.	↗	↘	↘
	Travel Time to Work[9]	23.4	23.6	23.6	23.9	24.0	24.1	n.a.	↘	↗	↗
	Population Density[10], persons per square mile	n.a.	n.a.	n.a	475	n.a.	n.a.	n.a.	↗	n.a.	n.a.
Environmental and Air Quality	*Ozone Exceedances,[11]										
	with 2008 EPA Ozone Standard (.075ppm)	0	10	11	11	1	1	1	↘	→	↘
	with 2015 EPA Ozone Standard (.070ppm)	2	25	22	15	1	2	3	↘	↗	↘
	Multi-Pollutant Air Quality Index Exceedances[12]										
	with 2008 EPA Ozone Standard (.075ppm)	1	10	12	11	1	1	1	↘	→	↘
	with 2015 EPA Ozone Standard (.070ppm)	3	25	40	15	1	2	3	↘	↗	↘
Freight Mobility	Commodity Flow, Freight Mode Share[13], by tons										
	Truck	n.a.	n.a.	n.a.	67%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Rail	n.a.	n.a.	n.a.	30%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Commodity Flow, Freight Mode Share[13], by dollar value										
	Truck	n.a.	n.a.	n.a.	82%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Rail	n.a.	n.a.	n.a.	5%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	*Port of Richmond Containers, Outbound[14]	n.a.	n.a.	n.a.	3,241	4,775	7,415	8,021	↗	↗	n.a.
	*Port of Richmond Containers, Inbound[14]	n.a.	n.a.	n.a.	3,205	4,821	6,699	8,326	↗	↗	n.a.
	RIC Total Cargo, Outbound/Enplaned, tons[15]	n.a.	n.a.	18,545	21,857	27,108	29,915	30,167	↗	↗	↗
	RIC Total Cargo, Inbound/Deplaned, tons[15]	n.a.	n.a.	28,062	30,863	31,756	28,369	29,281	↗	↗	↗
	Transportation/Warehousing Employment[16], number	19,406	19,172	19,263	19,438	19,743	21,074	27,419	↗	↗	↗
Multimodal Connectivity & Access to Employment	Park and Ride Lots / Spaces[17], number	n.a.	11 / 1,760	11 / 1,760	11 / 1,760	12 / 1,987	12 / 1,987	12 / 1,987	↗	→	↗
	RideFinders Vanpools[18], number	n.a.	n.a.	117	120	137	138	145	↗	↗	↗
	Transit Trips[19], per capita	30.7	31.6	28.5	22.3	19.5	20.6	n.a.	↗	↗	↘
	Transit Operating Expense per passenger trip[20]	$3.40	$3.45	$3.62	$4.82	$5.42	$5.06	n.a.	↘	↘	↗
	Transit Passenger Miles[21], per capita	154.0	158.7	139.1	152.0	140.7	145.2	n.a.	↗	↗	↘
	Transit Operating Expense per passenger mile[22]	$0.68	$0.69	$0.74	$0.71	$0.75	$0.72	n.a.	↘	↘	↗
	Transit Revenue Miles[23], number	10,894,167	11,310,381	11,319,872	11,486,456	11,418,456	11,712,133	n.a.	↗	↗	↗
	Transit Revenue Miles[24], per capita	24.2	25.2	25.2	25.5	25.4	26.1	n.a.	↗	↗	↗
	Transit Operating Expense, per revenue mile[25]	$4.30	$4.32	$4.10	$4.20	$4.17	$4.01	n.a.	↘	↘	↘
	*Regional Households served by Transit[26], percent	n.a.	n.a.	n.a.	42.83%	n.a.	n.a.	n.a.	↗	n.a.	n.a.
	*Regional Employment served by Transit[26], percent	n.a.	n.a.	n.a.	53.47%	n.a.	n.a.	n.a.	↗	n.a.	n.a.
	*Bicycle to Work[27], percent	0.34%	0.46%	0.47%	0.51%	0.50%	0.52%	n.a.	↗	↗	↗
	*Drove Alone to Work[28], percent	81.89%	81.49%	81.51%	81.24%	81.66%	81.59%	n.a.	↘	↘	↗

Transportation Performance Measures Summary Table

Goals	Measure	2009	2010	2011	2012	2013	2014	2015	Desired Trend	1-year Trend	5-year Trend
Multimodal Connectivity & Access to Employment	*Pedestrian to Work[29], percent	1.55%	1.57%	1.65%	1.47%	1.56%	1.65%	n.a.	↗	↗	↗
	*Passenger Rail Ridership[30], number	296,216	313,026	375,226	404,700	439,525	427,426	435,199	↗	↗	↗
	Commercial Air Boardings[31]	1,649,284	1,651,131	1,571,155	1,582,565	1,597,913	1,671,096	1,740,380	↗	↗	↗
	Commercial Air Available Seat-Miles[32] Inbound, thousands	1,096,259	1,072,879	1,066,139	1,014,951	1,035,901	1,038,566	1,062,431	↗	↗	↘
	Commercial Air Available Seat-Miles[32] Outbound, thousands	1,079,124	1,043,167	1,045,854	1,007,221	1,026,515	1,025,401	1,042,401	↗	↗	↘
	*Commercial Air Non-Stop Destinations[33]	n.a.	n.a.	n.a.	n.a.	n.a.	16	17	↗	↗	n.a.
Safety and Security	*Highway Crashes, number[34]	17,505	17,423	18,428	18,348	18,430	18,228	19,750	↘	↗	↗
	Highway Crash Rate, per 100 million VMT[35]	163	157	168	168	160	165	n.a.	↘	↗	↗
	*Highway Fatalities, number[34]	94	85	90	70	83	76	92	↘	↗	↗
	Highway Fatality Rate, per 100 million VMT[35]	0.88	0.77	0.83	0.69	0.83	0.73	n.a.	↘	↘	↘
	Transit Crashes, number[36]	15	35	35	41	32	27	n.a.	↘	↘	↘
	Transit Crash Rate, per 100 million PMT[37]	34.5	80.8	101.8	108.8	101.8	88.12	n.a.	↘	↘	↗
	Transit Fatalities, number[36]	2	0	0	0	0	0	n.a.	↘	✓	✓
	Transit Fatality Rate, per 100 million PMT[37]	4.6	-	-	-	-	-	n.a.	↘	✓	✓
	Bicycle and Pedestrian Crashes, number[38]	290	344	441	425	386	382	353	↘	↘	↘
	Bicycle and Pedestrian Fatalities, number[38]	21	9	16	16	13	14	14	↘	→	↘
Preservation and Maintenance	*Interstate Pavement Condition, % rated fair or better[39]	n.a.	n.a.	n.a.	71.7%	75.1%	75.7%	76.7%	↗	↗	n.a.
	*Primary Pavement Condition, % rated fair or better[39]	n.a.	n.a.	n.a.	74.6%	79.4%	74.4%	72.5%	↗	↘	n.a.
	Interstate Bridge Sufficiency Rating, number[40]										
	Rated 0 - 49.9 (Eligible for Replacement)	n.a.	n.a.	n.a.	n.a.	6	8	9	↘	↗	n.a.
	Rated 50 - 80 (Eligible for Rehabilitation)	n.a.	n.a.	n.a.	n.a.	121	145	129	↘	↘	n.a.
	Rated 80.1 - 100 (Sufficient)	n.a.	n.a.	n.a.	n.a.	202	189	203	↗	↗	n.a.
	Interstate Bridge Sufficiency Rating, percentage[40]										
	Rated 0 - 49.9 (Eligible for Replacement)	n.a.	n.a.	n.a.	n.a.	1.8%	2.3%	2.6%	↘	↗	n.a.
	Rated 50 - 80 (Eligible for Rehabilitation)	n.a.	n.a.	n.a.	n.a.	36.8%	42.4%	37.8%	↘	↘	n.a.
	Rated 80.1 - 100 (Sufficient)	n.a.	n.a.	n.a.	n.a.	61.4%	55.3%	59.5%	↗	↗	n.a.
	Primary Bridge Sufficiency Rating, number[40]										
	Rated 0 - 49.9 (Eligible for Replacement)	n.a.	n.a.	n.a.	n.a.	26	26	26	↘	→	n.a.
	Rated 50 - 80 (Eligible for Rehabilitation)	n.a.	n.a.	n.a.	n.a.	151	150	140	↘	↘	n.a.
	Rated 80.1 - 100 (Sufficient)	n.a.	n.a.	n.a.	n.a.	306	294	303	↗	↗	n.a.
	Primary Bridge Sufficiency Rating, percentage[40]										
	Rated 0 - 49.9 (Eligible for Replacement)	n.a.	n.a.	n.a.	n.a.	5.4%	5.5%	5.5%	↘	→	n.a.
	Rated 50 - 80 (Eligible for Rehabilitation)	n.a.	n.a.	n.a.	n.a.	31.3%	31.9%	29.9%	↘	↘	n.a.
	Rated 80.1 - 100 (Sufficient)	n.a.	n.a.	n.a.	n.a.	63.4%	62.6%	64.6%	↗	↗	n.a.
	Deficient Bridges, number[41]	n.a.	n.a.	n.a.	n.a.	292	295	273	↘	↘	n.a.
	, percentage	n.a.	n.a.	n.a.	n.a.	20.7%	20.9%	19.2%	↘	↘	n.a.
	Average Age of GRTC Bus Fleet, years[42]	8.0	7.3	7.8	8.8	8.1	6.2	n.a.	↘	↘	↘

Transportation Performance Measures Summary Table

Footnotes

* Denotes performance measures included in '*Transportation Performance Measures Analysis Report*'

