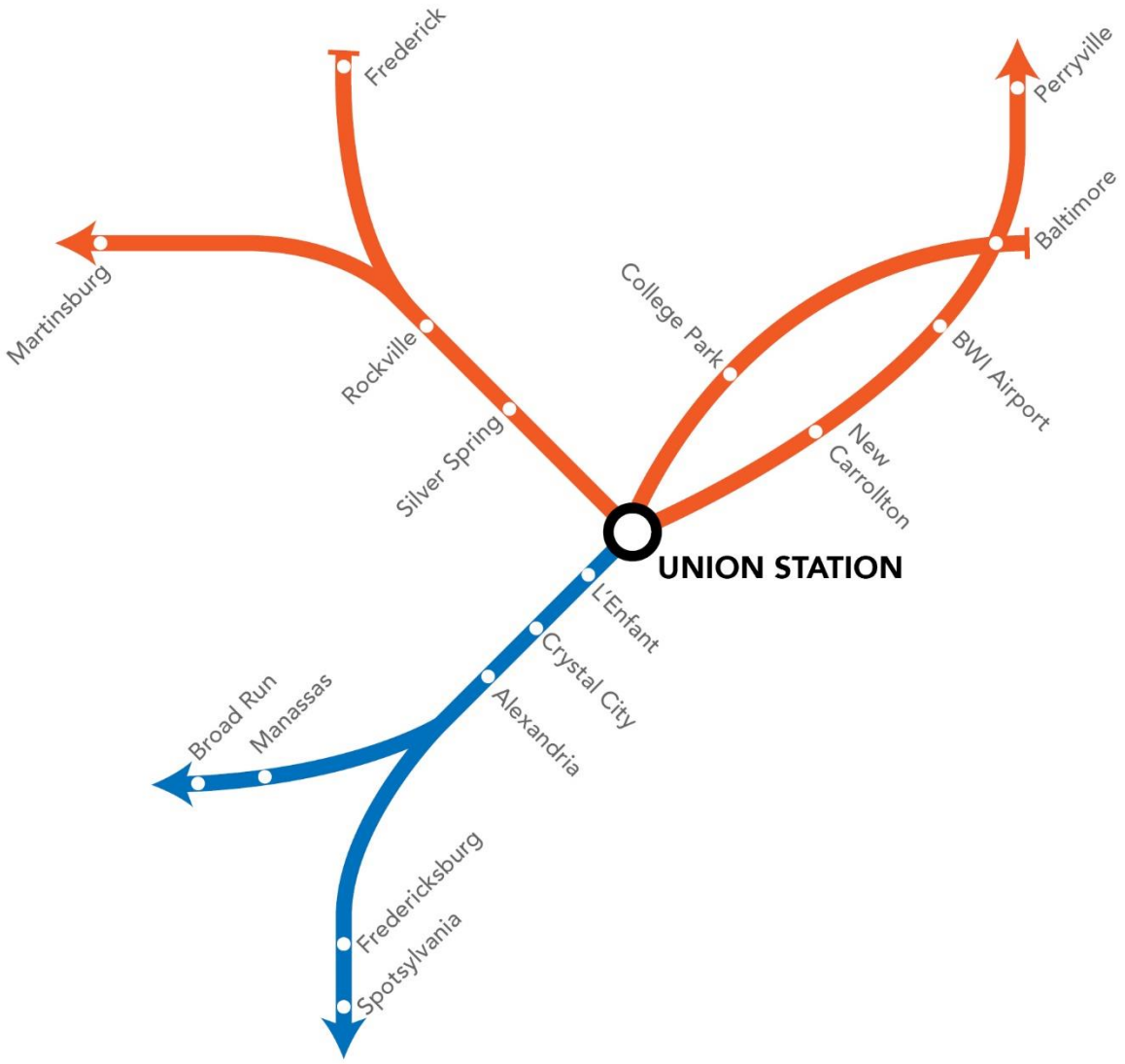
Market Assessment and Technical Considerations for

VRE-MARC Run-Through Service in the National Capital Region



Prepared on Behalf of:

Metropolitan Washington Council of Governments

National Capital Region Transportation Planning Board

Market Assessment and Technical Considerations for VRE-MARC Run-Through Service in the National Capital Region

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Prepared by
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with assistance from
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CONTENTS

FIGURES

TABLES

1. INTRODUCTION

1.1. Project Background

The *Market Assessment and Technical Considerations for VRE-MARC Run-Through Service in the National Capital Region* is a study by the Transportation Planning Board (TPB) at the Metropolitan Washington Council of Governments (COG) to explore the market potential for run-through service between the Maryland Area Regional Commuter (MARC) and Virginia Railway Express (VRE) commuter rail systems. While this study outlines some broad considerations that need to be addressed for run-through implementation, this effort is not a large-scale, comprehensive engineering feasibility study.

The study was commissioned by the TPB through its Technical Assistance Program to support MARC and VRE's collaboration on market potential for run-through service. As part of this effort, a technical advisory committee (TAC) was formed to support the technical team with subject matter expertise in its analysis. The TAC consists of representatives from COG, Virginia Department of Rail and Public Transportation (VDRPT), VRE, Maryland Department of Transportation (MDOT), Maryland Transit Administration (MDOT MTA), Northern Virginia Transportation Commission (NVTC), and District Department of Transportation (DDOT). The technical work was completed by Foursquare Integrated Transportation Planning (Foursquare ITP) with assistance from RL Banks and Associates (RLBA). See **Table 1** for a list of TAC participants.

Table 1: Technical Advisory Committee

Name	Organization
Eric Randall	COG / TPB
Nicole McCall	COG / TPB
Timothy Canan	COG / TPB
Jeffrey Bennett	DDOT
Randy Selleck	DRPT
Katherine Youngbluth	DRPT
Kari Snyder	MDOT
Kyle Nembhard	MDOT MTA
Dan Goldfarb	NVTC
Sonali Soneji	VRE

While the topic of run-through service has been discussed and studied several times in the past, a need for a new study was identified in 2017. A number of planning initiatives and railroad infrastructure expansion projects were underway, including: the MARC Cornerstone Plan; capacity expansion proposed at Washington Union Station; expansion of the Long Bridge and its approach tracks; and, additional tracks proposed by the Atlantic Gateway/DC2RVA initiatives in Virginia. All these contributed to a renewed interest in studying the potential to better connect the region and enhance the role of commuter rail in serving the region. Before the study began, Amazon announced its decision to establish its second headquarters (HQ2) at National Landing near the VRE Crystal City station in Arlington, VA, adding to the timeliness of the study.

