Transportation Performance Measures

Progress Report ● 2017

Approved by RRTPO on November 2, 2017

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).

DISCLAIMER

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Richmond Regional Planning District Commission

Metropolitan Planning Organization

Town of
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Counties of
Charles City
Chesterfield
Goochland
Hanover
Henrico
New Kent
Powhatan
City of
Richmond

RRTPO AGENDA 11/2/17; ITEM I.D.2.

2017 TRANSPORTATION PERFORMANCE MEASURES REPORT

Richmond Regional Transportation Planning Organization

On motion of Patricia S. O'Bannon, seconded by Manuel Alvarez, Jr., the Richmond Regional Transportation Planning Organization unanimously approved the following resolution:

RESOLVED, that the Richmond Regional Transportation Planning Organization accepts the *Transportation Performance Measures – Progress Report 2017* as a Fiscal Year 2018 Unified Planning Work Program work task complete.

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This is to certify that the Richmond Regional Transportation Planning Organization approved the above resolution at its meeting held November 2, 2017.

WITNESS:

Sharon E. Robeson
Program Assistant
Richmond Regional Planning
District Commission

BY:

Barbara Schoeb Nelson
Secretary
Richmond Regional Transportation
Planning Organization

9211 Forest Hill Avenue, Suite 200 • Richmond, Virginia 23235 • Telephone: (804) 323-2033 • Fax: (804) 323-2025
www.richmondregional.org

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INTRODUCTION

The Richmond Regional Transportation Planning Organization (RRTPO) *Transportation Performance Measures - Progress Report 2017* 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 2017* 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 7, 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, no additional measures were recommended in the update of the 2017 report.

The "Transportation Performance Measures Analysis Report" beginning on page 12, 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. Additionally, 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, bridge and 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).

In addition to implementing an overall performance-based approach in metropolitan transportation planning, the *Moving Ahead for Progress in the 21st Century (MAP-21)* federal transportation bill included new requirements for states and metropolitan planning organizations to report performance measures and targets tied to national goals. The performance measures and performance-based planning and programming requirements of MAP-21 were reaffirmed in the *Fixing America's Surface Transportation (FAST) Act* federal transportation authorization of 2015. These legislative actions require that states and MPOs report performance measures and targets related to safety, bridge and pavement condition, system performance, and freight. The federal rulemaking process is now complete and in FY18 the RRTPO will be required to report the first set of MPO-area targets for the safety performance measures.

The following pages of this report describe the requirements associated with federal performance measures and target-setting, as well as a case study example from the deliberative process undertaken in early FY 18 by a working group of the RRTPO Technical Advisory Committee to recommend safety targets.

Federal PM and Target Requirements

State targets: Within one year of the DOT final rule effective date, States are required to set performance targets for each measure.

MPO targets: Within 180 days of States setting performance targets, MPOs are required to set targets for each measure (where applicable) by either:

Adopting unique targets, and reporting metrics specific to the metropolitan planning area;

or

Agreeing to State DOT targets, and reporting metrics specific to the metropolitan planning area.

MPOs Roles and Responsibilities

1.) Include targets in planning documents

- Metropolitan Transportation Plans [§1201; 23 USC 134(i)(2)(B)]
- Transportation Improvement Programs [§1201; 23 USC 134(j)(2)(D)]

2.) Link investment priorities to performance targets

3.) Report on progress

Rulemaking	Final Performance Measures
Safety PM Final Rule (4/14/2016 Effective Date) *RRTPO Targets Due February 2018*	Number of fatalities
	Rate of Fatalities
	Number of Serious Injuries
	Rate of Serious Injuries
	Number of non-motorized fatalities and non-motorized serious injuries
Infrastructure PM Final Rule (5/20/2017 Effective Date) *RRTPO Targets Due November 2018*	Percentage of pavements of Interstate System in Good condition
	Percentage of pavements of Interstate System in Poor condition
	Percentage of pavements of the non-interstate NHS in Good condition
	Percentage of pavements of the non-interstate NHS in Poor condition
	Percentage of NHS bridges classified as in Good condition
	Percentage of NHS bridges classified as in Poor condition
System Performance PM Final Rule (5/20/2017 Effective Date) *RRTPO Targets Due November 2018*	Percent of Person-Miles Traveled on Interstate that are Reliable
	Percent of Person-Miles Traveled on non-interstate NHS that are Reliable
	Percent change in tailpipe CO2 emissions on the NHS compared to 2017
	Truck Travel Time Reliability Index
	**Annual Hours of peak hour excessive delay per capita
	**Percent of non-SOV travel
	**Total emissions reduction

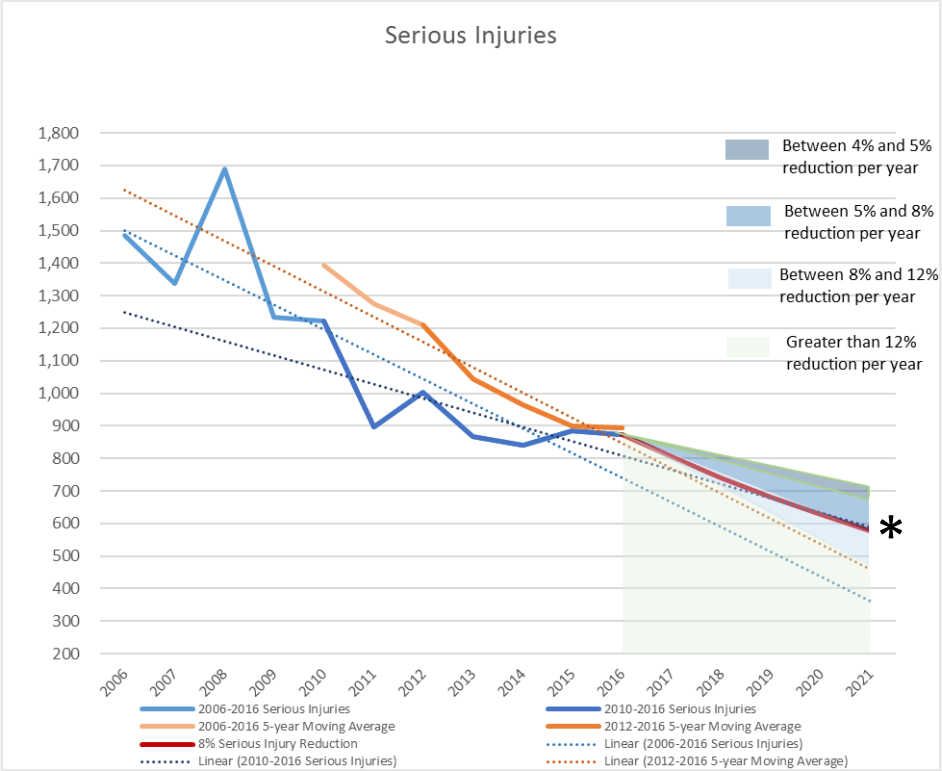
Note: ** Denotes PMs not applicable to RRTPO in first reporting cycle.

RRTPO Approach to Target-Setting – Safety PMs and Targets Example

The RRTPO is now required to report progress toward five safety performance targets on an annual basis. In order to undertake the initial target-setting exercise, the RRTPO Technical Advisory Committee established the Performance Measures and Target Setting Working Group of the TAC to work through a deliberative process and make recommendations to the full committee.

The working group began in early FY 18 and met in a series of three web-based meetings. As recommended by FHWA, the process to consider and define regionally specific safety targets was 1.) Collaborative and 2.) Documented. As of the writing of this report, the working group has delivered a detailed memo describing the deliberations and recommendations for TAC consideration. To reach a recommendation, the working group first engaged in a high-level discussion of opportunities, strategies or initiatives to support the Richmond region in achieving safety targets. Further meetings went in some depth on the baseline data and trends for the 5 safety performance measures. An example graphic used in these discussions is included at right. A consensus-based process was used to arrive at a set of working group recommendations.

Upon RRTPO approval of targets, future versions of this report will further incorporate Federally required PMs and targets.



Example graph used by PM and Target Setting Working Group to analyze baseline data and trends in Serious Injuries.