1. Annual hours of delay per peak period traveler in Richmond Urbanized Area, *2015 Urban Mobility Scorecard and Appendices* , Texas Transportation Institute
2. Annual gallons of fuel lost due to congestion per peak period traveler in Richmond Urbanized Area, *2015 Urban Mobility Scorecard and Appendices* , Texas Transportation Institute
3. INRIX Index in Richmond Urbanized Area, *2015 Urban Mobility Scorecard and Appendices* , Texas Transportation Institute
4. Annual congestion costs per peak auto commuter in Richmond Urbanized Area, *2015 Urban Mobility Scorecard and Appendices* , Texas Transportation Institute
5. Daily VMT per capita in Richmond Urbanized Area, FHWA Highway Statistics Series Annual Reports 2009-2013 Table HM-72
6. Ratio of Jobs to Households in Richmond PDC Area, Richmond TPO 2012-2040 Socioeconomic Data Report, Base year 2012
7. Regional Linear Jobs-Households Dissimilarity Index for Richmond PDC Area, BEA CA30 regional economic profile & American Community Survey Table B25002 5-Year Estimates
8. % of workers 16-older working in the county in which they live in Richmond PDC Area, American Community Survey Table B08007 5-Year Estimates
9. Mean travel time to work for workers 16 and older (not incl. work at home) in Richmond PDC Area, American Community Survey Table GCT0001 5-Year Estimates
10. Richmond PDC total population from Richmond TPO 2012-2040 Socioeconomic Data Report divided by Land Area in sq. miles for Richmond PDC Area in RRPDC GIS shapefile inventory
11. Annual eight-hour ozone exceedances at Richmond region's five air quality monitoring stations, data provided by Virginia Department of Environmental Quality
12. Annual daily multi-pollutant air-quality index exceeding 100 at Richmond region's five air quality monitoring stations, data provided by Virginia DEQ Air Quality Summary Report (2009-2014)
13. Truck and Rail mode share by Tons & Dollar Value of commodities, FHWA Freight Analysis Framework (FAF3) 2012 Provisional data
14. Containers of freight transported through the Port of Richmond for export & import by State Fiscal Year (ex. 2014 corresponds to FY 2015), data provided by Virginia Port Authority
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18. Number of registered vanpools with RideFinders, data provided by RideFinders 2011-2014
19. Annual unlinked transit trips per capita (transit service area population), National Transit Database 2009-2013
20. Transit Operating Expense per Passenger, calculated from National Transit Database data reported by GRTC (Annual Operating Expenses, Total / Annual Unlinked Trips, Total)
21. Annual transit passenger miles (cumulative sum of the distances ridden by each passenger) per capita (transit service area population), National Transit Database 2009-2013
22. Transit Operating Expense per Passenger Mile, calculated from National Transit Database data reported by GRTC (Annual Operating Expenses, Total / Annual Transit Passenger Miles)
23. Annual transit revenue miles (vehicle miles traveled while in revenue service) per capita (transit service area population), National Transit Database 2009-2013
24. Annual transit revenue miles per capita (transit service area population), National Transit Database 2009-2013
25. Transit Operating Expense per Revenue Mile, calculated from National Transit Database data reported by GRTC (Annual Operating Expenses, Total / Annual Vehicle Revenue Miles)
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33. Number of non-stop commercial air destinations via Richmond International Airport, data as of March 2015 from RIC route map at flyrichmond.com/index.php/route-map
34. Number of Highway Crashes and Fatality Crashes in Richmond PDC Jurisdictions, data collected from VDOT Traffic Engineering Division Tableau Crash Analysis Tool
35. Highway Crash and Fatality Rates per 100 Million VMT in Richmond PDC Jurisdictions, data provided by VDOT Traffic Engineering for Highway Crashes, Fatality Crashes and Daily VMT
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37. Transit Crashes (non-preventable) and Transit Fatalities, data provided by GRTC; Annual Transit Passenger Miles (Bus), from National Transit Database data reported by GRTC
38. Bicycle and Pedestrian Crashes and Fatalities in Richmond VDOT District, from Virginia DMV Traffic Records Electronics Data System
39. Interstate and Primary Pavement Condition in VDOT Richmond District, VDOT State of Pavement Reports (2012-2014)
40. Bridge Sufficiency Rating and Bridge Sufficiency Rating as Percentage of all bridges in Richmond PDC area, data provided by VDOT
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42. Average Age of GRTC Bus Fleet in years, from National Transit Database data reported by GRTC

TRANSPORTATION PERFORMANCE MEASURES
ANALYSIS REPORT

TRANSPORTATION PERFORMANCE MEASURES ANALYSIS REPORT

This report provides an analysis of selected data points and data sources, evaluation of trends, and connections to studies, programs and projects which contribute to meeting the region's plan2040 goals. A few notes on the analysis report:

- The analysis is organized into sections which correspond to goal categories from "Transportation Performance Measures Summary Table" and align with the plan2040 regional transportation goals as approved by the RRTPO.
- The introduction page for each section highlights the RRTPO UPWP work efforts, and/or other studies, programs and projects that demonstrate planning emphasis toward regional transportation goals.
- The "Inside the Numbers" component provides a deeper analysis of selected data points within each goal area.
- The "Project Highlight" links the intended outcomes and benefits of projects underway or nearing construction to the plan2040 regional transportation goals.

PLANNING, PROGRAMMING & PROJECT DELIVERY

The RRTPO partners with the FHWA, Federal Transit Administration, VDOT and DRPT to plan, program and deliver transportation projects in the Richmond region.

MAP-21 Project Delivery Goal:

"To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices."

In order to be good stewards of public funds, the U.S. Department of Transportation has increasingly emphasized the monitoring of federally-funded transportation projects and programs to ensure on-time and on-budget completion. RRTPO continually collects information and monitors progress on projects funded in the RRTPO Transportation Improvement Program (TIP). To advance this effort, VDOT will need to provide expenditure data for TIP projects on a routine basis.

The RRTPO is particularly interested in on-time and on-budget delivery of Congestion Mitigation and Air Quality (CMAQ) and Regional Surface Transportation Program (RSTP) projects. The RRTPO has the lead responsibility for selecting projects and allocating these federal funds. Through a competitive prioritization and selection process, the RRTPO is responsible for the allocation of over $24 million in federal funds each year.

Photo Credit: Meghan Gough

Planning

Programming

Photo Credit: VDOT

Project Delivery

Inside the Numbers

The **Transportation Improvement Program (TIP),** provides a four-year program of federal, state and locally funded transportation projects that require RRTPO approval for obligation of public funds. Obligation of funds means that the project has been authorized to spend the funds and advance from preliminary engineering to construction. The current FY 15- FY 18 TIP includes more than 200 projects with $667 million in planned obligations. The TIP is multimodal and multijurisdictional, including highway, transit, intermodal, bicycle and pedestrian projects across the region.

For **CMAQ** and **RSTP**, the RRTPO has responsibility for project selection and allocation of funds. Figure 1 details the funding allocated by the RRTPO since the early 1990s when federal transportation legislation provided MPOs greater programming authority. The two programs have grown from a combined total of around $13 million available annually in 1994 to a combined total of around $24 million allocated by the RRTPO in recent fiscal years. The policy of the RRTPO has been to allocate these funds consistent with federal regulations to advance regional priority projects and leverage other fund sources to complete significant projects.

208

Highway and Transit Projects in the FY 15- FY 18 RRTPO TIP with

$667,638,128

in FY 15- FY 18 Federal Obligations

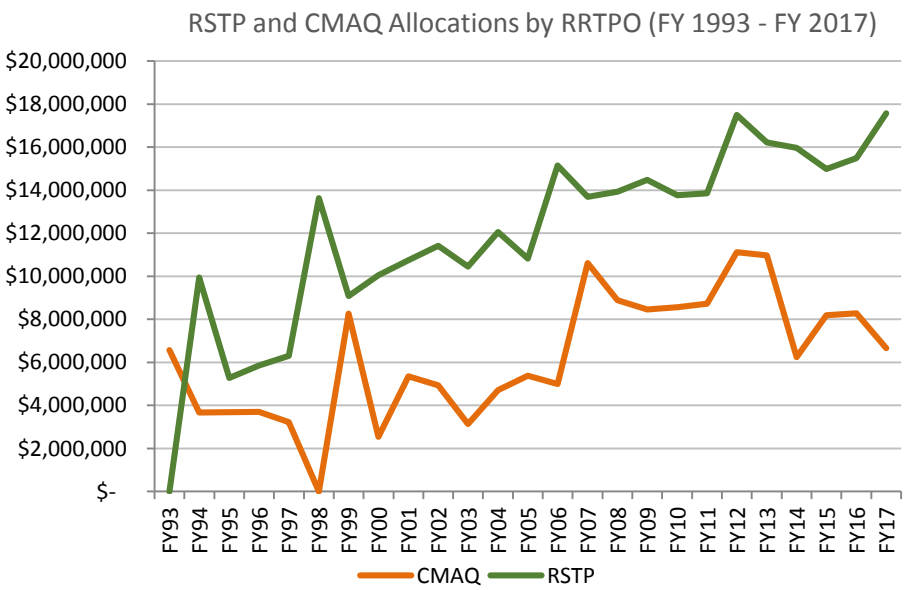


Figure 1: RSTP and CMAQ Allocations by RRTPO

plan2040 REGIONAL TRANSPORTATION GOALS

goals & objectives

Access to Employment

Provide for transportation system connections to areas of employment density and key activity centers, with an emphasis on connecting to areas of high poverty rates.

Congestion Mitigation

Support transportation system improvements that address existing and expected future traffic congestion.

Freight Mobility

Enhance freight corridors and intermodal connections to facilitate goods movement into, within and out of the region.

Environment & Air Quality

Provide for project alternatives that protect and enhance the region's natural resources.

Safety & Security

Provide for transportation improvements that increase safety and security for system users.

Multimodal Connectivity

Improve accessibility and interconnectivity of various transportation modes for all system users.

Preservation & Maintenance

Ensure that existing transportation infrastructure and facilities achieve a constant state of good repair.

System Reliability

Implement technologies and programs to improve travel times and support the ease of travel throughout the region.

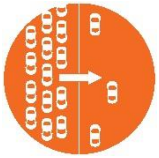
Transportation & Land Use Integration

Support transportation investments that meet the needs of existing and future land use and development patterns.

plan2040

CONGESTION MITIGATION & SYSTEM RELIABILITY

plan2040 Goals:



Support transportation system improvements that address existing and expected future traffic congestion.

Implement technologies and programs to improve travel times and support the ease of travel throughout the region.

The RRTPO works toward the goals of congestion mitigation and system reliability through the Congestion Management Process (CMP). The CMP is a component of the RRTPO work program, and a requirement of Metropolitan Planning Organizations. The Federal Highway Administration (FHWA) defines the CMP as a systematic and regionally-accepted approach for managing congestion that provides accurate, up-to-date information on transportation system performance. This information is used to assess alternative strategies for congestion management that meet state and local needs. For a thorough analysis of the region's congestion issues and strategies see the Congestion Management Process Technical Report completed as part of plan2035.

The following performance measures provide a regional scale look at congestion, including trends over time and comparisons to peer and comparably sized metropolitan areas. This analysis relies on data from studies released by INRIX and the Texas Transportation Institute (TTI). Currently, the TTI Urban Mobility Report is the industry standard for congestion data. The TTI report includes information on the amount of time travelers in 100 urbanized areas spend in congestion, fuel loss and other costs by auto commuters due to congestion.

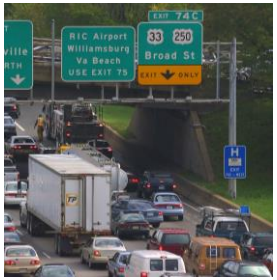


Photo Credits: Virginia Department of Transportation

Inside the RRTPO Work Program

The **Congestion Management Process (CMP) Technical Report** is an evaluation of the current conditions of the Richmond region's transportation network in terms of operations and safety. This thorough analysis of the regional roadway network is used to identify congested corridors and safety needs, and includes strategies to alleviate the identified issues.

Update work on the CMP is conducted as an element of the Metropolitan Transportation Plan update. The RRTPO will finalize and consider adoption of plan2040 and the CMP Technical Report in FY 2017.

Inside the Numbers

Annual hours of delay per peak auto commuter is a measure of the extra travel time incurred annually by a person driving at congested peak hour speeds than what would be experienced by the same person driving at free-flow condition. As indicated by Table 1, TTI estimates in the most recent Urban Mobility Report that a peak period auto commuter in the Richmond region experienced a total delay of 34 hours over the course of calendar year 2014, or about 8 minutes per work day.

As a part of the Urban Mobility Report, TTI groups metropolitan areas into categories (very large, large, medium and small) based on population. In the most recent report the Richmond region was defined as a large urban area. As seen in Figure 2, the expected annual delay of peak period auto commuters in the Richmond region has been consistently lower than comparably sized 'large urban areas' and fairly consistently below the expected delay of residents in 'medium urban areas'. The data seems to indicate that at a regional scale, the highway network in Richmond allows for easier, more reliable movement of workers as compared to most other metros. This scale of analysis is interesting in drawing broad conclusions about the state of congestion in the Richmond region, but such a scale may overlook the well-known spot areas of daily congestion where opportunities for applying mitigation strategies still exist.