This study kicked off in the Spring of 2019, and since that time, the Commonwealth of Virginia announced its intent to enter into an agreement with CSX Transportation (CSXT) to acquire the right-of-way necessary to

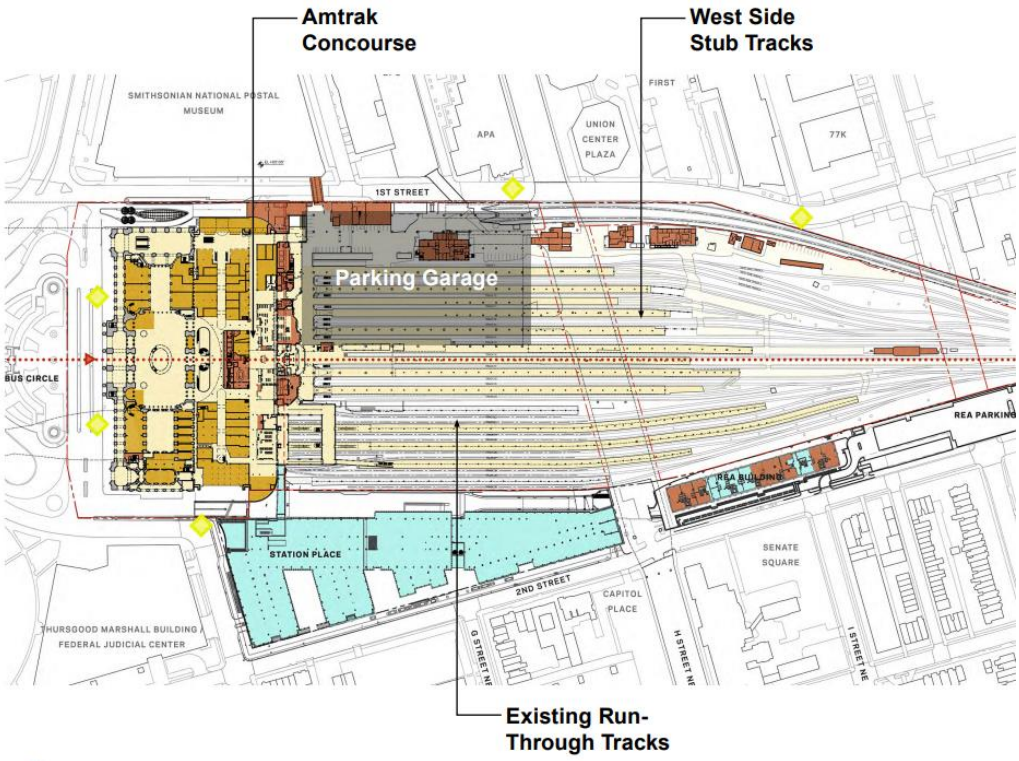
expand passenger rail capacity south of the Potomac River. In response to the efforts by the Commonwealth of Virginia, the Maryland General Assembly passed legislation in the 2020 legislative session in a show of support for the run-through service concept; however, due to the anticipated fiscal impact of the COVID-19 virus, Governor Larry Hogan determined that it was not financially feasible at this time and ultimately vetoed the legislation as a result. The efforts underway in Maryland and Virginia are occurring independently of this study. The analysis developed here is intended to assist the states in making informed decisions as they consider the possibility of run-through service.

This study is envisioned as an initial step in a fresh evaluation of run-through commuter rail service in the region. The focus of this analysis is to understand and quantify the market potential for run-through service. It also summarizes the various considerations that would need to be addressed in an implementation plan.

1.2. What is Run-Through Service?

Run-through service in this report describes a scenario whereby MARC and/or VRE provide service beyond their current terminus of Washington Union Station, and into Virginia or Maryland, respectively. MARC trains could continue south past Union Station into the District of Columbia and potentially into Virginia to serve stations currently served only by VRE and Amtrak. Similarly, VRE trains could continue north into Maryland to serve stations currently only served by MARC and Amtrak. Today both MARC and VRE terminate all services at Union Station, with VRE occupying the lower level of the station and MARC occupying the station's upper levels. Amtrak operates intercity through-service at Union Station, however the required locomotive change results in lengthy dwell times.

Figure 1: Location of Union Station Run-Through Tracks (FRA, 2019)



1.3. Report Organization

The report is organized into three sections. The first section describes the background research on run-through service, including a review of relevant plans and documents. As part of this phase of the project, the team reached out to regional stakeholders including local jurisdictions and railroads to better understand how run-through service would impact them. The team then developed travel demand estimates to quantify the scale of demand for run-through travel. Finally, the team documented some of the technical and implementation considerations that will need to be addressed before run-through service is realized.

2. BACKGROUND

2.1. Historical Context

As early as 1971, the *Washington Metropolitan Area Rail Commuter Feasibility Study* proposed an integrated regional rail network for the metropolitan area. In 1999 the Greater Washington Board of Trade published *The Potential for MARC/VRE Run-Through Services*, which concluded there was enough demand to support the implementation of run-through service. The *VRE 2004-2024 Strategic Plan* highlights a series of infrastructure improvements necessary to facilitate commuter rail run-through service. Several VRE and MARC studies over the last decade have acknowledged the potential of through service.

Since the 1970s, commuter rail ridership in the region has grown substantially. Regional stakeholders have discussed the potential for run-through service for years. Infrastructure, capacity, and institutional challenges have contributed to the difficulty of implementing the service. Currently, major projects, programs, and initiatives are underway, including Long Bridge, the Transforming Rail in Virginia Program, and Union Station improvements. These capital investments will help address some of these challenges.

Figure 2: The Long Bridge, which connects commuter, intercity, and freight rail networks across the Potomac River, is in the planning phases for major improvements (Image from DDOT)

2.2. Why Study Run-Through Service?

Overlapping the VRE and MARC service areas has the potential to improve travel options and opportunities for residents, expand the employee pool available to employers, and achieve a better jobs-housing balance across the region. It is also possible that the run-through service can aid key mobility goals, including improved reliability and convenience for longer commutes, and an improved user experience for existing riders. Finally, run-through service may benefit operations by reducing the need for midday storage at Union Station.

2.2.1. Improve Jobs-Housing Balance

One of the key potential benefits of run-through service is that it will improve accessibility by strengthening linkages between major employment centers and housing across the region. TPB's Visualize 2045 Aspirational initiative, Bring Jobs and Housing Closer Together, seeks to attain benefits to both businesses and residents by calling for the concentration of housing and jobs near the region's activity centers and high capacity transit stations, including commuter rail stations.[1] Through its regional housing initiative, in 2019 COG set a goal for three-quarters of all new housing to be built in activity centers or near high-capacity transit stations. These locations, including commuter rail stations, were noted as ideal locations to optimize and balance the proximity of new housing to jobs. Run-through service provides residents with the opportunity to connect to other

[1] Activity centers include urban centers, priority growth areas, and traditional towns. These locations will accommodate the majority of the region's future growth and play a central role in achieving COG Region Forward Vision's prosperity, sustainability, accessibility, and livability goals.

employment and housing nodes across the region with a one-seat transit ride and potentially reduce their dependence upon driving. Run-through service can also increase the pool of talent within a reasonable commute to employers, and similarly, make more jobs accessible to more regional residents.