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	2016	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.	n.a.	↘	→	↗
	Fuel Loss per peak period commuter[2], gallons	13	13	13	14	14	14	n.a.	n.a.	↘	→	↗
	*Peak period travel time index[3]	1.12	1.12	1.12	1.12	1.13	1.13	n.a.	n.a.	↘	→	↗
	Congestion costs[4], annual per peak period commuter	$746	$754	$733	$727	$736	$729	n.a.	n.a.	↘	↘	↘
Transportation and Land Use Integration	*Daily VMT[5], per capita	n.a.	32.5	32.3	32.1	31.9	33.6	34.0	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.	n.a.
	*Jobs/Housing Dissimilarity Index[7]	0.066	0.060	0.061	0.056	0.049	0.047	0.067	n.a.	< .5	✓	✓
	% Workers working in jurisdiction in which they live[8]	48.5%	48.8%	49.1%	48.9%	48.6%	48.2%	48.3%	n.a.	↗	↗	↘
	Travel Time to Work[9]	23.4	23.6	23.6	23.9	24.0	24.1	24.2	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.	n.a.
Environmental and Air Quality	*Ozone Exceedances,[11]											
	with 2008 EPA Ozone Standard (.075ppm)	0	10	11	11	1	1	1	2	↘	↗	↘
	with 2015 EPA Ozone Standard (.070ppm)	2	25	22	15	1	2	3	4	↘	↗	↘
	Multi-Pollutant Air Quality Index Exceedances[12]											
	with 2008 EPA Ozone Standard (.075ppm)	1	10	11	11	1	1	1	2	↘	↗	↘
	with 2015 EPA Ozone Standard (.070ppm)	3	25	22	15	1	2	3	4	↘	↗	↘
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.	n.a.
	Rail	n.a.	n.a.	n.a.	30%	n.a.	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.	n.a.
	Rail	n.a.	n.a.	n.a.	5%	n.a.	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	8,309	11,423	↗	↗	n.a.
	*Port of Richmond Containers, Inbound[14]	n.a.	n.a.	n.a.	3,205	4,821	6,699	8,038	11,077	↗	↗	n.a.
	RIC Total Cargo, Outbound/Enplaned, tons[15]	n.a.	n.a.	18,545	21,857	27,108	29,915	30,167	30,380	↗	↗	↗
	RIC Total Cargo, Inbound/Deplaned, tons[15]	n.a.	n.a.	28,062	30,863	31,756	28,369	29,281	36,863	↗	↗	↗
	Transportation/Warehousing Employment[16], number	19,406	19,172	19,263	19,438	19,743	21,074	27,419	28,725	↗	↗	↗
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	12 / 1,987	↗	→	↗
	RideFinders Vanpools[18], number	n.a.	n.a.	117	120	137	138	145	143	↗	↘	↗
	Transit Trips[19], per capita	30.7	31.6	28.5	22.3	19.5	20.6	20.3	n.a.	↗	↘	↘
	Transit Operating Expense per passenger trip[20]	$3.40	$3.45	$3.62	$4.82	$5.42	$5.06	$4.97	n.a.	↘	↘	↗
	Transit Passenger Miles[21], per capita	154.0	158.7	139.1	152.0	140.7	145.2	143.2	n.a.	↗	↘	↘
	Transit Operating Expense per passenger mile[22]	$0.68	$0.69	$0.74	$0.71	$0.75	$0.72	$0.70	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	11,877,541	n.a.	↗	↗	↗
	Transit Revenue Miles[24], per capita	24.2	25.2	25.2	25.5	25.4	26.1	26.4	n.a.	↗	↗	↗
	Transit Operating Expense, per revenue mile[25]	$4.30	$4.32	$4.10	$4.20	$4.17	$4.01	$3.82	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.	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.	n.a.
	*Bicycle to Work[27], percent	0.34%	0.46%	0.47%	0.51%	0.50%	0.52%	0.48%	n.a.	↗	↘	↗
	*Drove Alone to Work[28], percent	81.89%	81.49%	81.51%	81.24%	81.66%	81.59%	81.38%	n.a.	↘	↘	↘

Transportation Performance Measures Summary Table

Goals	Measure	2009	2010	2011	2012	2013	2014	2015	2016	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%	1.65%	n.a.	↗	→	↗
	*Passenger Rail Ridership[30], number	296,216	313,026	375,226	404,700	439,525	427,426	435,199	426,966	↗	↘	↗
	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	1,775,573	↗	↗	↗
	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	1,086,048	↗	↗	↗
	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	1,065,520	↗	↗	↗
	*Commercial Air Non-Stop Destinations[33]	n.a.	n.a.	n.a.	n.a.	n.a.	16	17	17	↗	→	n.a.
Safety and Security	*Highway Crashes, number[34]	17,505	17,423	18,460	18,359	18,453	18,234	19,752	20,550	↘	↗	↗
	Highway Crash Rate, per 100 million VMT[35]	163	157	167	167	169	163	168	n.a.	↘	↗	↗
	*Highway Fatalities, number[34]	94	85	90	70	83	76	92	78	↘	↘	↘
	Highway Fatality Rate, per 100 million VMT[35]	0.88	0.77	0.83	0.69	0.83	0.73	0.78	n.a.	↘	↗	↗
	Transit Crashes, number[36]	15	35	35	41	32	27	n.a.	n.a.	↘	↘	↘
	Transit Crash Rate, per 100 million PMT[37]	34.5	80.8	101.8	108.8	101.8	88.12	n.a.	n.a.	↘	↘	↗
	Transit Fatalities, number[36]	2	0	0	0	0	0	n.a.	n.a.	↘	✓	✓
	Transit Fatality Rate, per 100 million PMT[37]	4.6	-	-	-	-	-	n.a.	n.a.	↘	✓	✓
	Bicycle and Pedestrian Crashes, number[38]	290	344	441	425	386	382	338	367	↘	↗	↘
	Bicycle and Pedestrian Fatalities, number[38]	21	9	15	14	12	13	11	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%	79.4%	↗	↗	n.a.
	*Primary Pavement Condition, % rated fair or better[39]	n.a.	n.a.	n.a.	74.6%	79.4%	74.4%	72.5%	78.5%	↗	↗	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.	↘	↗	n.a.
	Rated 50 - 80 (Eligible for Rehabilitation)	n.a.	n.a.	n.a.	n.a.	121	145	129	n.a.	↘	↘	n.a.
	Rated 80.1 - 100 (Sufficient)	n.a.	n.a.	n.a.	n.a.	202	189	203	n.a.	↗	↗	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.	↘	↗	n.a.
	Rated 50 - 80 (Eligible for Rehabilitation)	n.a.	n.a.	n.a.	n.a.	36.8%	42.4%	37.8%	n.a.	↘	↘	n.a.
	Rated 80.1 - 100 (Sufficient)	n.a.	n.a.	n.a.	n.a.	61.4%	55.3%	59.5%	n.a.	↗	↗	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.	↘	→	n.a.
	Rated 50 - 80 (Eligible for Rehabilitation)	n.a.	n.a.	n.a.	n.a.	151	150	140	n.a.	↘	↘	n.a.
	Rated 80.1 - 100 (Sufficient)	n.a.	n.a.	n.a.	n.a.	306	294	303	n.a.	↗	↗	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.	↘	→	n.a.
	Rated 50 - 80 (Eligible for Rehabilitation)	n.a.	n.a.	n.a.	n.a.	31.3%	31.9%	29.9%	n.a.	↘	↘	n.a.
	Rated 80.1 - 100 (Sufficient)	n.a.	n.a.	n.a.	n.a.	63.4%	62.6%	64.6%	n.a.	↗	↗	n.a.
	Deficient Bridges, number[41]	n.a.	n.a.	n.a.	n.a.	292	295	273	n.a.	↘	↘	n.a.
	, percentage	n.a.	n.a.	n.a.	n.a.	20.7%	20.9%	19.2%	n.a.	↘	↘	n.a.
	Average Age of GRTC Bus Fleet, years[42]	8.0	7.3	7.8	8.8	8.1	6.2	7.2	n.a.	↘	↗	↘

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 2009-2015 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 DP03 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
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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 recently adopted FY 18 - FY 21 TIP includes more than 180 projects with nearly $500 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.