Note: Analysis to be updated pending the release of TTI 2016 Urban Mobility Report.

Annual Hours of Delay Per Peak Richmond Region Auto Commuter						Desired Trend	1-year Trend	5-year Trend
2009	2010	2011	2012	2013	2014			
33	33	33	33	34	34	↘	→	↗

Table 1: Annual Hours of Delay in Richmond Urbanized Area, TTI 2015 Urban Mobility Report

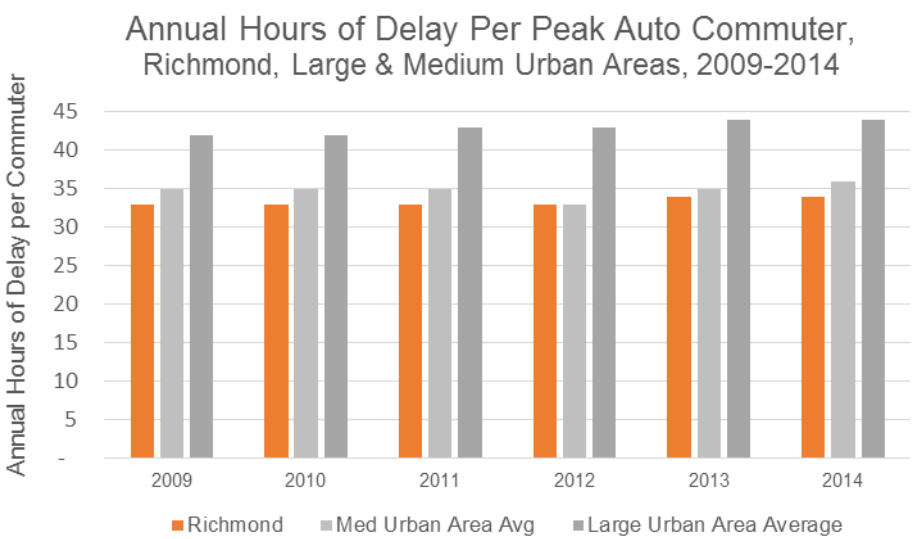


Figure 2: Annual Hours of Delay by Urban Area, TTI 2015 Urban Mobility Report

Inside the Numbers

Travel Time Index is a ratio measure of travel time in the peak period to travel time at free-flow conditions. As an example, a Travel Time Index of 1.13 in the Richmond region indicates that a 20-minute free-flow trip would be expected to take about 22 minutes and 36 seconds during the peak commuting period. This metric can be interpreted as the daily, rather than annual, effect of congestion on the peak auto commuter. As seen in table 2, the Travel Time Index for the Richmond region has held relatively steady since 2009.

An interesting application of this measures is to assess how congestion impacts travel times in our region as compared to the 'peer regions' as established in the Richmond Regional Comprehensive Economic Development Strategy (CEDS). As indicated in figure 3, the Richmond region may have a competitive advantage and/or higher level of attractiveness for traffic averse businesses and residents as compared to these six peer regions. As an economic development strategy, marketing the relatively low levels of traffic congestion may signal businesses in their locational decisions as well as residents interested in a certain quality of life outside the commute, to consider the Richmond Region favorably over some the more congested peers. A goal of the RRTPO is to maintain favorable system performance as the region continues to grow.

Note: Analysis to be updated pending the release of TTI 2016 Urban Mobility Report.

Travel Time Index, Richmond Region						Desired Trend	1-year Trend	5-year Trend
2009	2010	2011	2012	2013	2014			
1.12	1.12	1.12	1.12	1.13	1.13			

Table 2: INRIX Travel Time Index for Richmond Urbanized Area, TTI 2015 Urban Mobility Report

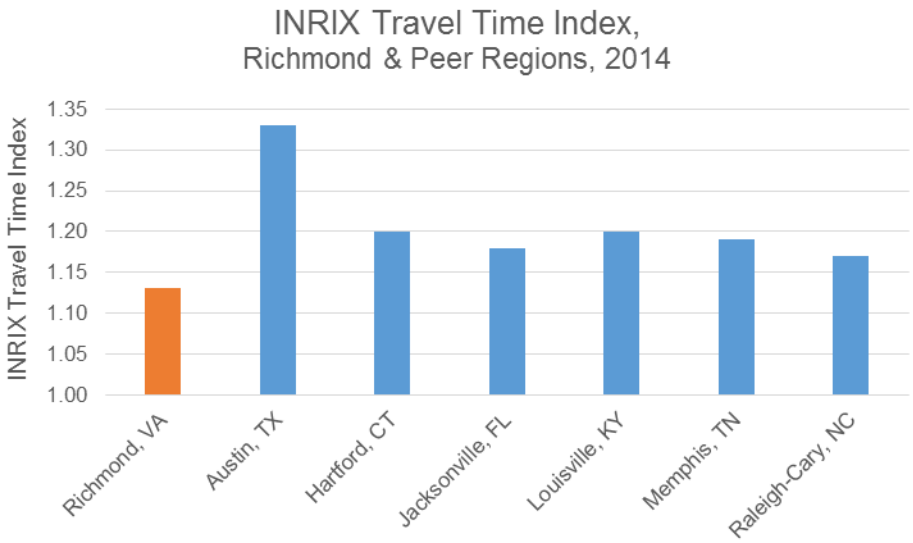


Figure 3: INRIX Travel Time Index by CEDS Peer Region , TTI 2015 Urban Mobility Report

Project Highlight

Parham Road and Patterson Avenue Intersection

As evidenced by the preceding statistics, the Richmond region as a whole does not face significant challenges with congestion compared to similar-sized urban areas. However, it is important to recognize that improvements are needed at well-known spot areas of daily congestion where opportunities for applying mitigation strategies exist. A good example of such a project, an RRTPO priority project connected to the goal of supporting system improvements that address existing and expected future traffic congestion, is the planned improvement to the intersection of Parham Road and Patterson Avenue (Route 6) in western Henrico County.

The Parham and Patterson Intersection Improvement Project (UPC #101034) will address the high volume of vehicles traveling these two heavily-trafficked corridors, while also making the intersection safer. Based on CMP analysis of INRIX travel time index data, this intersection currently experiences both A.M. and P.M. peak period congestion. The improvements include installation of dual left-turn lanes on Patterson Avenue's eastbound and westbound approaches to the intersection, as well as Parham Road's northbound approach. This $14 million project is funded through a combination of RRTPO allocations of CMAQ and RSTP, along with funds received through the Virginia SMART SCALE competitive funding process.

Parham and Patterson Intersection viewed from NW corner

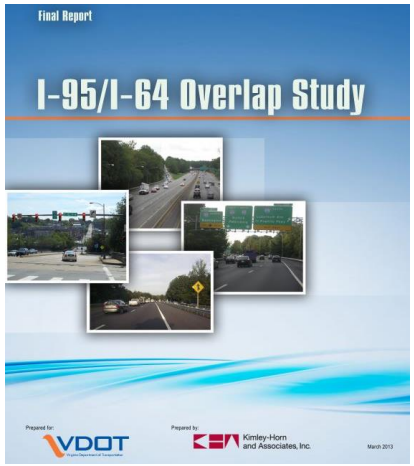
Figure 3: PM Peak Hour Travel Time Index – Red indicates TTI > 2.5, or an over 60% increase in travel time through segment than what would be experienced by the same person driving at free-flow condition.

Project Highlight

Bryan Park Interchange – I-95/I-64 Overlap Study

The I-95/I-64 Overlap Corridor provides another case study of spot daily congestion where opportunities for mitigation strategies exist. In 2013, VDOT completed the I-95/I-64 Overlap Study which identified potential transportation capacity and safety improvements within the study area. Several improvement projects, both short- and long-term concepts, were identified as part of this study. The I-95/I-64/I-195 interchange (known as the Bryan Park Interchange) is not only a hotspot of daily peak hour congestion but also experiences a high volume of crashes. The Overlap Study found that three of the five ramps with the highest crash severity throughout the corridor were located in the merges and diverges at the Bryan Park Interchange. Major bottlenecks in the study area include the eastbound I-64 to northbound I-95 and the northbound I-95 to westbound I-64 movements through the Bryan Park interchange.

Working with VDOT, a number of projects have been advanced from the Overlap Study. As of this report, only two of the short-term project concepts have yet to be funded for construction. A total of five SMART SCALE applications for projects recommended in the Overlap Study have been recommended by the RRTPO. The RRTPO is working with VDOT to reassess feasibility and prioritize the larger, more expensive, long-term type project concepts for future rounds of SMART SCALE.



TRANSPORTATION AND LAND USE INTEGRATION

plan2040 Goal:

Support transportation investments that meet the needs of existing and future land use and development patterns.

As the designated Metropolitan Planning Organization (MPO) for the Richmond region, the RRTPO is charged with undertaking a continuing, cooperative and comprehensive planning process. A key component of this process is confirming that federal and state funded transportation investments will be consistent with, and support local land use and development plans. The RRTPO process must account for bottom-up pressure, the transportation impact of land-use and development decisions made at each local jurisdiction, while also understanding top-down pressure that transportation investment decisions will have on regional growth patterns, land-use demand, and mode choice.

The following performance measures provide a lens for understanding the connection between existing land use and commuting patterns (note: for information on transportation mode-choice, refer to Multimodal Connectivity). The following analysis relies on data from the U.S. Census Bureau American Community Survey, FHWA's Highway Statistics Series, and RRTPO's *Socioeconomic Data Report 2012-2040* and *Socioeconomic Analysis Report 2012-2040*.

Inside the RRTPO Work Program

The RRTPO is now applying the **Richmond Regional Travel Demand Model** and building capacity to support future corridor plans and studies to inform plan2045, the regional long-range plan which will be adopted in 2021.

In FY 2015, the RRTPO completed an update to the Richmond Regional Socioeconomic Data Forecast which provides base year (2012) and forecasted (2040) population and employment at small geographic units for the entire Richmond region. The Regional Travel Demand Model utilizes this data to forecast future traffic volumes and identify deficiencies in the transportation network. This tool can be used in scenario planning applications to more fully explore the impacts and linkages between land use development patterns and the transportation network necessary to accommodate growth.

Inside the Numbers

Daily Vehicle Miles Traveled (DVMT) per capita is a measure broadly describing the average distance each auto driver travels from their home for their daily trips. This measure can be used to indicate a greater density of services and jobs relative to the location of housing, an appropriate indicator for the connection between transportation and land use.

As indicated by Table 3, the DVMT per capita in the Richmond region held steady and slightly decreased over the 2010 to 2013 period, however, the data for 2014 shows the first increase in DVMT since 2010. It is important to note that trends in aggregate VMT can be influenced by a variety of factors, for example the economic downturn of 2008-2009 correlated to a significant decrease in VMT nationally over that time period. For 2014, it could be reasonably assumed that increased DVMT in the Richmond region was related to falling gas prices experienced in that year. As a result of multiple variables impacting DVMT, the RRTPO tracks this measure but has not established a desired trend for increasing or decreasing DVMT over time.

As with Travel Time Index in the previous section, it is interesting to evaluate how DVMT in the Richmond region compares to the peer regions established in the *Richmond Regional Comprehensive Economic Development Strategy (CEDS)*. As indicated in Figure 4, the Richmond region compares favorably in that any given resident of the Richmond region would be expected to drive fewer miles to meet their daily work, shopping or entertainment needs than the average resident of peer regions.