The construction of Amazon's HQ2 in Northern Virginia has the potential to increase travel demand to Arlington, Alexandria, and other surrounding jurisdictions.[2] Similarly, increased employment opportunities in Maryland also has the potential to increase travel demand. Through the stakeholder outreach, interviewed participants voiced an interest in strengthening links to the numerous government agencies with a presence near commuter rail stations in both Maryland and Virginia, including the U.S. Patent and Trademark Headquarters, the National Science Foundation, the National Security Administration, and the National Institute of Health. Additional development is also occurring across jurisdictions, including, but not limited to, a Virginia Tech campus in Alexandria and Kaiser Permanente new regional offices in Prince George's County.

2.2.2. Reduce and Mitigate Peak Congestion on Highways and Metrorail and Improve Reliability and Resiliency of the Transportation Network of the Washington Region

Across the plans reviewed, congestion was cited as one of the critical transportation issues facing the National Capital Region. Growing congestion is a major theme of TPB's Long-Range Transportation Plan, *Visualize 2045*, DDOT's *District State Rail Plan*, and VRE's *2004-2024 Strategic Plan* and *Analysis of Benefits to a Regional Multimodal Network of Northern Virginia and Washington, D.C*. Run-through service offers an opportunity to provide an alternative to overburdened roads and transit systems.

Visualize 2045 contains goals and aspirational initiatives related to congestion and reliability that would be supported by run-through service, including:

- **Provide More Options for Commuting:** This initiative involves reducing solo car trips and getting cars off the road. Run-through service could better connect regional activity centers together and reduce the need for driving between Maryland and Northern Virginia.
- **Move More People on Metrorail:** While run-through service does not directly expand Metrorail capacity, it creates a parallel service that potentially distributes transfers to Metrorail across more stations, reducing crowding at Union Station.

Run-through service could further expand the utility of several underway transit investments. The completion of the Potomac Yard Metrorail station and expansion of the Potomac Yard Transitway will increase accessibility from Crystal City's VRE station to destinations along Route 1. In Maryland, projects like the Purple Line and US-29 Bus Rapid Transit will connect with MARC, allowing run-through riders to access destinations in Maryland from Virginia while bypassing Metrorail. In Washington, D.C., WMATA is experiencing challenges with capacity along most of its trunk Metrorail lines. Run-through service would reduce the need to transfer between commuter rail and Metrorail and may potentially help reduce projected Metrorail capacity issues.

Finally, run-through service would enhance the resiliency of the region's transportation network by providing an additional route or mode. Greater volumes of commuter rail service across the Potomac could absorb some demand in instances where there is a disruption of service on Metrorail or closure of a highway bridge.

2.2.3. Improve Service Convenience and Reliability for MARC and VRE Riders

Run-through service could also appeal to existing commuter rail riders. Today a large volume of riders transfer at Union Station to other modes to reach their final destinations. With services continuing past Union Station,

[2] The Maryland Statewide Transportation Model (MSTM) used for this study estimates that the area around Crystal City (including Amazon HQ2) will see a 58 percent growth in average daily trips between today and 2040.

the number of transfers could be reduced. Run-through service could also help ease congestion at Union Station by spreading out boardings and alightings across a larger number of stations. This reduction of congestion could be especially critical as implementation of the Union Station master plan gets underway. The prospect of run-through service also leaves open the possibility of travel time savings however, the ultimate savings will depend on the anticipated, extended dwell times at Union Station to accommodate the boarding and alighting of passengers, and any additional operational requirements.

2.2.4. Reduce Midday Train Storage Demand at Union Station

Run-through service also has the potential to provide operational benefits and efficiencies for the two railroad agencies. Both MARC and VRE currently experience storage and maintenance challenges at Union Station due to limited space to store trains. With increasing pressure to reduce activity at nearby Amtrak-owned facilities to accommodate future plans, both agencies have worked to identify solutions.

By extending the terminus of select trains, MARC and VRE are potentially presented with more options for outlying midday storage. This also has the potential to minimize the need for running empty, non-revenue trains over long distances for the purposes of midday storage.

2.3. Past Plans

As part of this study, the technical team completed a comprehensive document review, which is summarized in **Table 2.** These documents come from a variety of sources, including transit agencies, regional transportation organizations, jurisdictions/local governments, and advocacy groups/non-profits. The reviewed documents include:

- Existing transportation plans and studies
- Jurisdictional plans
- Previous work related to run-through service
- Run-through service studies in other communities

Table 2: Documents Reviewed

Document	Author	Date	Document Description	Why it was Reviewed
Local Studies				
Critical Infrastructure Needs along the Northeast Corridor	Northeast Corridor (NEC) Commission	January 2013	This study considers the entirety of the NEC and evaluates infrastructure weaknesses that are preventing rail providers from adding additional service.	This study highlights infrastructure needs along the NEC (MARC Penn Line), including between Baltimore and Washington, D.C. In particular, it provided insight on capacity constraints that will impact the feasibility of run-through service.
D.C. to Richmond Southeast High-Speed Rail EIS	VDRPT, Federal Railroad Administration (FRA)	September 2017	This is the EIS document for proposed High-Speed Rail between Richmond, VA and D.C.	If constructed, this service will complement and place additional demands on rail right-of-way.
District of Columbia State Rail Plan	DDOT	2017	DDOT's plan for future rail investments and policies, including improvements to VRE, MARC, Amtrak, and Metrorail.	The document includes the rail system goals and plans for the District; the right-of-way used by MARC and VRE run-through.
Long Bridge Environmental Impact Statement	DDOT, FRA	June 2018	The environmental impact statement (EIS) for proposed capacity expansion of the Long Bridge over the Potomac River, connecting Washington, D.C. and Arlington. The EIS was prepared by the DDOT with help from the FRA	The only passenger and freight rail connection between Virginia and Washington, D.C., the Long Bridge is a major bottleneck. The capacity expansion, through the construction of a second span, is critical to the feasibility of run-through service.
MARC Cornerstone Plan	MDOT MTA	August 2019	Outlines a series of investments over the next 25 years and illustrates various infrastructure improvements that are required for improved MARC Train Service.	The Cornerstone Plan includes a section on potential MARC Train service into Northern Virginia and outlines a series of capital improvements that are expected to help facilitate feasible implementation of run-through service.
MARC Origin-Destination (O-D) Study	MDOT MTA	August 2016	Large-scale rider survey that collected O-D, trip characteristic, demographic, and fare data from MARC riders.	Key source of data to understand existing commuter rail travel patterns between Maryland and Virginia