185
Highway and Transit Projects in the FY 18 - FY 21 RRTPO TIP with
$495,605,475
in FY 18 - FY 21 Federal Obligations

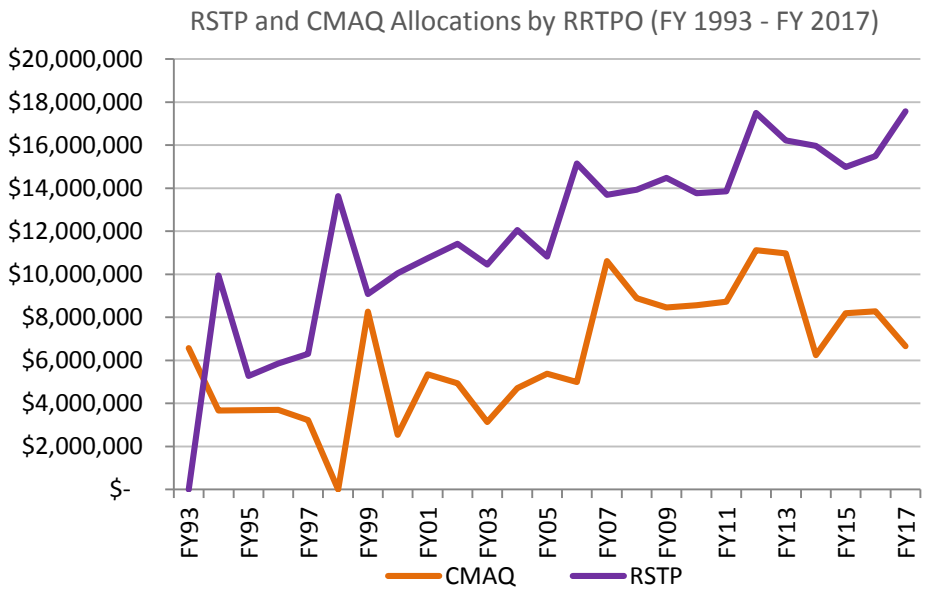


Figure 1: RSTP and CMAQ Allocations by RRTPO

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 plan2040.

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 at a regional scale. 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.

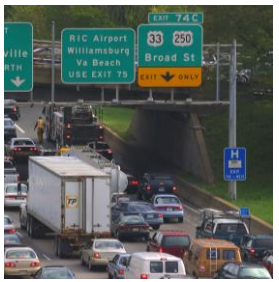


Photo Credits: Virginia Department of Transportation

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 was conducted as an element of the Metropolitan Transportation Plan update. The RRTPO adopted both 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 2017 Urban Mobility Report. (Anticipated Fall 2017)

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

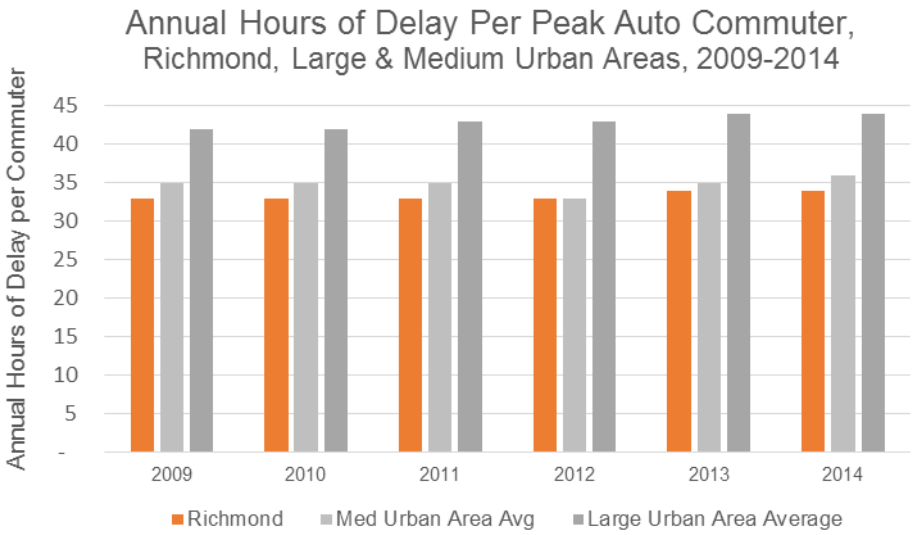


Figure 2: Annual Hours of Delay by Urban Area, TTI 2015 Urban Mobility Report

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 2017 Urban Mobility Report. (Anticipated Fall 2017)

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

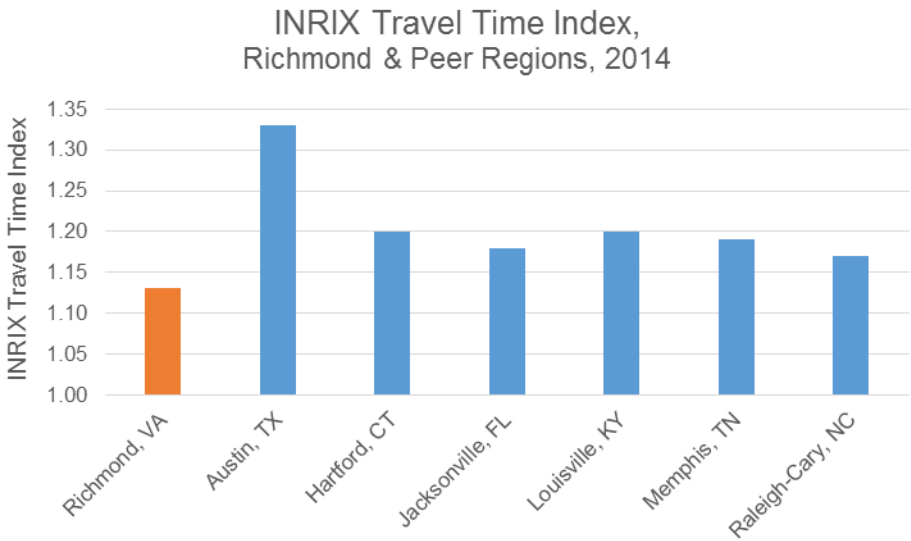


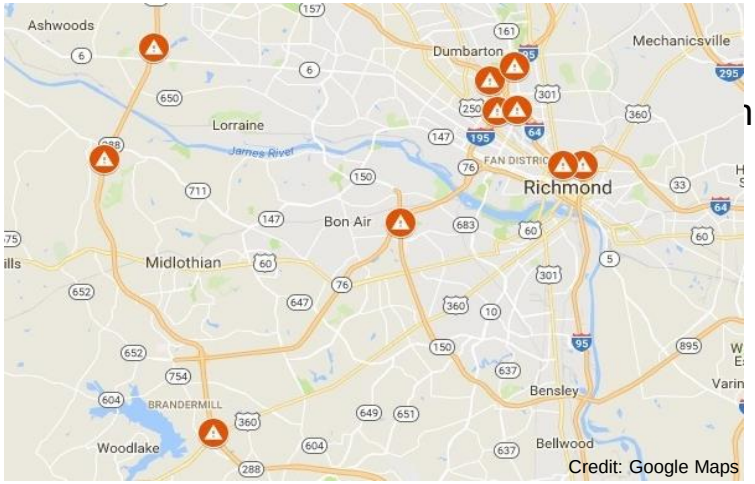
Figure 3: INRIX Travel Time Index by CEDS Peer Region , TTI 2015 Urban Mobility Report

Program Highlight

Congestion Mitigation Process - Bottleneck Analysis

In December 2016, the Congestion Mitigation Process (CMP) Technical Report was approved by the RRTPO board. The CMP is defined by the Federal Highway Administration (FHWA) as a systematic and regionally accepted approach for managing congestion that provides accurate, up-to-date information on transportation system performance and assess alternative strategies for congestion management that meet state and local needs. The CMP is intended to apply these strategies to capacity increasing projects and improvements and transition them into the funding and implementation stages for major corridors identified in the CMP roadway network.

Congestion is analyzed using tools from the I-95 Corridor Coalition Vehicle Probe Project (VPP) which allows for the analysis over time of most of the areas with congestion. Data on bottlenecks were compiled in order to monitor the trends on the CMP network. Analysis between 2013-15 show that the Interstate 64/95 corridor between downtown Richmond and the Bryan Park interchange have some of the longest and most consistent bottleneck incidents and occurrences. Three sections of VA-288 also made the list.



Top 10 Bottlenecks in the Richmond Region
I-64E at I-195/I-95/W Laburnum Ave/Exit 186
I-64W at I-95/Exit 190
VA-288S at VA-6/Patterson Ave
VA-288N at Huguenot Trail
I-95M at US-301/US-1/N Belvidere St/Exit 76
VA-76E at VA-150/Chippenham Pkwy
I-195N at I-64/I-95
VA-288S at US-360/Hull Street Rd
I-95S at Hermitage Rd/Exit 78
I-95S at VA-161/Hermitage Rd/Exit 80

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*.