Daily VMT Per Capita in Richmond Region						Desired Trend	1-year Trend	5-year Trend
2010	2011	2012	2013	2014	2015			
27.9	27.7	27.6	27.4	28	n.a.	n.a.	↗	↗

Table 3: Daily VMT in Richmond Urbanized Area, FHWA Highway Statistics Series

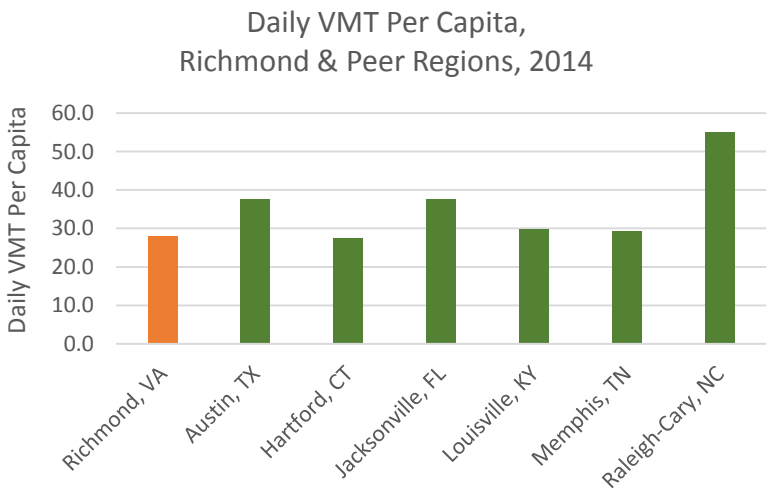


Figure 4: Daily VMT Richmond and Peer Regions, FHWA Highway Statistics Series

Inside the Numbers

Jobs-to-Housing Ratio, indicates the relative jobs and housing balance within each jurisdiction in the Richmond region, and in aggregate, the region as a whole. If a large mismatch between employment and housing exists in a locality, significant in-commuting or out-commuting would be expected, creating additional strain on the regional transportation system and adding to household transportation costs. The jobs-to-housing ratio for the region in 2012 is shown in Table 4. This provides a high-level view of the variation in jobs/housing balance across RRTPO jurisdictions.

Jobs to Housing Dissimilarity Index, is an additional measure to evaluate the regional balance of jobs and households. The index ranges from 0 to 1.0, with a score of 0 indicating a region that is completely balanced (i.e. every county has the same number of households and jobs assuming one job per household) while an score of 1.0 indicates unbalanced (i.e. every county has either all households or all jobs). In the Richmond region, as indicated in the figure at right, the dissimilarity index has consistently decreased, moving toward 0, from 2011 to 2014 which indicates a trend toward more balance. The two measures give a high-level view, but are somewhat limited by the inherent, built-in assumption that workers would necessarily have a job in the locality in which they live, if a supply of jobs were to exist, which is not always the case.

Jurisdiction	Jobs	Households	Jobs-to-HH Ratio
Charles City	1,419	2,979	0.48
Chesterfield	116,434	116,981	1.00
Goochland	12,509	8,081	1.55
Hanover	45,888	37,234	1.23
Henrico	178,665	127,720	1.40
New Kent	3,653	7,149	0.51
Powhatan	5,406	9,635	0.56
Richmond	146,268	90,266	1.62
Richmond Region	**510,242**	**400,045**	**1.28**

Table 4: Jobs, to Household Ratio, 2012 Base Year, RRTPO Socioeconomic Forecast (2015)

Regional Jobs to Households Dissimilarity Index						Desired Trend	1-year Trend	5-year Trend
2009	2010	2011	2012	2013	2014			
0.066	0.0596	0.061	0.0555	0.0485	0.0472	<.5	✓	✓

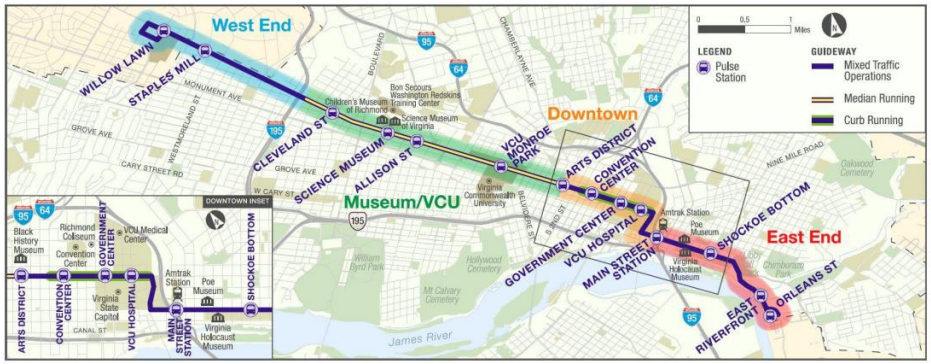
Table 5: Regional Linear Jobs to Households Dissimilarity Index, RRTPO analysis of Bureau of Economic Analysis, CA30 Regional Profiles and ACS 5-Year Estimates

Project & Program Highlight

Construction for the **GRTC Pulse Bus Rapid Transit (BRT)** began in the fall of 2016. Upon completion in the fall of 2017, this project will introduce high capacity, high frequency bus service expected to cut bus travel times in half along the 7.6-mile corridor from Rockett's Landing to Willow Lawn Shopping Center along West Broad Street and East Main Street (see map at right).

In order to capture the full benefits of this project, the City of Richmond, DRPT, and Richmond Regional PDC/TPO have partnered on a study which connects and integrates transportation and land use planning.

The **BRT Connectivity and Land-Use Analysis Plan,** included in the FY 2017 RRTPO Unified Planning Work Program, is a study of current land use and socioeconomic analysis to guide future land use decisions along the Pulse corridor. More than 33,000 residents and 77,000 jobs are located within a half-mile radius of station stops, and population density is only expected to increase along the Pulse corridor. This plan examines the existing conditions of the area to determine what changes could be made to maximize transit access, ridership, and development opportunities around BRT stations. Consideration of transit-oriented development (TOD) forms the basis of the plan along with recommendations to encourage land use design and walkability that will complement the BRT line.



Map of Pulse Corridor with station locations, courtesy of GRTC

Photo Credit: GRTC

ENVIRONMENTAL & AIR QUALITY

***plan2040 Goal*:**

Provide for project alternatives that protect and enhance the region's natural resources.

Another important responsibility of the RRTPO is understanding how regional transportation investments impact the region's natural environment. Every transportation project constructed has an impact on the environment. It is a goal of the RRTPO to select those projects that mitigate negative environmental impacts. On one hand, investments in transportation infrastructure can increase mobility for commuters and freight, resulting in economic benefits to residents of the region. On the other hand, these same investments may contribute to far-ranging environmental externalities from mobile source emissions, degradation of environmentally sensitive lands and waters, to noise and vibration impacts.

Presently, the measuring of performance related to environmental impacts is the least robust section in the annual report. This limitation can be primarily attributed to a lack of data available at the regional scale for many potential measures. A set of potential measures are being researched for consideration in future updates of this report. The following analysis relies on Ozone and Air Quality data as monitored by the Virginia Department of Environmental Quality and the U.S. Environmental Protection Agency.

Smog over city skyline in July 2010
Photo Credit: Richmond Times-Dispatch

Inside the RRTPO Work Program

As a core component of the federally mandated MPO process, RRTPO planning & programming documents must comply with the U.S. Environmental Protection Agency (EPA) **Air Quality Conformity** Requirements**.** As of FY 2017, the Richmond region has been designated as an air-quality attainment area, meaning the region's concentrations of criteria pollutants are below national standards. In an effort to monitor and maintain the attainment designation, the RRTPO has participated in developing an annual Ozone Advance Action Plan with the Virginia Department of Environmental Quality (DEQ).

Inside the Numbers

An **Ozone Exceedance**, is an occurrence of the Ozone (O3) criteria pollutant exceeding the EPA designated parts-per million threshold at any of the five air quality monitoring stations in the Richmond region. Ozone is one of six common (criteria) pollutants for which the EPA sets national air quality standards and the research suggests presence of Ozone can be correlated to high rates of automobile usage in an area and/or emissions from burning low-quality gasoline. Table 6 indicates a steep drop-off in ozone exceedances at monitoring stations in the region after 2012, but a slight year over year uptick since 2013. Important to note that Ozone exceedances cannot be directly linked to transportation and automobile usage, factors such as changes in atmospheric conditions or decreased industrial emissions must also be considered.

Air Quality Index (AQI), is an index reporting air quality for all six criteria air pollutants. AQI is a health-based index, on a daily basis it tracks how clean or polluted the air is and what associated health effects might be a concern. Table 7 shows the number of days in the Richmond region when the AQI exceeded 100, which indicates air quality conditions that are at a minimum unhealthy for sensitive groups (older adults, children, people with lung disease) and at a certain level considered unhealthy to the general public. In comparing these tables, the exceedances track consistently aside from 2011 where the region experienced a number of Sulfur Dioxide (SO2) caused exceedances. SO2 is generally linked to point source industrial emissions, rather than mobile source transportation related emissions.

Annual # of days with Ozone Level Exceedances*						Desired Trend	1-year Trend	5-year Trend
2010	2011	2012	2013	2014	2015			
25	22	15	1	2	3			

Table 6: U.S. EPA AirData, Virginia Department of Environmental Quality
* Note: data reflects new 2015 EPA Ozone Standard (.070ppm)

Annual # of days Air Quality Index Exceedances*						Desired Trend	1-year Trend	5-year Trend
2010	2011	2012	2013	2014	2015			
25	40	15	1	2	3			

Table 7: U.S. EPA AirData, Virginia Department of Environmental Quality
* Note: data reflects new 2015 EPA Ozone Standard (.070ppm)

Project Highlight

GRTC replacement of bus fleet with CNG buses

The Greater Richmond Transit Company (GRTC) is currently undergoing a multiyear transition to an all Compressed Natural Gas (CNG) bus fleet. Early research on the air quality impact of CNG buses indicates that new CNG buses have significantly lower emissions of Nitrogen Oxide (NOx), Particulate Matter (PM), and Hydrocarbon (HC) than the older (12 years old) diesel buses that they replace[1]. According to EPA's MOVES emissions model, a model year 2012 CNG bus emits 80 percent less NOx, 99 percent less PM, and 100 percent less HC than a model year 2000 diesel bus[1].

According to GRTC, a total of 28 new CNG buses were ordered in 2015 to replace retired diesel vehicles. Delivery of the new alternative fuel vehicles is expected for spring 2017. This order included 10 40-foot BRT Pulse buses, 10 40-foot fixed route buses, four 35-foot fixed route buses and four 30-foot fixed route buses. Additionally, GRTC accepted delivery of 12 CNG Specialized Transportation buses in January 2016. As of 2016, GRTC operates a total of 42 CNG fixed route buses and 42 CNG Specialized Transportation buses. Upon delivery of the new vehicles in 2017, GRTC will have a total CNG fleet of 112 buses.