Document	Author	Date	Document Description	Why it was Reviewed
NEC Futures EIS	FRA	July 2016	NEC Futures is the plan for the future of the NEC. The plan is to expand capacity on this corridor and improve the aging infrastructure.	The NEC Future EIS describes plans to expand capacity, improve aging infrastructure, and expand service along the NEC (MARC Penn Line). Infrastructure improvements to the network between Baltimore and D.C.
Northeast Corridor Through-Ticketing Study	NEC Commission	November 2018	This study analyzes the feasibility of deploying integrated ticketing across multiple modes of transit in the NEC.	The study highlights challenges of establishing an integrated fare collection system between multiple commuter rail agencies.
Potential for MARC/VRE Run-Through Services	Washington Board of Trade	1999	This report examines the feasibility and potential ridership demand for run-through service. The study concludes that by 2020 there will be demand for over 5,000 trips a day across the MARC and VRE service areas.	Example of past study estimating run-through ridership demands. The existing level of services on MARC and VRE have changed substantially enough that ridership estimates are no longer valid. However, many of the market opportunities and constraints still apply.
State of Commute Survey	COG/TPB	June 2017	This report summarizes the results of 2016 State of Commute Survey performed by COG. This survey asks individuals to answer questions relevant to their commute, including mode, distance, and length.	The report provides detail on commuting patterns in the National Capital Region.
Union Station Master Plan	Amtrak	July 2012	Amtrak's plan for Union Station, including future expansion and updates to the physical infrastructure.	Union Station is the hub of transit for Amtrak, VRE, MARC, and other transit service in the District. The station's infrastructure must be able to accommodate any future commuter rail run-through service that is proposed.
Virginia Railway Express 2004-2024 Strategic Plan	VRE	May 2004	VRE's Strategic Plan estimates future ridership demand; identifies the extent, quantity and type of service that VRE would need to provide to meet its future market potential; determines the required capital projects and associated costs; and identifies potential implementation and funding strategies.	Although it is dated, the plan details issues related to run-through service. It extensively describes the challenges and necessary adjustments for run-through service to be implemented.

Document	Author	Date	Document Description	Why it was Reviewed
Virginia Railway Express Analysis of Benefits to Regional Multi-Modal Network of Northern Virginia and Washington D.C.	VRE	2015	This study describes the economic and physical benefits that the transportation network in Northern Virginia and D.C. receive from the operation of VRE as a commuter rail option.	The study examines the role VRE plays in the overall network and how it connects to other transportation systems.
Virginia Railway Express System Plan 2040	VRE	February 2014	Framework for VRE system investments and actions the agency should pursue through 2040 to best meet regional travel needs.	The plan groups future system investments in three phases. The third phase (2021-2040) includes investments that support potential run-through service.
Virginia State Rail Plan	VDRPT	2017	The state rail plan for the Commonwealth of Virginia. The plan evaluates the state of all rail in Virginia, including freight and considers the future of rail.	The plan examines both freight and commuter rail which share track for most of the run-through service area.
Visualize 2045	COG/TPB	October 2018	The Long-Range Transportation Plan (LRTP) for the National Capital Region. It was approved in October of 2018.	The plan includes a list of transportation improvements and goals for the region over the next 25 years. The plan includes both a financially constrained element as well as an aspirational element.
VRE Customer Opinion Survey Results	VRE	2018	This study presents the survey results from the VRE Customer Survey.	The survey includes some basic origin, destination, and mode transfer questions.
VRE Master Agreement Survey	VRE	2018	This is an O-D passenger survey	Includes greater detail of O-D data.
VRE FY 2020-2025 TDP	VRE	February 2019	VRE's six-year Transit Development Plan (TDP). The plan discusses infrastructure changes, service updates, and capital improvements and includes a five-year, fiscally constrained plan and a ten-year, fiscally-unconstrained plan	Provides background on the agency's fiscally constrained and unconstrained service improvements over the next ten years.
Washington Metropolitan Area Rail Commuter Feasibility Study	Urban Mass Transportation Administration	May 1971	This is an early study that analyzed the feasibility of redesigning the rail system in the Washington region. At the time of the study, neither MARC nor VRE existed.	Although it is outdated, this plan shows an early approach to redesigning regional rail systems, so they are more coherent and connected.

Document	Author	Date	Document Description	Why it was Reviewed
		Other Studies		
London Crossrail Environmental Impact Statement	Cross London Rail Links Limited	February 2005	Analysis of the impacts of London's Crossrail on the metropolitan area's transport system.	The study provides an example of how another region analyzed the impacts of new rail infrastructure on its overall transportation system, including existing and expected system constraints.
North-South Rail Link Feasibility Reassessment	Massachusetts Department of Transportation	January 2019	This report examines the feasibility of connecting Massachusetts Bay Transportation Authority's (MBTA) Northside and Southside commuter rail networks to create one regional system.	The report provides an example of another transit agency's approach in examining the feasibility of run-through service. The report also highlights one approach to address capacity constraints.
Penn Station Access	Metro-North Railroad	September 2002	Developed by Metro-North Railroad in New York, the Penn Station Access plan examines the feasibility of several alternatives for expanding access between the Metro-North service area, east of the Hudson River, to Penn Station and destinations on the West Side of Manhattan.	The study provides an example of another region's attempt to provide improved commuter rail connections in a capacity constrained environment.
Rail Vision Study	Massachusetts Bay Transportation Authority (MBTA)	2019	The Rail Vision Study aims to determine the most "cost-effective strategies to transform the existing Commuter Rail System" in the Boston region. This study is ongoing, however, through the study, MBTA has evaluated costs, ridership potential, and operational feasibility of a variety of alternatives to construct a vision for the future of commuter rail in the region.	The report provides an example of how a peer agency has undergone a visioning process, including the development of alternatives, for a commuter rail system. The analysis is in an early stage and limited information is available about the methodology.

2.4. Stakeholder Feedback

To complement the comprehensive review of past studies, the study team conducted a series of phone interviews with stakeholders regarding the potential for run-through service in the region. These interviews were intended to gain additional perspectives on run-through service that were not necessarily available through published plans. To ensure more widespread participation, the study team also developed an online questionnaire for stakeholders, which covered the same questions as the phone interviews.

2.4.1. Overview of Outreach

For the interviews, the study team reached out to 40 organizations, including members of the technical advisory committee (TAC), regional agencies, railroads, transit providers, jurisdictions and economic development organizations within the COG planning region. While the study team recognizes that there are many more stakeholders for VRE-MARC run-through service, this was a first step to obtain feedback. The study team conducted a total of eleven phone interviews, and eight stakeholders participated in the online questionnaire; these stakeholders are listed in **Table 3**.

Table 3: Participating Stakeholders

Name	Organization	Response Type
Regional Agencies		
Sree Nampoothiri	Northern Virginia Transportation Authority	Online questionnaire
Dan Goldfarb	Northern Virginia Transportation Commission	Phone Interview
Betsy Massie	Potomac and Rappahannock Transportation Commission	Online questionnaire
Rail Agencies		
Byron Comati	Amtrak	Phone interview
Stephen Flippin	CSXT	Online questionnaire
Randy Marcus	CSXT	Online questionnaire
John Edwards	Norfolk Southern (NS)	Phone interview
Kyle Nembhard	MDOT MTA	TAC Input
Christine Hoeffner Sonali Soneji	VRE	Phone interview
Transit Agencies		
Martin Barna	Alexandria DASH	Online questionnaire
Melissa Kim	Washington Metropolitan Area Transit Authority	Online questionnaire
Jurisdictions		
Rich Roisman	Arlington County	Phone interview
Chloe Delhomme	City of Manassas	Phone interview
Jim Maslanka	City of Alexandria	Phone interview
Jeffrey Bennett	District of Columbia	Phone interview
Robert Brown	Loudoun County	Online questionnaire
Gary Erenrich	Montgomery County	Phone interview
Victor Weissberg	Prince George's County	Phone interview
Paolo Belita	Prince William County	Phone interview
Economic Development Organizations		
Joe McAndrew	Greater Washington Partnership	Online questionnaire

The online questionnaire and the phone interviews included the same questions, adjusted slightly based on if the participant were part of a rail or transit agency versus a jurisdiction or economic development organization. The questions for jurisdiction's and rail and transit providers are listed in **Table 4**.