Photo Credit: Google Maps

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. For more information see the program highlight on page 26 of this report.

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 consistently increased over the 2012 to 2015 period. 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. A number of factors including a strengthening post-recession economy and relatively low gas prices may be contributing to the recent increases in DVMT in the Richmond region. 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 compared less favorably to peers in 2015, in that any given resident of the Richmond region drove additional miles to meet their daily work, shopping or entertainment needs on average than residents of most peer regions.

Daily VMT Per Capita in Richmond Region						Desired Trend	1-year Trend	5-year Trend
2010	*2011*	*2012*	*2013*	*2014*	*2015*			
32.5	32.3	32.1	31.9	33.6	34.0	n.a.	↗	↗

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

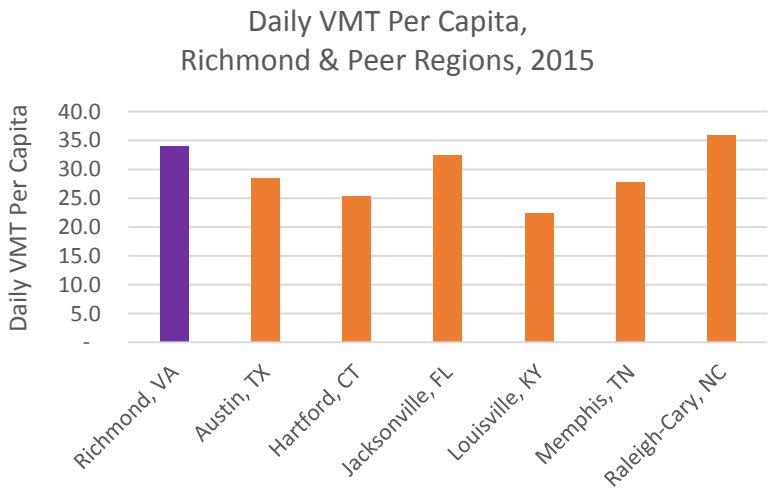


Figure 4: Daily VMT Richmond and Peer Regions, FHWA Highway Statistics Series

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 2015 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*	*2015*			
0.066	0.060	0.061	0.056	0.049	0.047	0.067	<.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

Program Highlight

The RRTPO is now using **the Richmond/Tri-Cities (RTC) Regional Travel Demand Model** in a number of applications internally and in service to regional partners to understand the transportation demand implications of changes to population, employment and transportation network changes. A few example applications include:

1.) Development of Existing Plus Committed (E+C) and the Cost Feasible (CF) Networks & Deficiency Analysis

In order to identify transportation network deficiencies, the RTC model has been used to analyze how project funding scenarios will meet future transportation demands. One case tested a scenario where all existing and committed (funded) projects in the Six-Year Improvement Program (SYIP), but no additional improvements between 2022 and 2040, was loaded with 2040 estimated traffic. This resulted in a deficiency analysis, where the volume-to-capacity (V/C) ratios were used to identify overly congested or failing roadway segments. A similar analysis was done for all projects included in the cost-feasible plan2040 constrained long-range plan. Again, the 2040 estimated traffic was loaded to the network in order to identify deficiencies.

This evaluation was completed after the adoption of plan2040, however, it is likely that similar applications will be used on the front end of plan2045 development to inform a regional needs assessment.

2. Corridor/Subarea-level Forecasts Development

The RTC model is constantly being refined for application in corridor and sub-regional analysis. The zoomed in look at the transportation network using the RTC model requires additional steps in validation to check model run results for reasonableness. This scale of analysis has been used to identify corridor specific deficiencies and needs.

Additionally, the RTC model has been used to fulfill locality requests for unique analysis. For example, in FY17 Goochland County requested a traffic analysis of the Hockett Road Corridor if additional dwelling units were to be developed on a specific parcel in the area. Upon model validation, the model run with additional housing was used to determine the resulting LOS (Level of Service), Direction Design Hour Volumes for the year 2040 and the breakeven year when additional lanes would be needed in the Hockett Road Corridor.

3. Ad Hoc Outputs from Model Runs

Finally, the RTC model and RRTPO staff have become a resource to consultants, non-profit organizations, local and state government staff requesting direct and derived outputs from the RTC model runs. In FY 17, staff fulfilled requests for AADTs, time-of-day volumes, VMT, travel times, highway and transit skims, O-D and P-A matrices etc. for intersection, corridor or a sub-area. These outputs have been used to better understand a variety of highway, transit, freight or multimodal projects.

Program Highlight

BRT Connectivity and Land Use Analysis

Under construction and expected to debut by early 2018, The *Pulse* is the Richmond region's first bus rapid transit (BRT) line offering a greatly reduced bus travel time of a 14-stop, or station, system extending from Rockett's Landing to Willow Lawn along Broad St. and E. Main St.

Adopted by Richmond City Council on July 24, 2017, the foundation for the *Pulse* Corridor Plan is a comprehensive study of the BRT Connectivity and Land-Use Analysis prepared by the RRPDC through a special services agreement executed with the City in July 2015 and completed October 2016. The study was funded by the City of Richmond Department of Planning and Development Review (PDR) and the Virginia Department of Rail and Public Transportation (DRPT).

The primary purpose of the *Pulse* Corridor Plan is to expand the BRT spine's reach and focus on a deliberate strategy to ensure the GRTC *Pulse* is used as an effective transformative tool. This plan's approach is to foster transit-oriented development (TOD), a development pattern that encourages most trips to be made by foot, bike, and transit. It is guided by six commonly held TOD principles which create opportunities for mixed-use, viable transportation alternatives, dense/compact development, historic preservation, greater transit access, and connectivity.

The RRPDC study identified and analyzed existing physical and demographic conditions in the corridor to provide a base-line for measurement of progress over time in meeting these transformative principles. Each station area was prioritized by indicators which measured 1) market readiness, 2) development potential, and 3) transit orientation.

Taking the study through the public review process from October 2016 through May 2017, the City staff worked with an advisory committee and Smart Growth America (SGA) to refine the plan and add specific measures to the implementation framework. Concurrent with plan adoption, the City sponsored rezoning proposal for Scott's Addition was introduced to Council. The proposal calls for rezoning from its current M-1 Industrial into two new zoning districts TOD-1 and B-7 Mixed Use Business District that will enable the area to be transformed into a higher density mixed-use supporting the rapidly emerging market forces for adaptive reuse by improving public infrastructure to ensure connectivity and a strong, eclectic neighborhood.

Image 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 consistent 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.

Annual # of days with Ozone Level Exceedances*							Desired Trend	1-year Trend	5-year Trend
2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*			
25	22	15	1	2	3	4			

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

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, with all AQI exceedances resulting from Ozone occurences.

Annual # of days Air Quality Index Exceedances*							Desired Trend	1-year Trend	5-year Trend
2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*			
25	22	15	1	2	3	4			

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

Project Highlight

Henrico County Automated Traffic Management System (ATMS)

Over the next five years, Henrico County is scheduled to receive $5.6 million in CMAQ funding to install and upgrade its transportation system with technology to coordinate traffic signals (UPC #109951). The upgrades will allow for an integrated signal system which can be managed from a central location or an operations center. This will enable officials to respond to transportation issues in "real-time."

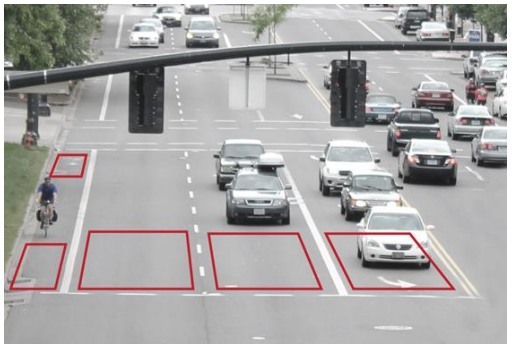
An improved Automated Traffic Management System (ATMS) should provide increased mobility and reduce congestion. It should also help connect people and move goods and services in a more timely and efficient manner, according to VDOT.

This phase of the countywide ATMS will include the provision and installation of approximately 12.5 miles of fiber optic interconnect and 40 fiber network switches that will complete the communication network for the system. It will also include "pan, tilt, zoom" (PTZ) cameras at 55 intersections and four portable Dynamic Message System (DMS) units for special events and incident management.