The RRTPO has supported GRTC's efforts to transition to CNG by allocating discretionary Congestion Mitigation and Air Quality (CMAQ) funds. In 2016, the RRTPO supported a funding request for nearly $600,000 in CMAQ to fund the local-level funding gap in replacing diesel-fueled vehicles with alternative fueled vehicles. As FTA funding is structured currently, GRTC is only eligible to receive direct FTA funding for replacement value of retired vehicles; any incremental cost for a more expensive replacement (such as a CNG bus) becomes the responsibility of the transit agency to make up the difference. In this case, the RRTPO voted unanimously to support GRTC in their transition to the lower emitting technology.

Photo Credit: GRTC

1 "Clean Diesel versus CNG Buses: Cost, Air Quality, & Climate Impacts"; Analysis by Dana Lowell of M.J. Bradley & Associates. http://www.catf.us/resources/publications/files/20120227-Diesel_vs_CNG_FINAL_MJBA.pdf

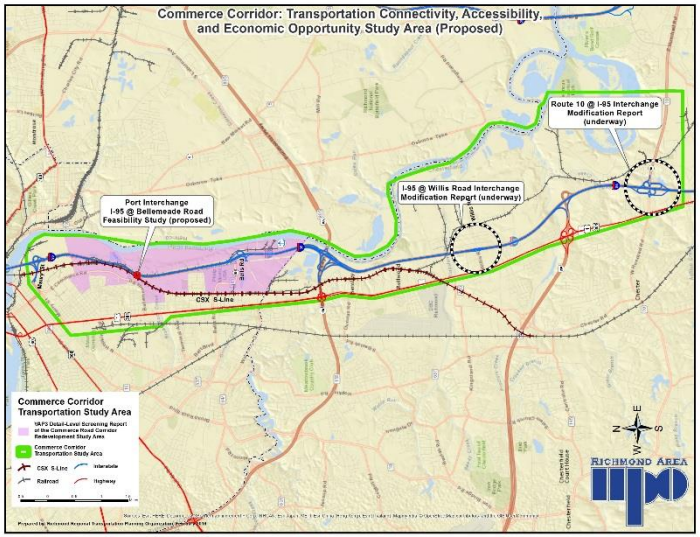
FREIGHT MOBILITY

plan2040 Goal:

Enhance freight corridors and intermodal connections to facilitate goods movement into, within and out of the region.

Over the last decade, the RRTPO has followed the lead of U.S. DOT and Federal transportation funding authorization bills which have placed an increasing emphasis on the incorporation of freight issues into the policy, planning and programming activities of metropolitan planning organizations. As freight traffic continues to increase nationally, more goods are moving into, within and out of the Richmond region along major freight corridors such as I-95 and I-64.

Given the Richmond Region's unique locational advantages, with proximity to Deepwater ports and major markets, the *Richmond Regional Comprehensive Economic Development Strategy (CEDS)* identifies logistics, distribution, and supply-chain management as an emerging industry cluster in the region. For freight to catalyze economic development, the region must capture the value of freight activities through increased employment and private sector capital investments as opposed to only bearing the infrastructure maintenance costs as a freight pass-through community. The following measure and analysis of Richmond Marine Terminal container volumes relies on data provided by the Port of Virginia.



Inside the RRTPO Work Program

The **Commerce Corridor Transportation Study** will capitalize on the regional opportunity provided by the Richmond Marine Terminal, operated by Port of Virginia, and identify short-, medium-, and long-term transportation infrastructure investments for the vital industrial and commercial corridor along 13-miles of Interstate 95 from the James River to Route 10.

This study is scheduled for completion in FY 2017 and is led by the RRTPO with financial and consultant support provided by the Secretary of Transportation's Office of Intermodal Planning and Investment (OIPI).

Inside the Numbers

Container Volumes at the Richmond Marine Terminal (RMT) have grown steadily year-over-year since FY 2013. In FY 2012, the RMT (owned by the City of Richmond) began operating as part of the Port of Virginia system of deepwater and inland ports. A key aspect of RMT operations is the "64 Express" James River barge which currently operates service three days per week carrying containers between the RMT and POV's deepwater facilities in Hampton Roads. The 64 Express pilot project continues to receive funding support through RRTPO allocations of Congestion Mitigation and Air Quality (CMAQ). This project reduces congestion, and improves air quality due to the significant number of trucks taken off of I-64 and US 460 with each sailing.

The pilot barge service has proven quite successful, as evidenced by year-over-year growth in container volumes through the RMT (Figure 5). The growth in container volumes through RMT is likely to continue as new business is pursued and more frequent barge sailings are considered. Additionally, in 2015 the POV reached an agreement with the City of Richmond to extend the terms of the operating lease to a 40-year relationship. With the RMT now part of the POV system, areas adjacent to the port terminal, as well as other areas throughout the region, have become more attractive locations for freight-related businesses in logistics, distribution and warehousing.

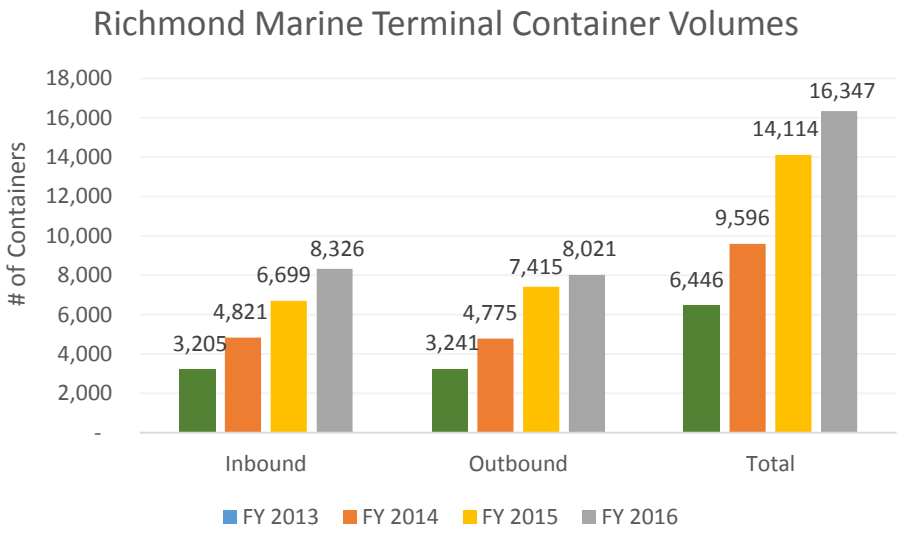


Figure 5: Container volumes at Richmond Marine Terminal by Fiscal Year, data provided by the Port of Virginia

Project Highlight

With the goal of enhancing freight corridors and intermodal connections to facilitate goods movement into, within and out of the region, the RRTPO has dedicated significant planning and programming resources toward advancing projects both inside and outside the gates of the Richmond Marine Terminal.

The RRTPO has supported a number of roadway projects including the extension of Deepwater Terminal Road (UPC #104882) funded with $1.75 million in RSTP, and improvements to Commerce Road (UPC #15958) supported with $2 million in CMAQ. Inside the gates of RMT, the RRTPO supported the 64-Express Barge (UPC #90354) service with CMAQ from FY 2009-2011, and the procurement of a modern Liebherr mobile harbor crane (UPC #104891) with over $4 million in CMAQ funds.

In 2016, the RRTPO Board approved over $2 million in RSTP funds for the RMT Intermodal Transfer Improvements project (UPC #109266). The project includes the repaving of the north wharf area, where the new mobile harbor crane is in operation. Also included is the reconstruction of dilapidated rail crossings at the five key cross points within the port complex. Funding will also help replace the fenders along the wharf wall, which facilitate cargo transfer and will increase safety during the transfer process. These improvements will improve site operations and provide the ability for increased freight movement at the port.

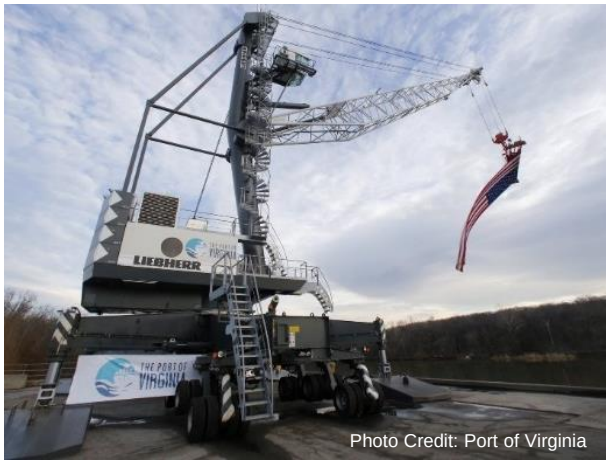
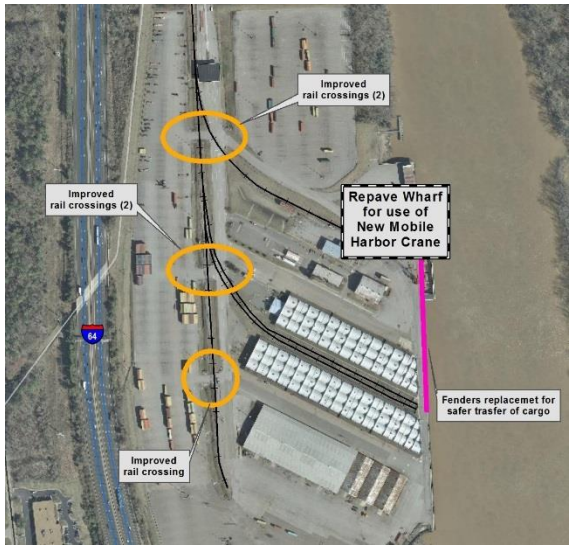


Photo Credit: Port of Virginia



Locations of RMT Intermodal Transfer Improvements (UPC #109266)

MULTIMODAL CONNECTIVITY & ACCESS TO EMPLOYMENT

plan2040 Goals:

Improve accessibility and interconnectivity of various transportation modes for all users.

Provide for transportation system connections to areas of employment density and key activity centers, with an emphasis on connecting areas of high poverty rates.

In developing the Metropolitan Transportation Plan (MTP), the RRTPO is required by federal regulations to take a multimodal approach to the long-range planning of major transportation investments. The MTP is a plan for projects to meet future travel needs for automobiles, buses, car and vanpools, passenger rail, bicycles and pedestrians, and freight by water, truck and rail. In addition to planning for connectivity between modes, plan2040 includes project selection criteria accounting for a projects impact on "access to employment." Connecting people and housing density to jobs and employment density by various transportation modes is a core component of the RRTPO process.

The following measures highlight multimodal connectivity for both the intra-regional (means of transportation to work, transit access) and inter-regional (intercity rail and air) travel markets.

Photo Credit: GRTC

Photo Credit: National Corridors Initiative

Inside the RRTPO Work Program

The Virginia Department of Rail and Public Transportation (DRPT) is leading the development of the **Greater RVA Transit Vision Plan** for the Richmond region. The RRTPO is a participating agency in this work effort which began in August 2015. The plan spans two fiscal years with completion scheduled for October 2016, and has been included in both the FY 2016 and FY 2017 Unified Planning Work Programs. The plan will examine gaps in the region's transit service, existing and future population and employment conditions, travel patterns and land use and development patterns in order to develop a regional vision for transit. Continued outreach for this plan includes a regional transit forum and coordinated stakeholder and public engagement, which will inform the alternative analysis and development of recommendations.