Table 4: Interview and Questionnaire Questions

Jurisdiction and Economic Development Organization Questions
Are there any planned or underway developments that would impact run-through service (e.g. infrastructure improvements, new developments)?
Does run-through service address any of your constituents' key transportation challenges?
Are there any major public priorities that run-through service addresses?
Are there any local hurdles that must be overcome to make run-through service a reality?
Is there any other information you would like to share with the team?
Rail and Transit Provider Questions
Are there any planned or underway developments that would impact run-through service (e.g. infrastructure improvements, new developments)?
Please describe any benefits related to run-through service for your organization.
Please describe any major constraints or concerns related to run-through service operating along your rail network or in your service area.
Is there any other information you would like to share with the team?

2.4.2. Stakeholder Feedback

The stakeholder outreach found general interest in run-through service. Participants mentioned opportunities to integrate major private developments underway across the region. Both Maryland and Virginia are investing in transportation infrastructure and transit service around rail stations, increasing the opportunities for multi-modal access. Finally, stakeholders have shared the belief that run-through service has the potential to address mobility constraints in the region.

Private Investment

Areas near MARC and VRE stations are seeing hundreds of millions of dollars in private commercial and residential development. One of the highest visibility projects underway is Amazon's HQ2, which is expected to bring thousands of new jobs to Arlington and Alexandria. Nearby, a large mixed-use development at Potomac Yards is under-construction, and will include a new technology center for Virginia Tech. Major housing and commercial development is also being planned at the Broad Run Station. Micron Technology is planning on expanding in Manassas, bringing with it 10,000 jobs.

Montgomery County also has plans for commercial and residential development in close proximity to several MARC stations, including Silver Spring, Rockville, and Gaithersburg. In addition, WMATA has plans to relocate some employees to Prince George's County, near the New Carrollton Metro Station. Kaiser Permanente in 2019 opened their new administrative offices in New Carrollton.

Regional Investments in Transportation

There are several public investments in infrastructure and transit service that will connect with the VRE and MARC systems. Some projects mentioned by stakeholders, include:

- The City of Alexandra has completed the process of redesigning its bus network that will improve bus connections to Alexandria's King Street Station.
- The Potomac Yard Transitway on Route 1 recently received additional state funding to extend its exclusive right-of-way. The transitway connects with VRE at Crystal City.
- A proposed pedestrian bridge connecting National Airport to Crystal City would place the VRE Crystal City station within reasonable walking distance to the Airport.
- The Purple Line will connect to MARC at Silver Spring, College Park, and New Carrollton stations.

Benefits of Run-Through Service

Respondents were largely positive about the impacts of run-through service. For example, WMATA noted that if implemented, run-through service could alleviate capacity issues on Metrorail as well as issues with crowding and congestion on platforms at Union Station and other busy transfer points. Others noted the positive impact run-through service could have on the labor pool by expanding access both for businesses and employees.

Concerns

While most interviews and online questionnaire participants were supportive of run-through service, many brought up concerns around feasibility due to capacity constraints. While these concerns did not represent outright opposition to run-through service, they did reiterate the many challenges revealed in the document review that the region faces in getting run-through service up and running. Norfolk Southern (NS), Amtrak, and CSX Transportation (CSXT) all highlighted concerns with the lack of additional rail capacity to support additional passenger train service south of Union Station.[3] Several participants brought up the Long Bridge as a key chokepoint in the region's rail network.

2.5. Planned and Underway Infrastructure Investments along the Corridor

A confluence of major infrastructure investments within the MARC and VRE network is creating new opportunities for implementing run-through rail service. Several constraining factors have limited the ability to operate trains between MARC and VRE service areas in the past, notability the lack of rail capacity to run additional trains, station infrastructure designed for uni-directional rail service, and limited locations where trains can enter and exit revenue service. The Transforming Rail in Virginia Program (Virginia's landmark deal with CSXT to acquire right-of-way and add passenger and commuter service), combined with improvements at Long Bridge, Union Station, and improvements to Amtrak's Northeast Corridor will help address some of these constraints. It's important to note that many of the planned and underway investments along the corridor have implementation timelines that stretch past 2030, and not all critical investments have yet been funded. Some key investments within the study area are described in the following section.

2.5.1. Investment along the Northeast Corridor

Amtrak's Northeast Corridor has several planned and underway improvements within MARC's operating service area. A major chokepoint for rail service in the region is the Baltimore & Potomac (B&P) tunnel just south of Baltimore Penn Station. The 144-year old two track tunnel needs replacement. Amtrak is pursuing funding for a new tunnel that would have double the rail capacity of the current tunnel.

[3] Interviews were completed prior to the deal between Virginia and CSXT to acquire rail-right-of-way.

Figure 3: Long Bridge (Image from DDOT)

2.5.2. Long Bridge Expansion

The Long Bridge is arguably the most relevant bottleneck to expanding commuter rail service in the region. It is the only railroad bridge spanning the Potomac River in the District and both passenger and freight trains share the two-track span. The bridge is currently nearing both its rail capacity and useful life and has been identified as a top investment priority in several plans.

The Long Bridge Draft Environmental Impact Statement (EIS), prepared by DDOT, analyzes two action alternatives: Alternative A, the locally preferred alternative, retains the existing two-track Long Bridge and constructs a second railroad bridge parallel to the existing span. This new bridge would be dedicated primarily to passenger rail service. Alternative B demolishes the existing Long Bridge and constructs two new parallel bridges, each with two sets of rail tracks (District Department of Transportation & Federal Railroad Assocation, 2018).

The tracks approaching the bridge also act as bottlenecks and would need to be expanded to take advantage of any new bridge capacity. One potential improvement is the addition of a fourth track between the First Street Tunnel and the Long Bridge. Virginia is pursuing the addition of a fourth track from Long Bridge to Alexandria as part of the Transforming Rail in Virginia Program.

2.5.3. Transforming Rail in Virginia Program/Atlantic Gateway Program

In December 2019, the Commonwealth of Virginia announced an intent to enter into an agreement with CSXT to acquire over 350 miles of right-of-way, including along the Fredericksburg Line corridor. Through an agreement with CSXT, the Transforming Rail in Virginia Program would allow Virginia to double Amtrak state-supported service and VRE Fredericksburg Line service (including first time ever weekend service) over the next decade in exchange for Virginia acquiring approximately 350 miles of CSXT right-of-way and 225 miles of track in the I-95, I-64 and I-85 corridors, and building incrementally over the next 10 years, 37 miles of track in the I-95 corridor (including a new two track Long Bridge). These improvements will allow Virginia to separate freight and passenger rail service along the corridor.