Implementation is expected to complete Henrico's upgraded communication network for the project. This will provide the additional capacity and reliability in the system to accommodate traffic monitoring cameras at 55 signalized intersections. This real-time traffic monitoring capability is expected to allow for quicker response for incident management and congestion relief. In addition, the DMS units allow for enhanced traffic management during incidents, construction, and special events.

Install and maintenance of traffic signal technology

Photo Credit: Henrico County



Example of signal detection and actuation as viewed from a Traffic Operations Center

Photo Credit: National Association of City Transportation Officials (NACTO)

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.

Ribbon cutting for new mobile harbor crane at Richmond Marine Terminal on 2/1/2016. Project was funded through RRTPO allocation of CMAQ funds.

Photo Credit: Port of Virginia

Inside the RRTPO Work Program

The Fixing America's Surface Transportation (FAST) Act of 2015 established a new National Highway Freight Program (NHFP) which apportions additional dollars to states for freight projects. The purpose of the program is to improve freight movement on the National Highway Freight Network by investing in infrastructure and operational improvements. The law allows for MPOs in consultation with the State to designate **Critical Urban Freight Corridors (CUFCs)** to be included in the National Highway Freight Network, making projects along those corridors eligible for NHFP funding.

The increasing emphasis on freight and goods movement in federal transportation funding bills and expanding role of MPOs in defining regionally significant freight assets have influenced and been incorporated into the FY 18 UPWP.

Inside the Numbers

Air Cargo through the Richmond International Airport showed a steady uptick in calendar year 2016. The total tons of deplaned cargo at RIC increased from 29,281 tons in 2015 to 36,863 tons in 2016; a marked 26% year-over-year increase in inbound volumes. Recently, air cargo growth at RIC has been attributed to the opening of two Amazon Fulfillment/Distribution centers in the Richmond region. The Richmond International Airport also welcomed another cargo operator, DHL, back to RIC in 2016. DHL joins FedEx and UPS as integrated shipping companies at RIC. The Capital Region Airport Commission has reported relatively flat belly freight in passenger planes, so much of the growth in air cargo is credited to package type freight movement in the supply chain.

Container Volumes at the Richmond Marine Terminal (RMT) have grown steadily year-over-year since FY 2013 (Figure 5). 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 growth in container volumes through RMT is likely to continue as new business is pursued and more frequent barge sailings are considered.

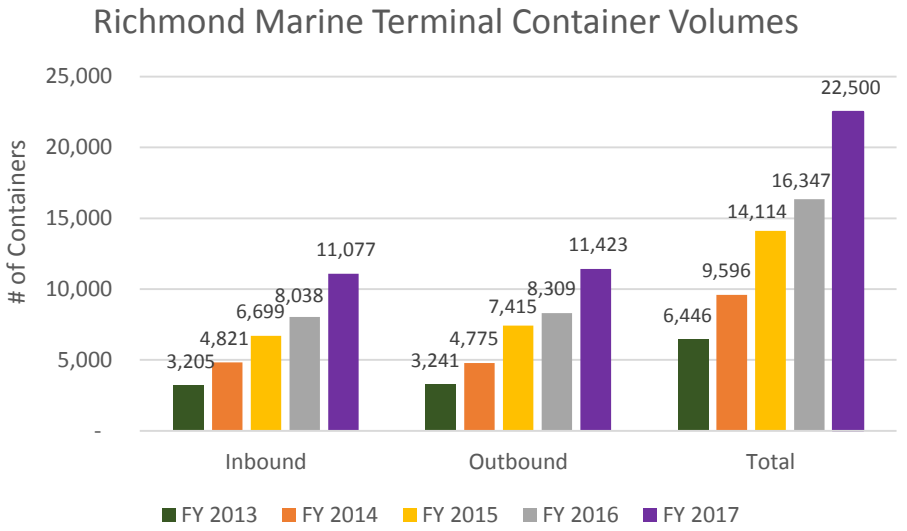


Figure 5: Container volumes at Richmond Marine Terminal by Fiscal Year, data provided by the Port of Virginia

Program Highlight

A key freight initiative in the FY 17 RRTPO work program was the ***Commerce Corridor Study.*** In June 2016, the RRTPO kicked off this regional transportation study in partnership with the Virginia Office of Intermodal Planning and Investment (OIPI) and key local and state government stakeholders to develop a comprehensive analysis of existing and future transportation needs and the prioritization of infrastructure investments along the Commerce Corridor.

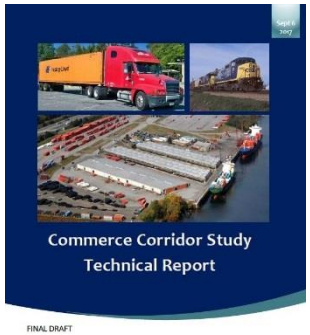
The Commerce Corridor study area centered on the Richmond Marine Terminal (RMT) transportation node and the I-95 corridor from the James River crossing in the City of Richmond to Route 10 in Chesterfield County. The study applied scenario planning, using the RRTPO regional travel demand model and the Transportation Economic Development Impact System (TREDIS) as tools, to evaluate future (2040) transportation and economic implications of growth at four priority development sites in proximity to the corridor and with potential for future RMT-oriented development. The study team and stakeholder advisory committee developed alternative model inputs to stress test the transportation system under multiple possible futures. This customized approach accounted for both macroeconomic industry forecasts and land use intensity change at targeted development sites.

Based on this analysis the study team developed a comprehensive list of transportation needs categorized as Highway-Oriented Needs, Rail-Oriented Needs, Port-Oriented Needs, and Miscellaneous (Policy/Community) Needs. For each need, one or more recommended solutions (i.e., infrastructure project or future study) was developed.

The technical work and recommended future investments in the corridor are included in two companion documents:

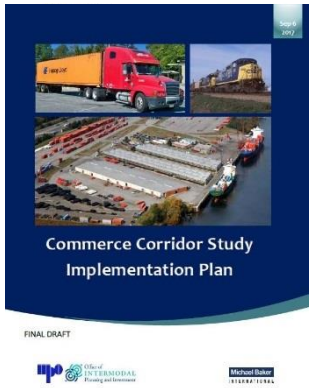
Commerce Corridor - Technical Report

Details the comprehensive study of existing and future transportation demand and system needs for multiple economic development scenarios.



Commerce Corridor - Implementation Plan

Identifies and positions a recommended list of infrastructure projects to compete for federal, state and regional funding in the short, medium-, and long-term.



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 FY 18 UPWP identifies planning priorities and activities related to Active Transportation to be carried out by the RRTPO. A priority for FY 18 is to begin a regional discussion on **Complete Streets** policies, principles and implementation strategies. Part of this effort will be to define what Complete Streets looks like in the Richmond region, and across various jurisdictions with differing transportation needs.

In our diverse region, balancing the design considerations in urban, suburban and rural context is a primary consideration; there is no one size fits all across the region. Simply put, the consideration and implementation of Complete Streets are to be designed and operated to enable safe access for all users and all modes: pedestrians, bicyclists, transit riders, motorists and truckers.

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; around 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 4.5 percent of total commuter mode share in the region.