Inside the Numbers

Means of Transportation to Work data is gathered by the U.S. Census Bureau in the American Community Survey (ACS). The ACS includes a much smaller sample size than the decennial census, therefore the results are expected to have a higher margin of error and more variability. In the ACS, respondents are asked to indicate "How did you usually get to work last week?" and respondents can only select a single mode. It is therefore assumed that survey respondents answer with their most commonly used mode, even if on occasion they choose a alternative mode. Additionally, respondents who chain their trip across multiple modes are asked to answer with the mode that is used for the longest distance leg of the overall trip.

In spite of the assumptions and limitations described above, the ACS Journey-to-Work is generally agreed to be the industry standard data source for understanding commuter mode choice at the jurisdictional, regional, state and/or national scale. As Figure 6 indicates, the Richmond region is primarily an auto-commuting region; over 90 percent of all commuters drive alone or carpool as their primary means of transportation to work, while active transportation modes (bicycling and walking) and public transit comprise about 4 percent of total commuter mode share in the region.

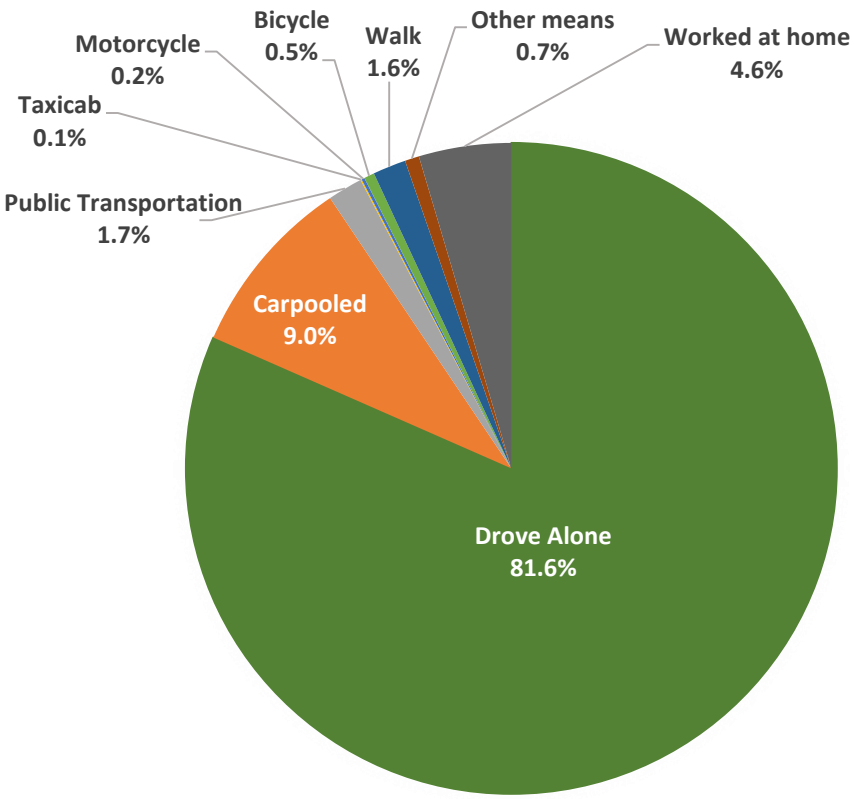
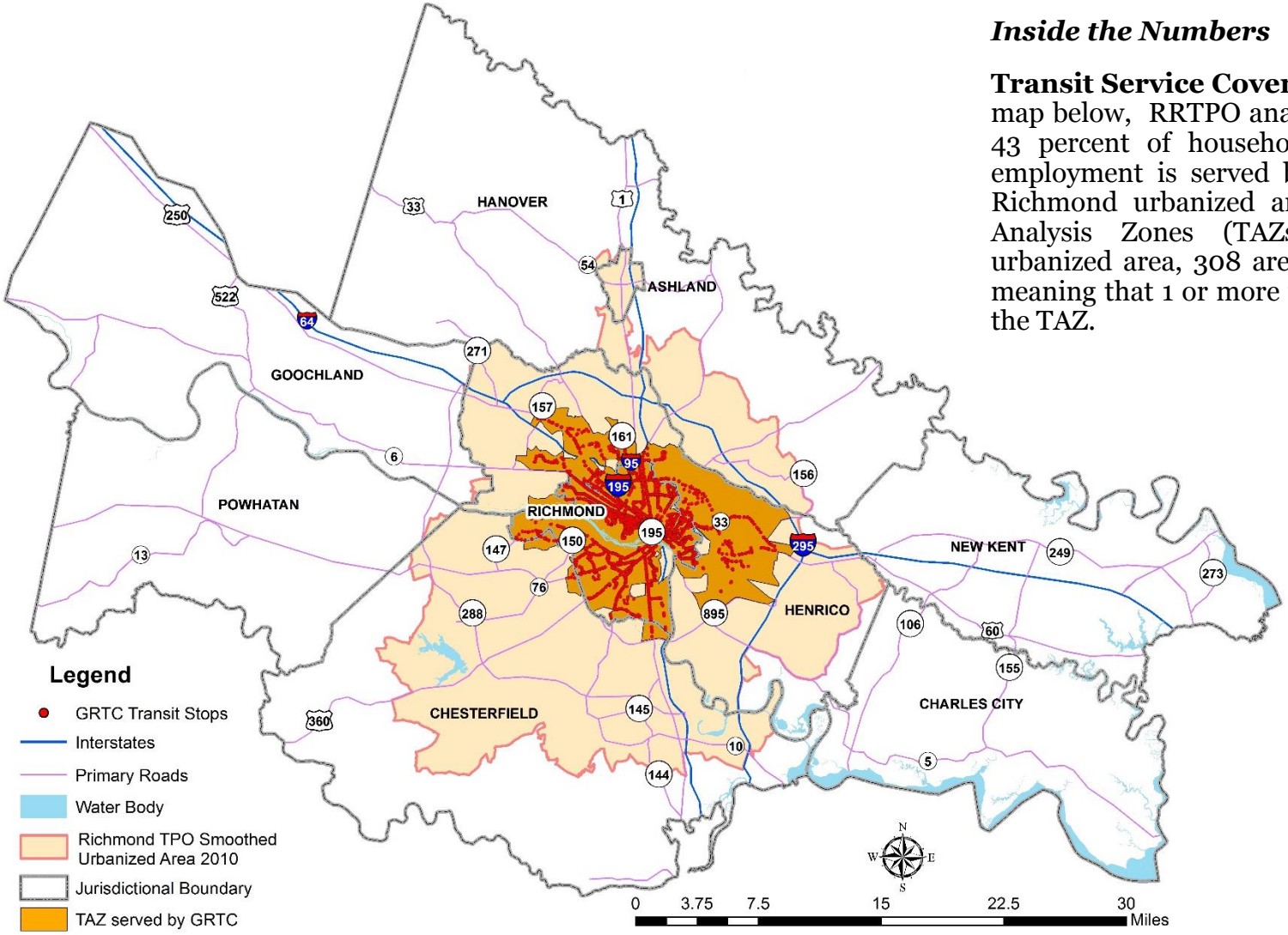


Figure 6: Means of Transportation to Work for Workers 16 years and over, American Community Survey 2010-2014 5-year estimates compiled for nine RRTPO jurisdictions



Inside the Numbers

Transit Service Coverage, as indicated by the map below, RRTPO analysis found that roughly 43 percent of households and 53 percent of employment is served by GRTC transit in the Richmond urbanized area. Out of 651 Traffic Analysis Zones (TAZs) in the Richmond urbanized area, 308 are served by local transit, meaning that 1 or more transit stop is located in the TAZ.

Inside the Numbers

Intercity Transportation by Rail is becoming an increasingly important transportation option as highway congestion between the Richmond region and neighboring areas to the Northeast worsens. Long-term plans for the Northeast and Southeast High-Speed Rail corridors are currently under development at the state and federal level. The Richmond region is a vital lynchpin between the two corridors and rail ridership has continued to grow at the three Richmond regional stations. As evidenced in Figure 7, conventional Amtrak service ridership has shown consistent growth from FY 09 to FY 15, with FY 13 as the highest ridership year with over 439,000 boardings and alightings.

Intercity Transportation by Air is increasingly an indicator of regional economic competitiveness and a critical component of the transportation system. With the non-stop destinations currently accessible via Richmond International Airport (RIC) (Table 8), the region is in a strong position to form continued economic linkages with major hub cities in the Northeast and Southeast. It is important to note that the routing of commercial flights are at the discretion of the airlines, largely outside the control of the airport, and/or state and local government. The existing supply of non-stop destinations, continually increasing demand for air travel through RIC, and new flight options such as recently added non-flight service to Denver continue to increase options for the region's residents and business travelers.

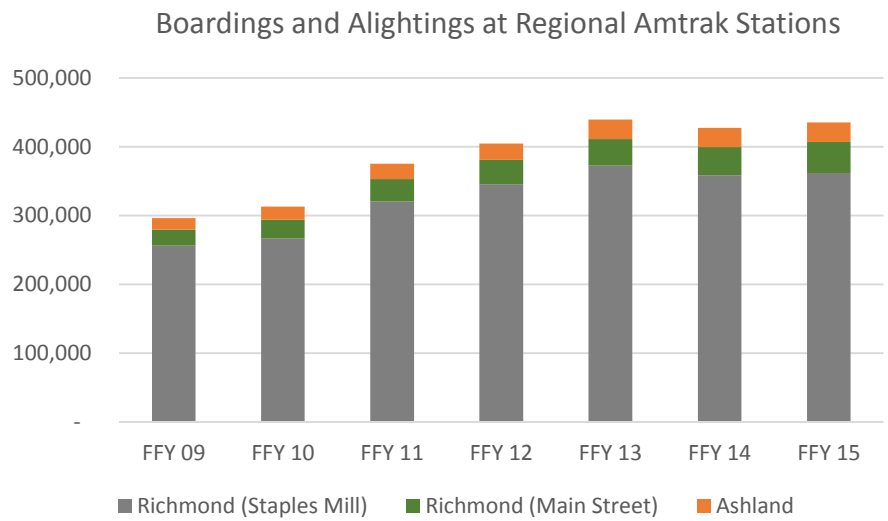


Figure 7: Boardings and Alightings at Richmond Stations, Amtrak Fact Sheets

Richmond International Airport Non-Stop Destinations	
Atlanta	Jacksonville
Boston	Miami
Charlotte	Minneapolis/St.Paul
Chicago	New York (LGA, EWR, JFK)
Dallas	Orlando/Sanford
Denver	Philadelphia
Detroit	Tampa/St. Petersburg
Ft. Lauderdale	Washington-Dulles
Houston	

Table 8: Non-Stop Air Destinations at RIC, from RIC Route Map at flyrichmond.com/index.php/route-map (as of March 2016)

Program Highlight

Coordinated Human Services Mobility Plan

In FY 2016, the RRTPO completed work on the **Needs and Gaps Assessment for the Transportation Disadvantaged** report. Highlights of the report include estimates of transportation disadvantaged persons and their location in the Richmond region; identification and analysis of gaps between existing paratransit services in meeting the needs of the transportation disadvantaged; and a forecast of future demand for paratransit services by the transportation disadvantaged.

From the report, the overall rate of poverty for the Richmond region was found to be 11.25 percent, representing 112,801 people. The City of Richmond's poverty rate is more than double the regional rate at 25.59 percent. The City of Richmond, Henrico and Chesterfield comprise more than 92 percent of the region's population below poverty.