The Transforming Rail in Virginia Program incorporates elements of the Atlantic Gateway Program, a multi-modal suite of projects focused on the I-95 corridor between Washington, D.C. and Fredericksburg, VA for which the Commonwealth pursued a FASTLANE grant to leverage public and private investment to improve one of the nation's busiest corridors. The program will reduce travel times, expand access to employment opportunities, enhance the ability to move people and freight, and alleviate some of the worst bottlenecks in

the United States. The initiative outlines several recommendations for improving rail infrastructure, including the construction of additional tracks along the Fredericksburg Line corridor for passenger rail service.

2.5.4. Union Station Master Plan

Union Station is the hub for MARC, VRE, and Amtrak, and is currently the only transfer point between all three services. The Union Station Master Plan includes plans for extensive renovations to this historic train station. The concourses will be expanded and additional entrances and exits will be added to help passengers filter through the station. The platforms will be updated in accordance with the Americans with Disabilities Act, which will improve accessibility for all riders. In general, the station is being re-imagined as a new multi-modal transit hub that can accommodate additional trains and passengers. These improvements are critical in order to allow run-through service to be implemented from Maryland to Virginia (Amtrak, 2012). As discussed later in this report, construction at Union Station will likely result in temporary capacity constraints.

Table 5 summarizes the major capital improvements documented in the literature.

Table 5: Planned, Upcoming or Ongoing Infrastructure Improvements

Project Name	Document	Location	Description	Status
Long Bridge Expansion	Long Bridge Study, VRE 2004-2024 Strategic Plan	Arlington, VA to Washington, D.C. over the Potomac	The existing two-track bridge is the only access point across the river; it limits the number of trains that can travel to and from the District of Columbia.	EIS in progress to expand capacity and improve reliability in the Long Bridge Corridor
Union Station Expansion	Union Station Master Plan	Washington, D.C.	Union Station has reached its maximum capacity for both train and pedestrian traffic. A new concourse would improve flow between MARC and VRE platforms.	Master plan, process underway
Fredericksburg Line Capacity Expansion	VRE Systems Plan 2040, 2020-2025 Transit Development Plan	Fredericksburg Line from Spotsylvania to Union Station	Triple track remaining Fredericksburg Line segments between Franconia-Springfield and Fredericksburg, with a 4th track at critical locations. The TDP also includes plans to extend the platform or construct a second platform at almost all stations.	Process underway

Project Name	Document	Location	Description	Status
Manassas Line Capacity Expansion	VRE 2020-2025 Transit Development Plan	Manassas Line from Broad run to Union Station	The TDP lists several expansion projects, including extending platform at all stations on the line, adding parking at Manassas Park and Broad Run, and adding track at select locations.	Process underway
Storage Yard Expansion	VRE Systems Plan 2040	Union Station	Expand rail yards to accommodate eight-car trains. Facilities will also need to be expanded as the VRE fleet grows.	EIS completed for Midday Storage Facility, preferred alternative selected for Broad Run expansion.
Parking Lot Expansion	VRE Systems Plan 2040	Various Locations, including Broad Run Station, Leeland Road Station, Manassas Station, and Quantico Station	The plan promotes the construction of additional parking spots or a parking garage where feasible.	Process underway
Four-track configuration between the District and Baltimore	Critical Infrastructure Needs Along the Northeast Corridor	NEC, between Baltimore and Washington, D.C.	Between Baltimore and Washington, D.C., the NEC consists largely of three main line tracks, which limits throughput. The investment includes construction of a fourth track between BWI and New Carrollton.	Feasibility complete, conducting EIS
B&P Tunnel	Critical Infrastructure Needs Along the Northeast Corridor	Northeast Corridor, Baltimore and Potomac Tunnels	The existing tunnels are some of the oldest structural assets on the NEC. In 2010, the State of Maryland received a $60 million grant to complete preliminary engineering and environmental review of options to change or replace the tunnels.	Feasibility complete, conducting EIS

Project Name	Document	Location	Description	Status
MARC Storage and Maintenance Improvements	MARC Cornerstone Plan	Martin's Yard	MDOT MTA is moving forward with plans to expand its Martin's Yard facility north of Penn Station in an effort to accommodate Amtrak's Penn Station improvements by re-locating two (2) train sets from Penn Station to the expanded facility.	Martin's Yard will be completed by 2025
MARC Storage and Maintenance Improvements	MARC Cornerstone Plan	Penn Station Storage and Maintenance Re-location	The project re-locates the balance of overnight storage at Penn Station to a new facility for overnight and weekend storage of MARC Penn Line trains. It will also enable MARC train to reduce crowding on trains and accommodate future ridership growth.	This project is still in the early planning stages with the goal of completion by 2035
Additional Platforms/Platform Edges	VRE 2020-2025 Transit Development Plan	Leeland Road, Rippon, Lorton, Crystal City, L'Enfant	VRE has a program to lengthen station platforms to 700 feet at origin stations and 850 feet at destination stations to accommodate longer trains. VRE also has plans to add second platforms on the Fredericksburg Line to accommodate bi-directional service.	Platform extension work is ongoing, second platforms are proposed
VRE Midday Storage	VRE 2020-2025 Transit Development Plan	L'Enfant	VRE is converting existing tracks located to the north and south of L'Enfant Station to be used to temporarily store trains during the midday..	L'Enfant North went into service in Summer 2018. L'Enfant South is expected to be put into service in 2020.

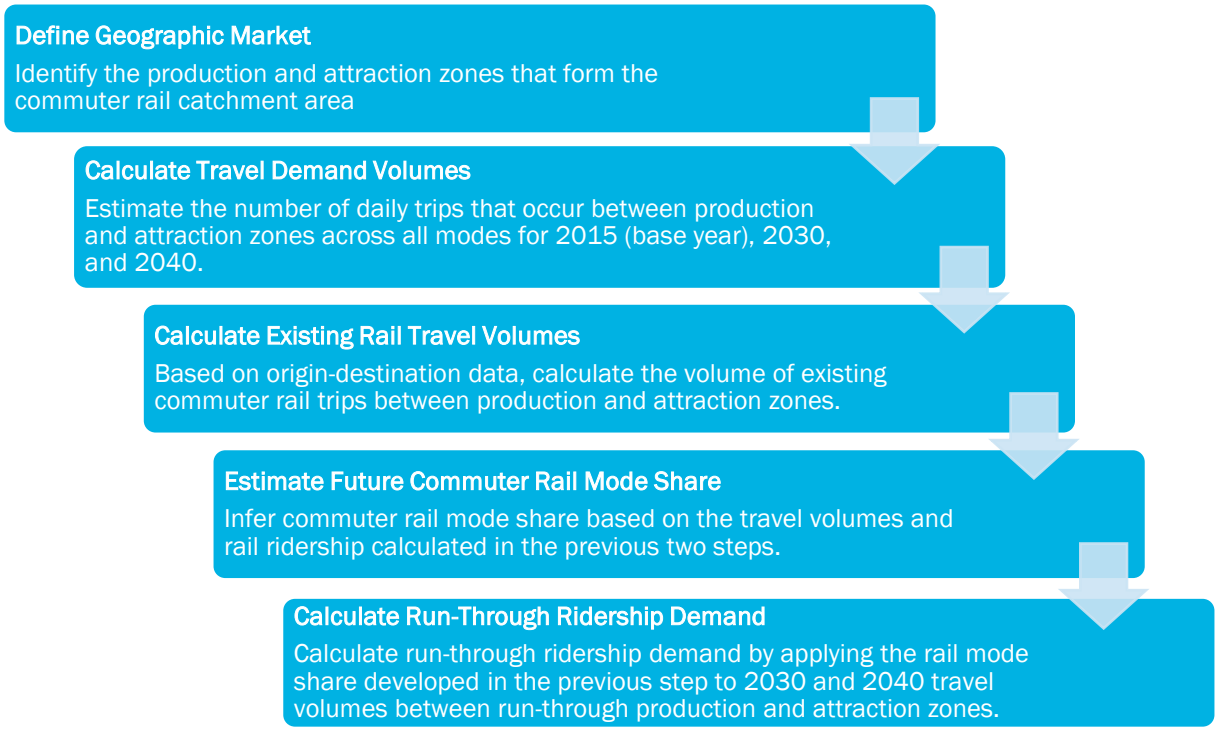
Project Name	Document	Location	Description	Status
Alexandria 4th Track Project	DC2RVA EIS	Arlington and Alexandria, Virginia	Virginia is advancing a section of fourth track from AF Interlocking just south of Alexandria to RO Interlocking in Arlington (the southern Long Bridge approach).	Expected to be completed by 2025