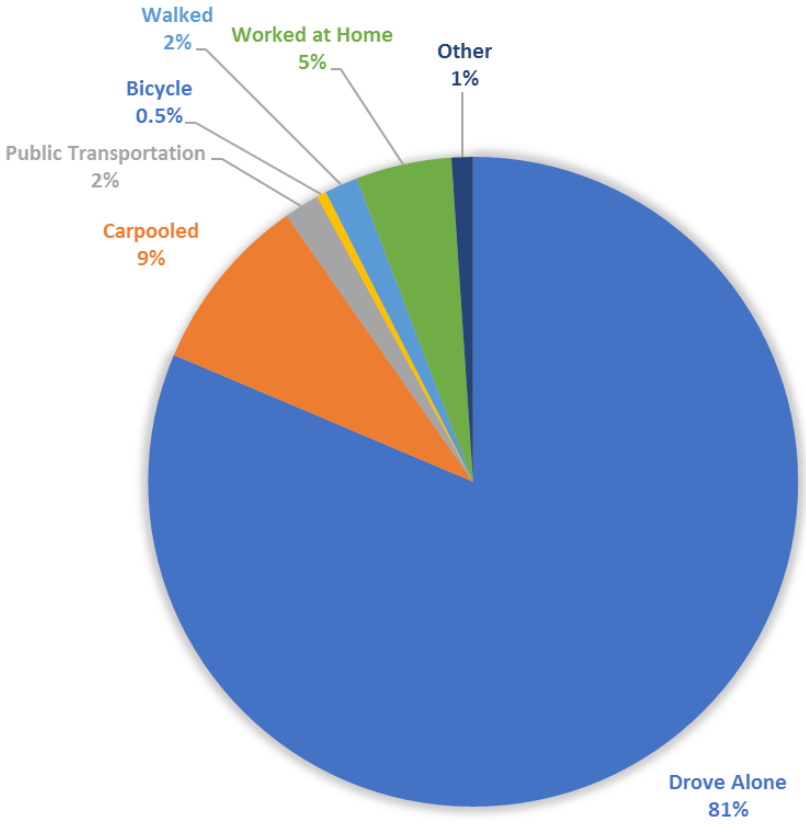
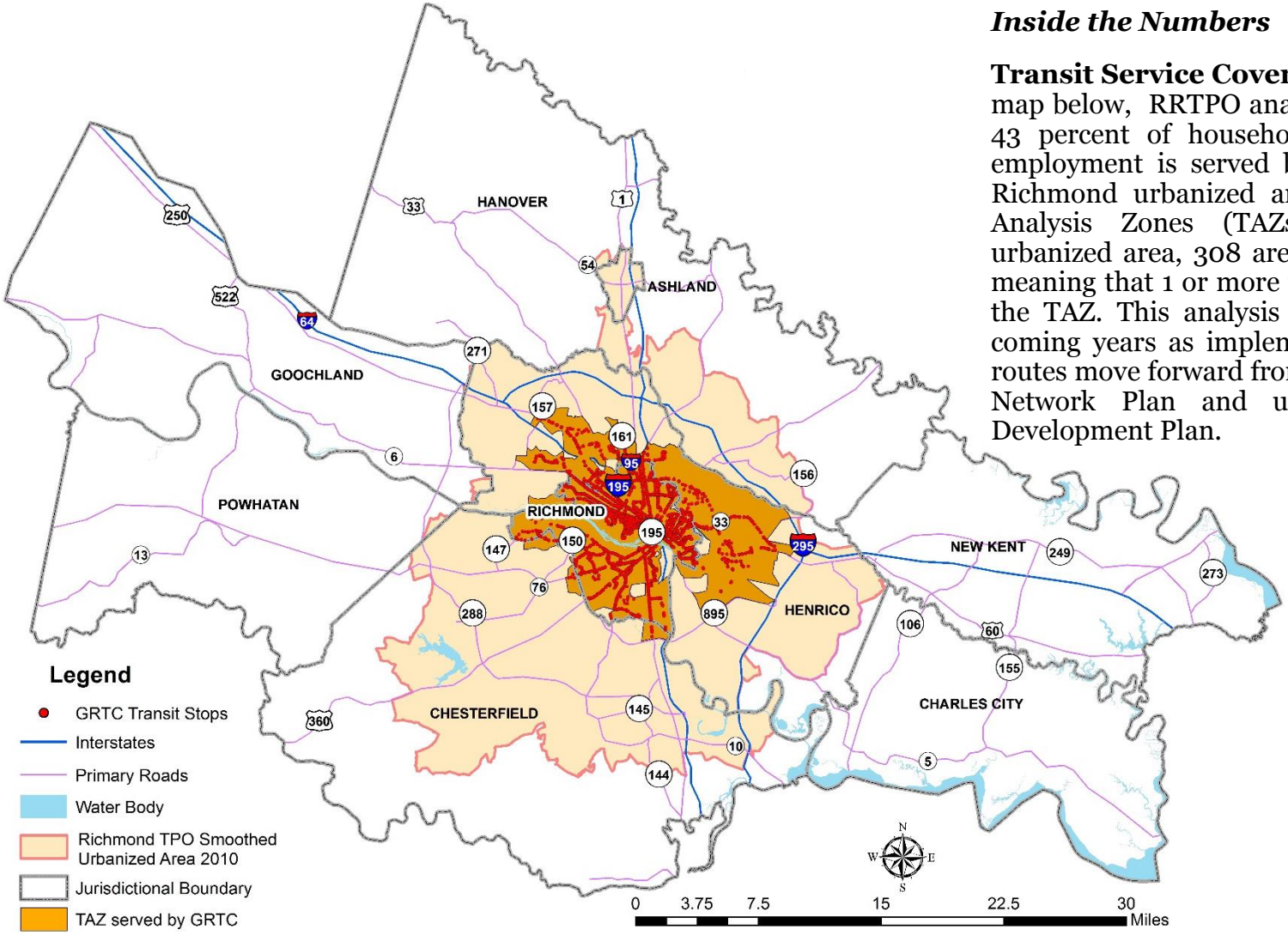


Figure 6: Means of Transportation to Work for Workers 16 years and over, American Community Survey 2011-2015 5-year estimates compiled for nine RRTPO jurisdictions



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. This analysis will be updated in the coming years as implementation of new GRTC routes move forward from the Richmond Transit Network Plan and updated GRTC Transit Development Plan.

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 grown from FY 09 to FY 16, with FY 13 as the highest ridership year with over 439,000 boardings and alightings. FY 14 to FY 16 ridership has been relatively flat, hovering around 430,00 annual riders.

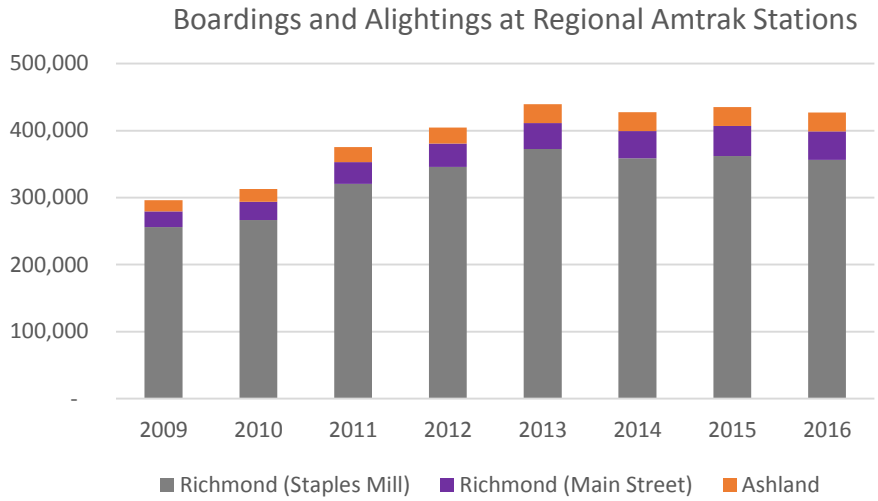


Figure 7: Boardings and Alightings (by FFY) at Richmond Stations, Amtrak Fact Sheets

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 newer non-flight services to Denver and Pittsburgh continue to increase options for the region's residents and business travelers.

Richmond International Airport Non-Stop Destinations	
Atlanta	Miami
Boston	Minneapolis/St.Paul
Charlotte	New York (LGA, EWR, JFK)
Chicago	Orlando/Sanford
Dallas	Philadelphia
Denver	Pittsburgh
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 2017)

Program Highlight

Greater RVA Transit Vision Plan

The Greater RVA Transit Vision Plan was developed through a collaborative process led by the Virginia Department of Rail and Public Transportation (DRPT) and the RRTPO. The planning process included all of the RRTPO jurisdictions as advisory committee members, through direct outreach and updates to the RRTPO citizen, technical and policy boards.

For the plan's development, a core group of stakeholders were engaged. The Regional Transit Forum was formed to provide guidance and input for this study, and the group is intended to continue in some form as the region moves forward with implementation of the plan. The general public was also engaged through three rounds of public meetings.

The full-build system presented by the study is estimated to cost between $123 and $147 million (in 2016 dollars) for annual operations, which is 150 to 200 percent more than the No Build Alternative. The No Build includes the current system, plus the planned Pulse BRT line from Willow Lawn to Rockett's Landing.

The Vision Plan includes an examination of both existing and future land use. The existing activity densities reveal several areas of the region that are already 'ripe' for transit and many areas that fall below the threshold for fixed route transit.

Future plans and projections indicate that even more of the region will be developed to transit-supportive densities by 2040. The plan accepted and endorsed by the RRTPO at the April 6, 2017 meeting with a recommendation to determine opportunities for implementation of high priority corridors.