The means of transportation to work in the region for workers below poverty reveals key details. The majority use a personal automobile, with 62 percent driving alone – a number that is 20 percent less than the number for all workers, which illustrates a dependence of low-income groups on public transit. Workers below the poverty level are more likely to carpool, use transit, walk, bike or take a taxi than the total workers cohort.

Going forward, recommendations from the plan's ad hoc committee on Regional Paratransit Services and Programs were grouped into three time bands: short term, mid-term, and long-term. The work program includes a key first task to identify an entity to champion transportation services coordination.

Means of Transportation to Work	Total Workers	Workers at or Below Poverty Level
Drove alone	81.3%	62.0%
Carpool	9.4%	18.4%
Transit	2.1%	7.5%
Walked	1.4%	4.9%
Taxicab, motorcylce, bi-cycle, or other	1.3%	3.4%
Worked at home	4.5%	3.9%

Table 9: Means of Transportation to Work in Richmond Region for Workers below the poverty line; ACS five year estimates 2008-2012

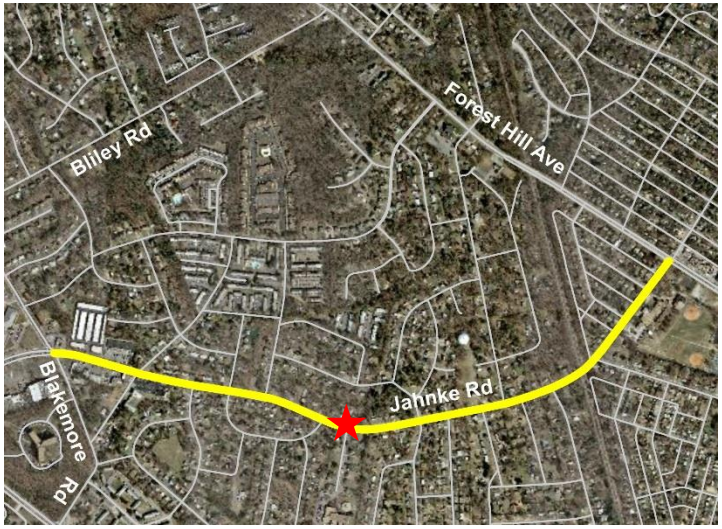
Project Highlight

Jahnke Road Complete Street

The RRTPO has funded a variety of projects aimed at the goal of multimodal connectivity, to improve accessibility and interconnectivity of various transportation modes for all users. This includes accommodating connections for vehicles, bicycles, pedestrians, and transit riders of all ages and socioeconomic groups to equally accessible opportunities for education and employment.

With funding from an RRTPO allocation of Regional Surface Transportation Program (RSTP), a 1.25-mile stretch of Jahnke Road between Forest Hill Avenue and Blakemore Road (UPC #19035) in the City of Richmond will be reconstructed as a complete street. Improving multimodal connectivity is essential along Jahnke. The $13.7 million project will include a variety of pedestrian-oriented improvements including a 5-foot sidewalk on the southern side and an 8-foot multi-use path on the northern side. Additional improvements will include turn lanes at key intersections and a new signal at Forestview School Drive, which serves as the entrance to Elizabeth Redd Elementary. Two more schools bookend the project corridor: Lucille Brown Middle to the west and Westover Hills Elementary to the east. Safety enhancements will also be implemented where the CSX Railroad crosses Jahnke Road.

Crosswalks with no sidewalks at Jahnke Rd. at Forestview School Drive



Project map for Jahnke Rd Complete Street with red star at Forestview School Drive

SAFETY & SECURITY

plan2040 Goal:

Provide for transportation improvements that increase safety and security for system users.

The RRTPO, with the goal of reducing transportation fatalities and injuries, is focused on integrating safety and security considerations into the metropolitan transportation planning process. The Virginia Department of Transportation (VDOT) is an important partner in this effort, as the RRTPO ensures that the Metropolitan Transportation Plan (MTP) and Transportation Improvement Program (TIP) are consistent with the state's strategic highway safety planning documents.

In addition to programming funds on safety projects in the TIP, two important safety and security related forums are housed within the RRPDC and RRTPO. The RRTPO ITS Work Group considers opportunities to use signal preemption, variable message signs and other techniques to reduce incident response times for emergency vehicles. The Central Virginia Emergency Management Alliance (CVEMA) is staffed by the RRPDC and provides a forum for discussion on disaster response, evacuation and other considerations of the resiliency of the transportation network in cases of emergency. The following performance measures primarily include crash data reported by VDOT.


Photo Credit: VDOT

Inside the RRPDC/RRTPO Work Program

The **Central Virginia Emergency Management Alliance** is a regional forum for local emergency managers, public safety officials, federal, state, regional and other partners to coordinate efforts on security issues related to emergency management and preparedness. The RRTPO has recently considered opportunities to engage this forum in discussions on incident response and the collection of information related to high frequency crash locations or other hazardous roadway conditions that may not be apparent in data currently collected.

Inside the Numbers

Highway Crash data is aggregated from police accident reports throughout the state by the Virginia Department of Motor Vehicles (DMV), and summarized by VDOT. The Virginia *Strategic Highway Safety Plan* (SHSP) analyzed crash data statewide over a ten year period from 2001 to 2010. Not surprisingly, the SHSP analysis found that the majority of crashes are concentrated in the more populous areas of the Commonwealth, namely Northern Virginia, Richmond and Hampton Roads. The SHSP includes emphasis areas ranging from 'Speeding' to 'Young Drivers' to 'Intersection Design'. Given the variety of potential crash factors, the SHSP recognizes engineering and constructing safer roadways as one strategy but also recommends enforcement, education and emergency response strategies.

As evidenced in Table 10, the reported roadway crashes in the RRPDC region held steadily around 18,400 crashes per year from 2011 to 2014. The data shows a significant (8 percent) increase in highway crashes from 2014 to 2015.

As of publication of this report, VDOT had not released 2015 VMT data necessary to calculate crash rates – this report will be updated as data becomes available.

Number of Highway Crashes in Richmond PDC Area						Desired Trend	1-year Trend	5-year Trend
2010	2011	2012	2013	2014	2015			
17,423	18,428	18,348	18,430	18,228	19,750	↘	↗	↗

Table 10: Number of Highway Crashes in Richmond PDC Jurisdictions, Virginia DMV and VDOT

Inside the Numbers

Highway Fatalities, a subset of crash data provided by DMV and VDOT, accounts only for those incidents that result in the loss of human life. To be consistent with the Federal Highway Administration's Toward Zero Deaths initiative, the SHSP includes "the goal of the SHSP is to reduce deaths and severe injuries by half by the year 2030 (an average decline of approximately 3 percent per year)."

For the RRPDC region (Table 11), data highway fatalities shows year to year fluctuation, with no discernable trend over the time period. As with analysis of all crash data in the region, fatality accidents in the region increased significantly from 2014 to 2015. A more thorough analysis of possible causes for this trend is an appropriate next step.

As of publication of this report, VDOT had not released 2015 VMT data necessary to calculate fatality rates per 100M VMT – this report will be updated as data becomes available.

Number of Highway Fatalities in Richmond PDC Area						Desired Trend	1-year Trend	5-year Trend
2010	2011	2012	2013	2014	2015			
85	90	70	83	76	92	↘	↗	↗

Table 11: Number of Highway Fatalities in Richmond PDC Area, Virginia DMV and VDOT

Project Highlight

Install signal at Route 623 and I-64 Interchange

With the goal of increasing safety, the Commonwealth of Virginia, the RRTPO and localities around the region plan, program and deliver projects at spot locations of high crash and incident frequency.

An example is the installation of a traffic signal (UPC #109313) at the eastbound Interstate 64 on- and off-ramps at Ashland Road (Route 623) in Goochland County. The installation of a traffic signal will replace existing stop and yield signs in a location where six injury crashes were recorded from 2012-2015. The project is expected to have significant safety benefits upon completion. Also near this location Ashland Road connects to West Broad Street (U.S. 250), where significant volumes of vehicles travel to and from activity centers at West Creek, Short Pump, and Innsbrook. In addition to safety benefits, this project will improve peak hour capacity and efficiency at the on- and off-ramps.

This project is funded with over $750,000 in SMART SCALE funding, a process by which the Commonwealth Transportation Board evaluates scored transportation projects based on an objective, outcome-based method. This project was competitive statewide due to the significant preliminary work prior to the development of the SMART SCALE application. The planned and possible future improvements are under additional study through an Interchange Modification Report-IMR (UPC #109231) underway with support by RRTPO allocations of RSTP funds. Additional phases of the overall interchange improvement may be considered upon completion of the IMR.

Project map for Signal Install at I-64 at Ashland Rd (Route 623)

PRESERVATION & MAINTENANCE

plan2040 Goal:

Ensure that existing transportation infrastructure and facilities achieve a consistent state of good repair.

As the U.S. Congress wrestles with competing frameworks for how to fund the nation's transportation infrastructure, the Commonwealth of Virginia and other states have begun to adjust to limited federal funds by focusing more on "fix-it-first" and "state of good repair." It appears that the future economics of transportation, with a smaller universe of funding sources, will require strategic maintenance and incremental improvements to existing infrastructure rather than large capital investments in new infrastructure.

In this spirit, the RRTPO has added tasks into the agencies Unified Planning Work Program, such as the annual *Richmond Regional Bridge & Culvert Inventory & Structural Assessment Report*, that set the stage for programming of projects that meet the region's system preservation and maintenance needs. Additionally, plan2040 included the evaluation and prioritization of projects using preservation and maintenance as a key criteria. The following performance measures include data drawn from the RRTPO Bridge Report and also pavement condition data as reported by VDOT.

Inside the RRTPO Program

The **Richmond Regional Bridge and Culvert Inventory & Structural Report**, adopted by the RRTPO in December 2015, is based on a snapshot of data captured from VDOT's online dashboard as of January 15, 2015. The development of the next update in 2017 will cover all bridges and culvert structures in the region including VDOT system and non-VDOT system roads such as those in the Richmond and Ashland urban system, the Henrico secondary system Richmond Metropolitan Transit Authority (RMTA), and private bridges and culverts. The report will provide an inventory of all structures in the region and identify those with poor conditions – known as structurally deficient, functionally obsolete, weight posted, etc. This work will result in a prioritized list of structures eligible for federal bridge replacement and bridge rehabilitation funds.

Inside the Numbers

Bridge Sufficiency Ratings were developed by the Federal Highway Administration as a prioritization tool for allocating maintenance funds. The rating ranges from 0 percent (poor) to 100 percent (very good) and considers three primary factors: structural adequacy; whether the structure is functionally obsolete; and level of service provided to the public. Important to note that a low sufficiency rating does not imply that a structure is necessarily unsafe to the traveling public, instead it indicates structures that are of the highest funding priority for rehabilitation or reconstruction.

As of the latest RRTPO Bridge Report (2015) the median sufficiency rating of structures in the Richmond region was found to be 85. As indicated in the summary (Table 12), out of 1,412 structures in the Richmond Region 80 structures (5.7 percent) had a sufficiency rating below 50 which indicates that the structure is eligible for complete replacement. The study found 454 structures (33.2 percent) had a rating in the range 50-80 which indicates that the structure is eligible for a rehabilitation project. Finally, the report found that 872 (61.8 percent) structures had a rating in the range 80.1 – 100 which indicates a sufficient structure. This information and other analysis provided in the RRTPO Bridge Report aid the agency in planning and programming scarce maintenance funds toward the most critical projects.