3. TRAVEL DEMAND ANALYSIS METHODOLOGY

3.1. Overview of Approach

The study team developed a methodology that incorporates several data sources to estimate the demand for run-through service. The scope of the study did not include comprehensive travel demand modelling and the study team was asked to apply a creative and innovative approach that leverages existing data. As a starting point, the team identified the production and attraction zones that encompass the geographic market for run-through service. Using a combination of data sources, the team estimated how many trips occur between production and attraction zones on a typical weekday. A rail mode share for these trips was inferred based on the observed mode share for destinations linked by a one-seat commuter rail ride today. To conclude the analysis, the assessment looks at travel demand across routes and station clusters to identify where run-through service has the greatest ridership potential. **Figure 4** illustrates the steps of this methodology. The following section provides more detail on how the final travel demand estimates were developed.

Figure 4: Summary of Travel Demand Methodology.



3.2. Data Sources

The following summarizes the key data source utilized in the travel demand analysis.

Census Transportation Planning Products Program (CTPP)

The CTPP is a State DOT-funded, cooperative program that produces special tabulations of American Community Survey (ACS) data that have enhanced value for transportation planning, analysis, and strategic direction. The 2012-2016 5-Year CTPP data estimates the flow of commuter trips throughout the Greater

Washington region for all modes. The CTPP represents one of the most robust samples of travel flow data available.

MARC Origin-Destination (O-D) Survey

MDOT MTA completed an O-D Survey of the MARC system in 2016. O-D Survey respondents were questioned during their trip aboard a MARC train and asked to provide a variety of details on their trip, including their origin and destination (O&D) information. The survey yielded 3,345 responses and 1,975 included both an O&D.

MARC Parking Inventory

The MARC Parking Inventory documents the number of vehicles at MDOT MTA-owned park and ride lots in 2014. With over 10,000 records, the dataset contains more records than the MARC O-D survey and served as a supplement to the O-D study to determine the station level travel sheds.

MDOT Maryland Statewide Transportation Model (MSTM)

The MSTM is the travel demand model for the state of Maryland. The model's geography covers Maryland as well as portions of Virginia, West Virginia, Delaware, Pennsylvania, and the District of Columbia. The model was used in tandem with CTPP data to develop travel demand forecasts for run-through service.

MARC Cornerstone Plan

The 2019 MARC Cornerstone Plan highlights MDOT MTA's long-term plans and priorities for the MARC train over the next 25 years. It was the source of MARC daily ridership used to weigh survey responses.

VRE Transit Development Plan (TDP)

The VRE TDP provided the team boardings and alightings by station which were used to adjust the weighting of survey results.

Traffic Analysis Zones (TAZ) Shapefiles

TAZs are the units of geography commonly used for travel demand data, and CTPP and MSTM data use slightly different TAZs. MSTM and CTPP data were related to each other based on geographic overlap of each dataset's TAZs.

TPB Walksheds: Existing High Capacity Transit (HCT) Stations, for Regional Rail Stations

TPB staff developed network-based half-mile walksheds that represent the area around each High Capacity Transit (HCT) station within its member jurisdictions. A walkshed is a catchment area in which the outer perimeter represents the distance that people are anticipated to be willing to walk to a central destination. The study team primarily used these walksheds to help define the travel shed in cases where there was insufficient survey data for a station.

VRE Master Agreement Survey

The VRE Master Agreement Survey is an annual survey that asks riders about their origin, destination, and ticket type. VRE has previously utilized this data to create catchment areas for the 2019 Transit Development Plan.

3.3. Defining the Geographic Market

To determine the ridership demand for run-through service, the study team started by identifying where the majority of run-through trips are expected to start and end. The zones around each station represent the geographic market for run-through service. Each MARC and VRE station can be conceptualized as having two zones around it: a production and attraction zone. **Production** zones describe the geography where a round trip

starts and most commonly refers to a person's home location. **Attraction** zones describes the mid-point of a round trip, such as someone's place of work.

The O&D survey data supplied by MARC and VRE helped the study team identify where commuter rail trips were being produced and attracted. Each zone was drawn based on Census TAZs and represented the most compact geography that could encompass 90 percent of trip producers and attractors for a station. In some cases, the O&D data had an insufficient sample size to determine alone the boundary of a zone. The team used supplemental data such as transportation infrastructure, the MARC Parking Inventory, and TPB's walk sheds to refine each zone's boundary, while also working to remove any overlap between zones. These final zones were presented to the Technical Advisory Committee for review.

After confirming the zone methodology and definition, the study team aggregated the zones around 60 individual stations into 22 sets of production and attraction zones, referred through this report as simply production and attraction zones or PA zones. These aggregated zones are the basis for all subsequent analysis. This was done for two reasons: First, to evaluate a travel matrix between all 60 individual stations would yield 3,540 unique travel flows, while sorting them into 22 groups yields only 462 unique flows. Second, larger groups of stations ensured the team was working with larger O-D data samples, reducing the margin of error on the analysis. Some larger stations were not grouped with any others, so that the study team could look at more precise demand to/from certain key areas in the region (e.g. Crystal City). The station groups, the individual station(s) that comprise them, and the total survey count (MARC 2016 O-D Survey and 2018 VRE Agreement Survey) are shown in **Table 6** alphabetically by PA zone.

Note that due to the proximity of the Penn and Camden lines to each other, some of the production and attraction zones of individual stations are grouped together across the two lines.