Program Highlight

RRTPO Bike/Ped Counter Program

In May 2015, the RRTPO was one of 10 Metropolitan Planning Organizations (MPOs) selected by the Federal Highway Administration (FHWA) to participate in a Bicycle-Pedestrian Counter Technology Pilot Project. The RRTPO has championed the development of safe and connected bicycle and pedestrian networks and the investment in bicycle and pedestrian infrastructure has increased in recent years. The RRTPO is now overseeing a regional bicycle and pedestrian count program to beto better understand the value of bicycle and pedestrian mobility in the Richmond region.

Purpose of Program: To develop regional baseline data for bicycle and pedestrian usage by providing the counters for spot counts in priority locations identified by local partners.

Tools: The RRTPO owns passive infrared counters for counting pedestrians, and pneumatic tube counters for counting cyclists. The tube counter has the flexibility to be positioned in the most appropriate locations for counting cyclists, including possibly on the sidewalk or across the entire street width.

Under the RRTPO program, counts have been collected in the City of Richmond, Town of Ashland and Henrico County to date. Recently, Henrico County has installed the RRTPO counting equipment to collect data on the county's first bike lanes on Park Terrance Drive. The photo below shows the installation of the pneumatic tube counters in this area.

Bike counter on Park Terrace Drive. Photo Credit: Henrico County

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. As evidenced in Table 10, the reported roadway crashes in RRPDC jurisdictions has hovered around 18,000 annual crashes until a recent uptick in 2015 and 2016. Figure 8 at right considers the number of highway crashes as a rate per 100 million Vehicle Miles Traveled. The most recent data for 2016 was not available as of writing this report, but this graphic indicates that the rate of crashes is actually quite comparable between 2013 and 2015 – which indicates that VMT increases may have some correlation to the overall increase in the number of crashes.

VDOT recently released an updated Strategic Highway Safety Plan (SHSP), which goes into great detail on the influencing factors for highway crashes. The SHSP provides strategies to reduce the number of fatality and serious injury crashes, focusing on speed, young drivers, occupant protection, impaired driving, roadway departures, intersections, bicyclists, and pedestrians as key emphasis areas. The RRTPO is using the SHSP as a guide to understand potential opportunities for promoting or implementing safety programs and initiatives.

Number of Highway Crashes in Richmond PDC Area							Desired Trend	1-year Trend	5-year Trend
2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*			
17,423	18,460	18,359	18,453	18,234	19,752	20,550			

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

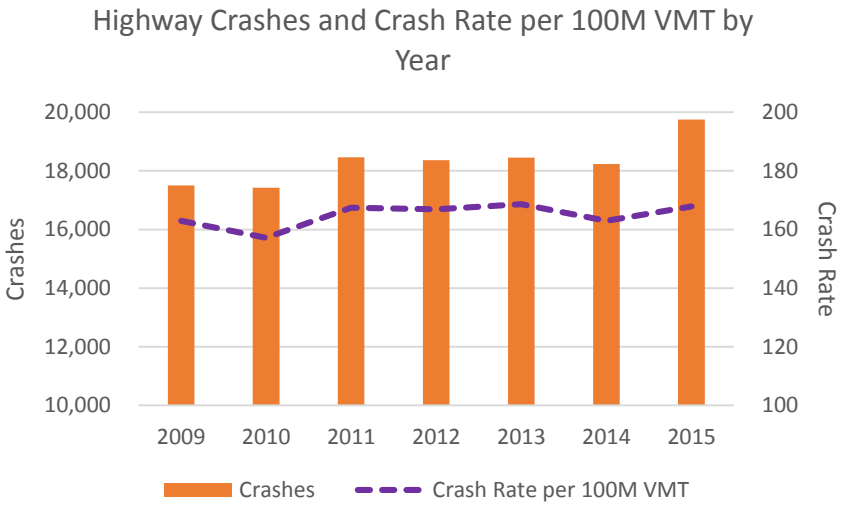


Figure 8: Highway Crashes per 100 M VMT in Richmond PDC Area, Virginia DMV and VDOT

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 serious injuries by 50% by the year 2030."

For the RRPDC jurisdictions (Table 11), 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, however, fatalities decreased in 2016. An analysis of the number of fatalities in the RRTPO study area, and a target setting exercise is underway as part of the FY 18 UPWP. See page 6 of this report for additional information on safety target setting.

In terms of fatality rate (Figure 9), a ratio of the number of fatalities and total vehicle miles traveled in each year, for the year 2015 just under one fatality accident on the region's roadways occurred with every 100 million vehicle miles traveled in the region. For context, the daily VMT in 2015 was just over 32 million miles per day in the Richmond region.

Number of Highway Fatalities in Richmond PDC Area							Desired Trend	1-year Trend	5-year Trend
2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*			
85	90	70	83	76	92	78			

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

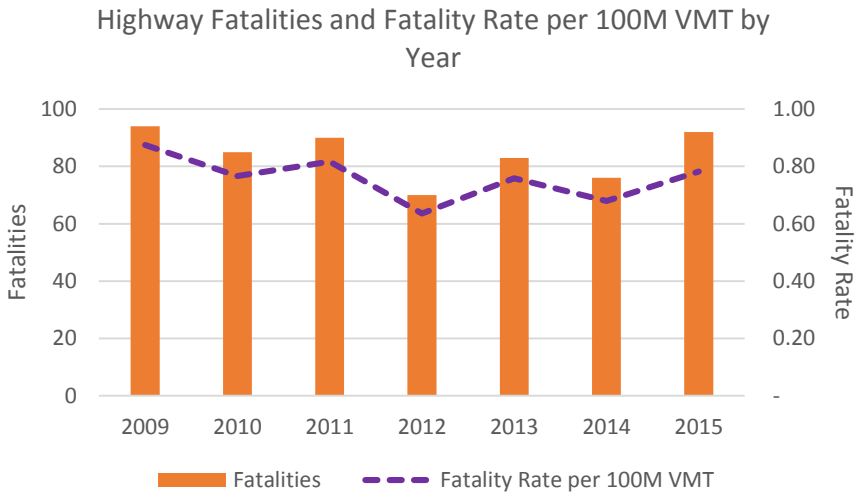


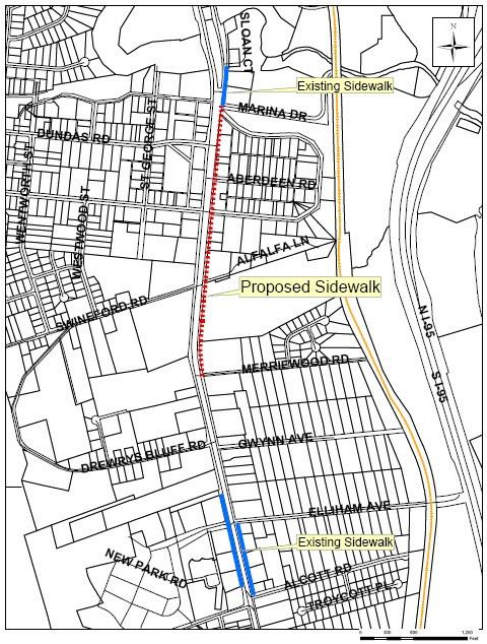
Figure 9: Highway Fatalities per 100 M VMT in Richmond PDC Area, Virginia DMV and VDOT

Project Highlight

Route 1. Sidewalk in Chesterfield County

The Virginia SMARTSCALE funding program is data-driven and performance based process to select transportation projects for funding and ensuring the best use of limited tax dollars. The process involves regional coordination of project development and submission of regional applications. The program prioritizes projects using objective and quantifiable analysis that at a minimum considers factors relative to the cost of the "project or strategy," congestion mitigation, economic development, accessibility, safety and environmental quality.

Chesterfield County applied for and received just over $2 million FY 18 SMARTSCALE funding to construct 3,000 feet of sidewalk along Route 1 between Marina Dr. and Merriewood Rd. (UPC #111712). New sidewalk at this location will improve accessibility and safety for pedestrians traveling between residences and retail areas. The project will connect to previous sidewalk improvements completed in 2011. More than 7,500 people live within a 1-mile radius of this project, and the project will improve safety along the shoulder of Route 1 which is posted 45 mph speed limit in this area.



Proposal for 3,000 feet of sidewalk along Route 1.

Person in wheelchair on the shoulder of Route 1.