Bridge Sufficiency Rating

0 – 49.9 : Structure is Eligible for Replacement

50 – 80 : Structure is Eligible for Rehabilitation

80.1 – 100 : Structure is Sufficient

Jurisdiction	Total # of Bridges & Culverts	Sufficiency Rating			
		0-49.9	50-80	80.1-100	NA
Town of Ashland	6		5	1	
Charles City County	29	1	4	24	
Chesterfield County	350	17	91	241	1
Goochland County	128	6	34	88	
Hanover County	204	16	70	116	2
Henrico County	360	11	123	223	3
New Kent County	97	1	27	69	
Powhatan County	47	9	14	24	
City of Richmond	191	19	86	86	
Richmond Region	**1,412**	80	454	872	6

Table 12: Bridge Sufficiency Rating by Jurisdiction, Richmond Regional Bridge & Culvert Inventory & Structural Assessment Report (2015)

Inside the Numbers

Pavement Condition information for the Richmond area is reported in the annual *State of Pavement* released by the Virginia Department of Transportation (VDOT). Important to note that Pavement Condition information is released at the geographic scale of the Richmond VDOT district, which extends beyond the RRTPO planning area and includes the Tri-Cities and Southside areas of the state.

VDOT reports pavement condition as an index scale from 1 to 100, grouping the results into five categories: 90 and above – Excellent; 70 to 89 – Good; 60 to 69 – Fair; 50 to 59 – Poor; and 49 and below – Very Poor. In general, pavements rating less than 60 are considered to be deficient and are identified as priorities for maintenance and/or rehabilitation work. As indicated in Figure 10, the Interstate and Primary network pavement conditions have varied considerably year to year from 2012 to 2015. The percentage of very poor condition has increased on VDOT maintained primary roads in the Richmond District. Interstate pavement conditions appear to be improving overall, however, the percentage of very poor pavement condition increased from 2014 to 2015. At this scale, pavement condition data provides a snapshot of how the overall regional highway network is maintained for safe roadway conditions. VDOT also develops this information on a much finer scale to prioritize their investments in pavement rehabilitation.

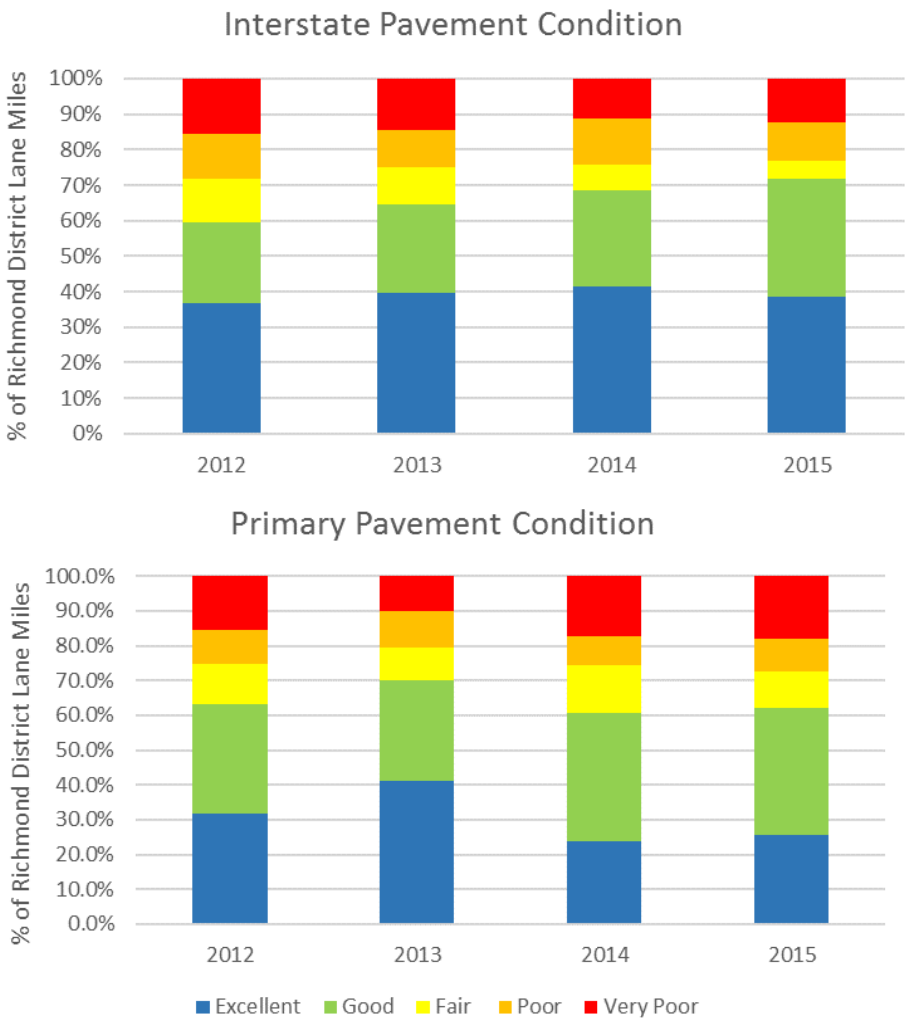


Figure 10: Interstate and Primary Pavement Condition, VDOT State of Pavement (2012-2015)

Project Highlight

Dundas Road Bridge Replacement

With the goal of maximizing financial resources and ensuring that existing transportation infrastructure achieves a consistent state of good repair, the RRTPO has applied Regional Surface Transportation Program (RSTP) funds to a variety of bridge and roadway rehabilitation projects. A recent example of such a project funded by the RRTPO is the Dundas Road Bridge Replacement (UPC #107085) in Chesterfield County.

As of the 2015 *Richmond Regional Bridge and Culvert Inventory & Structural Report,* the Dundas Road Bridge had a reported sufficiency rating of 34. This rating is categorized as in "poor condition" and in need of rehabilitation. The bridge itself provides a link from Dundas Road to Beulah Road over the CSX Railroad. The bridge also provides a connection point between Bensley Elementary School to the east and a dense residential areas to the west.

As pictured at right, the existing bridge has visible deck and pavement quality issues. Additionally, the current bridge has no sidewalks and lacks appropriate pedestrian accommodation. This project would not only improve the bridge's structural integrity but also provides much needed accommodation for pedestrians. The $6 million project is fully funded with $3 million in RRTPO directed RSTP funding and $3 million in state revenue-sharing resources.

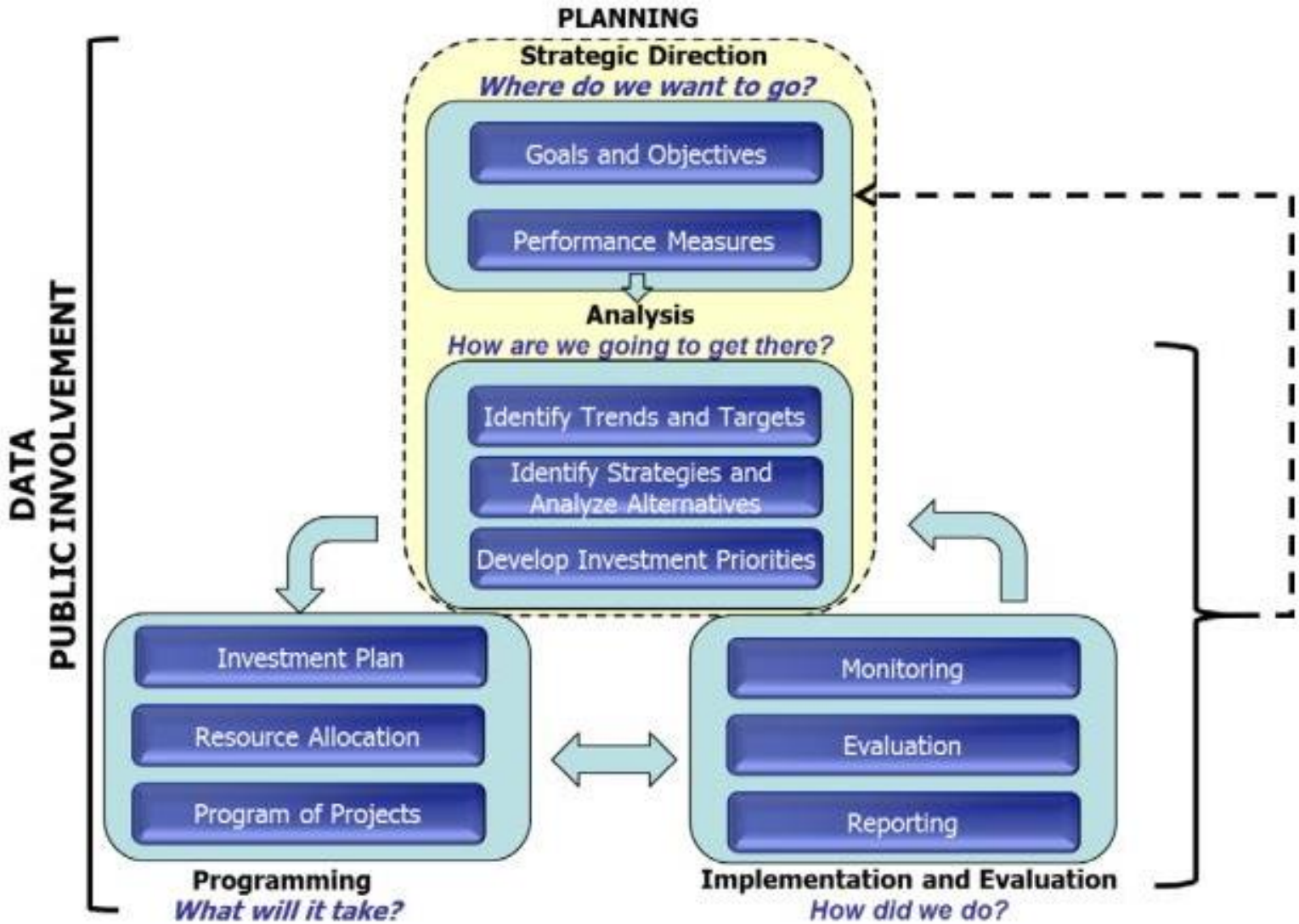
Project map for Dundas Road Bridge Replacement

Dundas Rd Bridge deck condition and lack of pedestrian accommodations

APPENDIX I – CORRELATION OF FEDERAL, STATE AND REGIONAL PERFORMANCE GOALS

Federal	**MAP-21** MAP-21 National Goals for Federal-aid Highway Program	•Safety •Infrastructure Condition •Congestion Reduction •System Reliability	Freight and Economic Vitality Environmental Sustainability Project Delivery
State	**VTrans Performance Measures**	•Safety and Security •Maintenance and Preservation •Mobility, Accessibility, & Connectivity •Transportation and Land Use	Economic Vitality Environmental Stewardship Program Delivery
State	**SmartScale Weighting Factors**	•Safety •Congestion Mitigation •Accessibility •Transportation and Land Use	Economic Development Environmental Quality
Region	**Regional Performance Measures for Richmond TPO** As approved by Board March 2011	•Safety •Congestion Reduction •Transit and HOV Usage •Jobs-to-Housing Ratio and Transit Access	Movement of Freight Air Quality

APPENDIX II – FRAMEWORK FOR PERFORMANCE BASED PLANNING AND PROGRAMMING



Source: FHWA Performance Based Planning and Programming Guidebook (2013)