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.

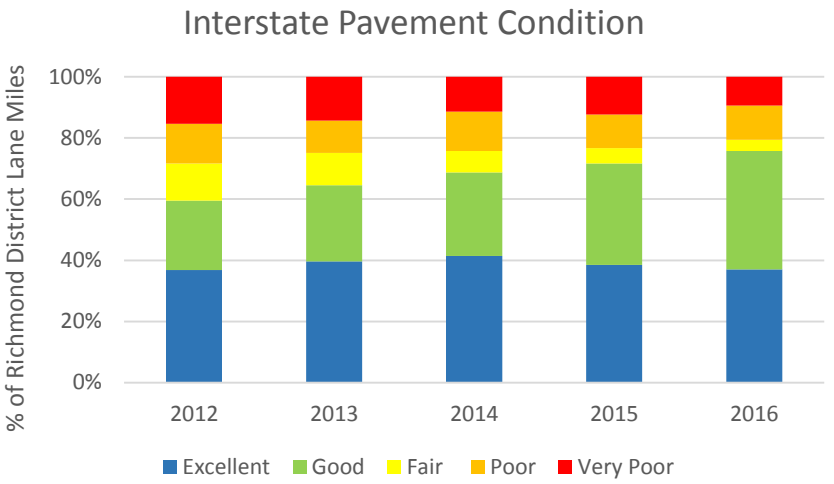
Inside the RRTPO Program

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 is underway as part of the FY 18 UPWP. The Update 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

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 2016. The percentage of very poor condition decreased in 2016 reporting on VDOT maintained primary roads in the Richmond District. Interstate pavement conditions appear to be improving overall, with the percentage of very poor pavement condition decreasing over the 2014 to 2016 reporting periods. 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.



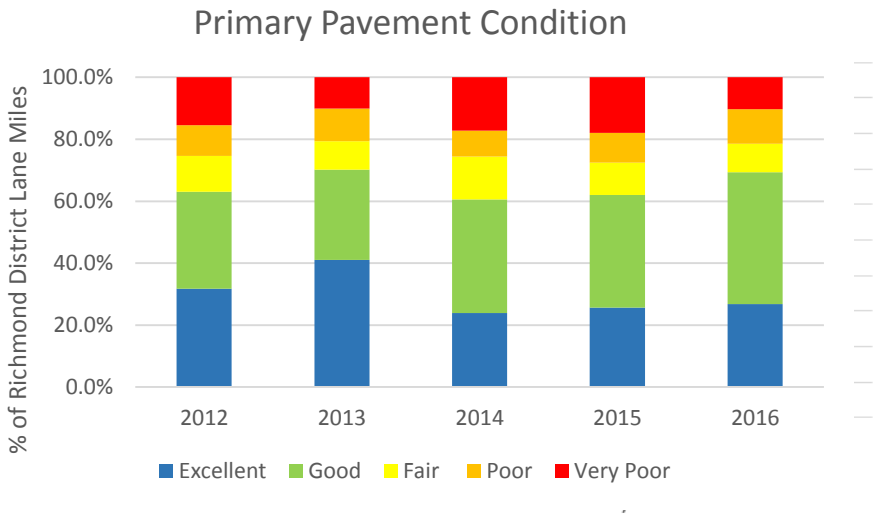


Figure 10: Interstate and Primary Pavement Condition, VDOT State of Pavement (2012-2016)

Program and Project Highlight

State of Good Repair Program – Mayo Bridge

As Virginia's transportation network ages and the costs of materials increase, it becomes increasingly important to consider how best to manage the system to preserve its condition and functionality, and to factor this consideration into the planning process, according to VDOT. The State of Good Repair Program helps to allocate funds to assist with projects like the reconstruction and replacement of structurally deficient state and locally owned bridges. It also helps with the reconstruction and rehabilitation of pavement on the Interstate System and primary state highway system, including municipality-maintained primary extensions. More than $171 million in funds were distributed under the State of Good Repair program in 2017.

Located on 14th Street in the City of Richmond, the Mayo Bridge was constructed in 1913 and provides a connection over the James River between Manchester and downtown Richmond. The bridge has a VDOT scored bridge sufficiency rating of 35.8, a condition which is considered poor. The City has received State of Good Repair funding for a $10 million rehabilitation project. The project will include reconstructing the deck and approaches; repairing all delaminated concrete from under the arch and spandrel beams, pier caps, columns and abutments; and repairing or replacing portions of the parapets.

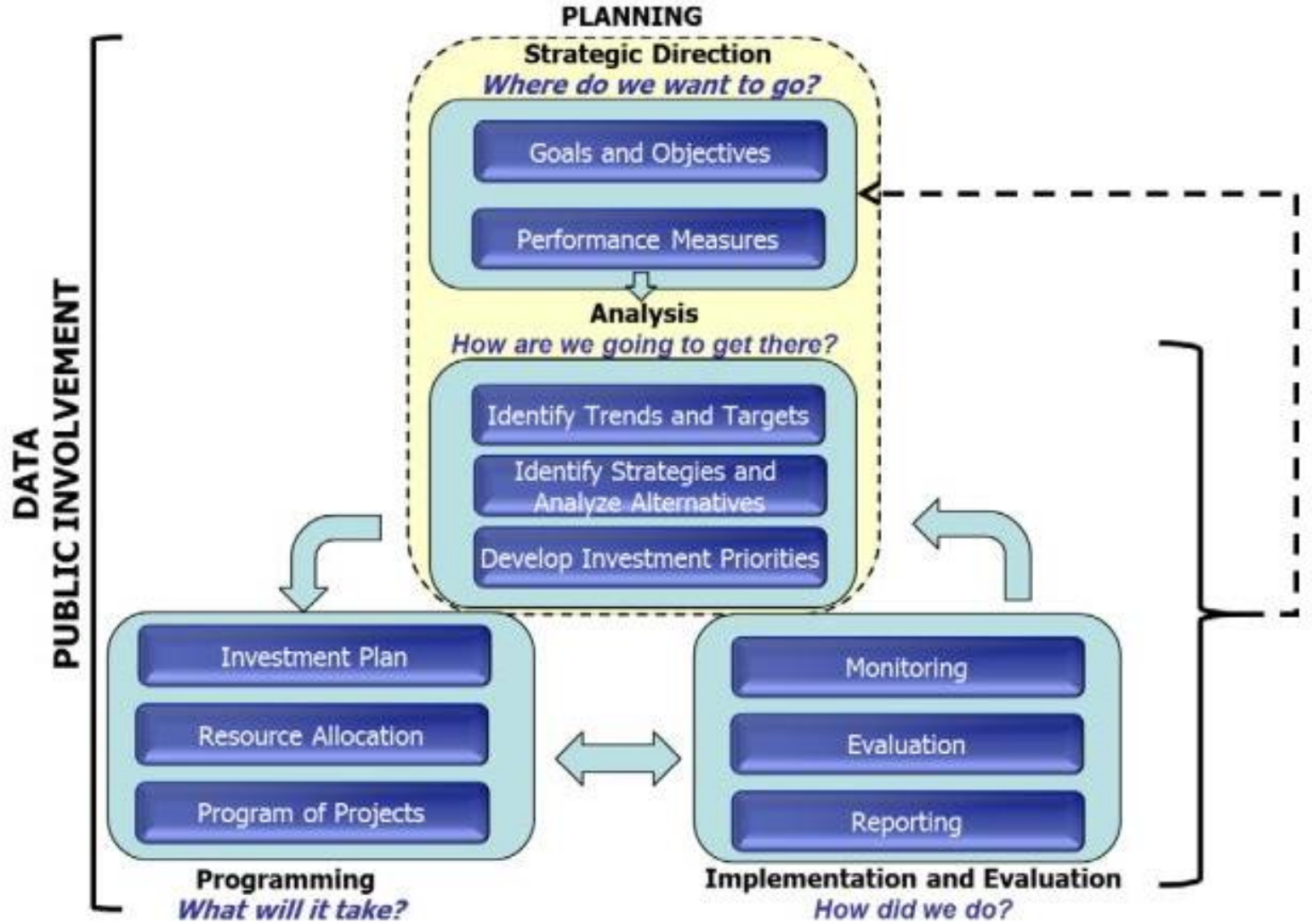
Project map for Mayo Bridge

Mayo Bridge VDOT scored bridge sufficiency rating of 35.8 is considered poor.

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
	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)