Table 6: Station Grouping

PA Zone Name	Service	Lines[4]	Individual Stations	Survey Count
Alexandria	VRE	VRE Shared Line	Alexandria	352
Backlick – Burke	VRE	Manassas	Backlick Road Burke Center Rolling Road	857
Bowie – Odenton	MARC	Penn & Camden	Bowie State University Odenton	57
Brunswick	MARC	Brunswick	Brunswick	56
Crystal City	VRE	VRE Shared Line	Crystal City	699
Franconia – Brooke	VRE	Fredericksburg	Brooke Franconia / Springfield Lorton Quantico Rippon Woodbridge	1,339
Greater Baltimore	MARC	Penn & Camden	Camden Station Penn Station West Baltimore	253

[4] Note that trips produced in Alexandria, Crystal City, and L'Enfant are categorized as operating on the VRE Shared Line instead of being assigned to the Fredericksburg and Manassas line. This was done so that the team could develop separate survey weights for trips starting at these stations.

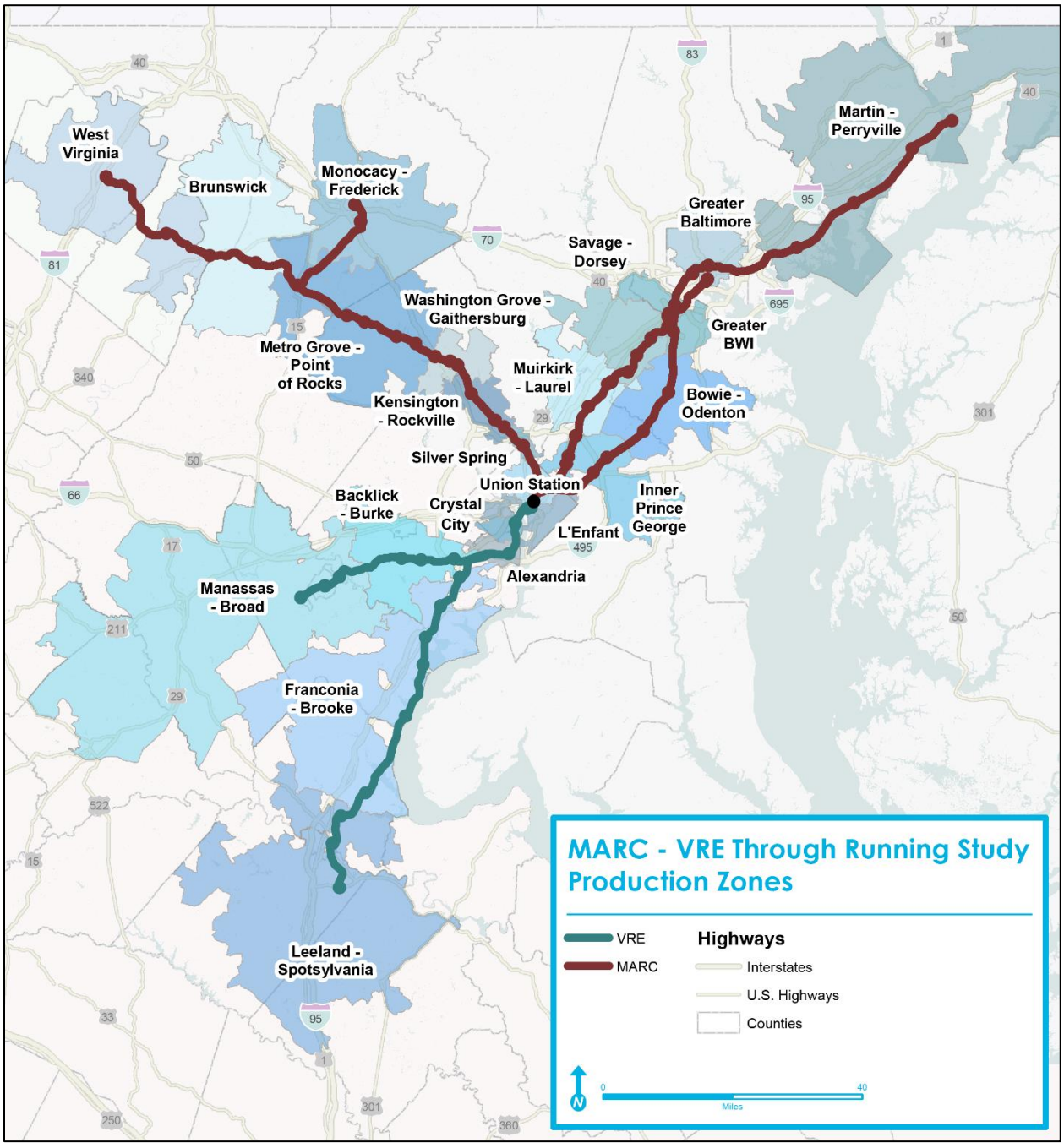
PA Zone Name	Service	Lines[4]	Individual Stations	Survey Count
Greater BWI	MARC	Penn & Camden	BWI Halethorpe St. Denis	53
Inner Prince George	MARC	Penn & Camden	College Park Greenbelt New Carrollton Riverdale Seabrook	52
Kensington – Rockville	MARC	Brunswick	Garrett Park, Kensington, Rockville	66
Leeland – Spotsylvania	VRE	Fredericksburg	Fredericksburg Leeland Spotsylvania	1,318
L'Enfant	VRE	VRE Shared Line	L'Enfant	2,452
Manassas – Broad	VRE	Manassas	Broad Run Manassas Manassas Park	1,658
Martin – Perryville	MARC	Penn & Camden	Aberdeen Edgewood Martin Airport Perryville	34
Metro Grove – Point of Rocks	MARC	Brunswick	Barnesville Boyds Dickerson Germantown Metropolitan Grove Point of Rocks	54
Monocacy – Frederick	MARC	Brunswick	Frederick Monocacy	107
Muirkirk – Laurel	MARC	Penn & Camden	Laurel Laurel Racetrack Muirkirk	66
Savage – Dorsey	MARC	Penn & Camden	Dorsey Jessup Savage	101
Silver Spring	MARC	Brunswick	Silver Spring	100
Union Station	MARC, VRE	Brunswick, VRE Shared Line, Penn & Camden	Union Station	2,037
Washington Grove – Gaithersburg	MARC	Brunswick	Gaithersburg Washington Grove	118
West Virginia	MARC	Brunswick	Duffields Harpers Ferry Martinsburg	55

3.3.1. Production Zones

The production zones for MARC and VRE encompass a population of 4.9 million people. These zones expand significantly beyond the station(s) they are named after. For example, the L'Enfant production zone includes over a third of the District of Columbia and parts of Arlington.

The Union Station, L'Enfant, and Greater Baltimore zones have the largest populations off all zones in the study. The production zones generally get larger and less dense farther out from the core cities of Baltimore and Washington, D.C. The largest production zones in terms of area are Manassas-Broad Run, Martin-Perryville, and Leeland-Spotsylvania. The size of these catchment areas is due to the greater distances riders travel to reach stations near the end of the commuter rail system.

Figure 5: Grouped Production Zones



**Note: Zones are shaded to help differentiate boundaries between zones.*

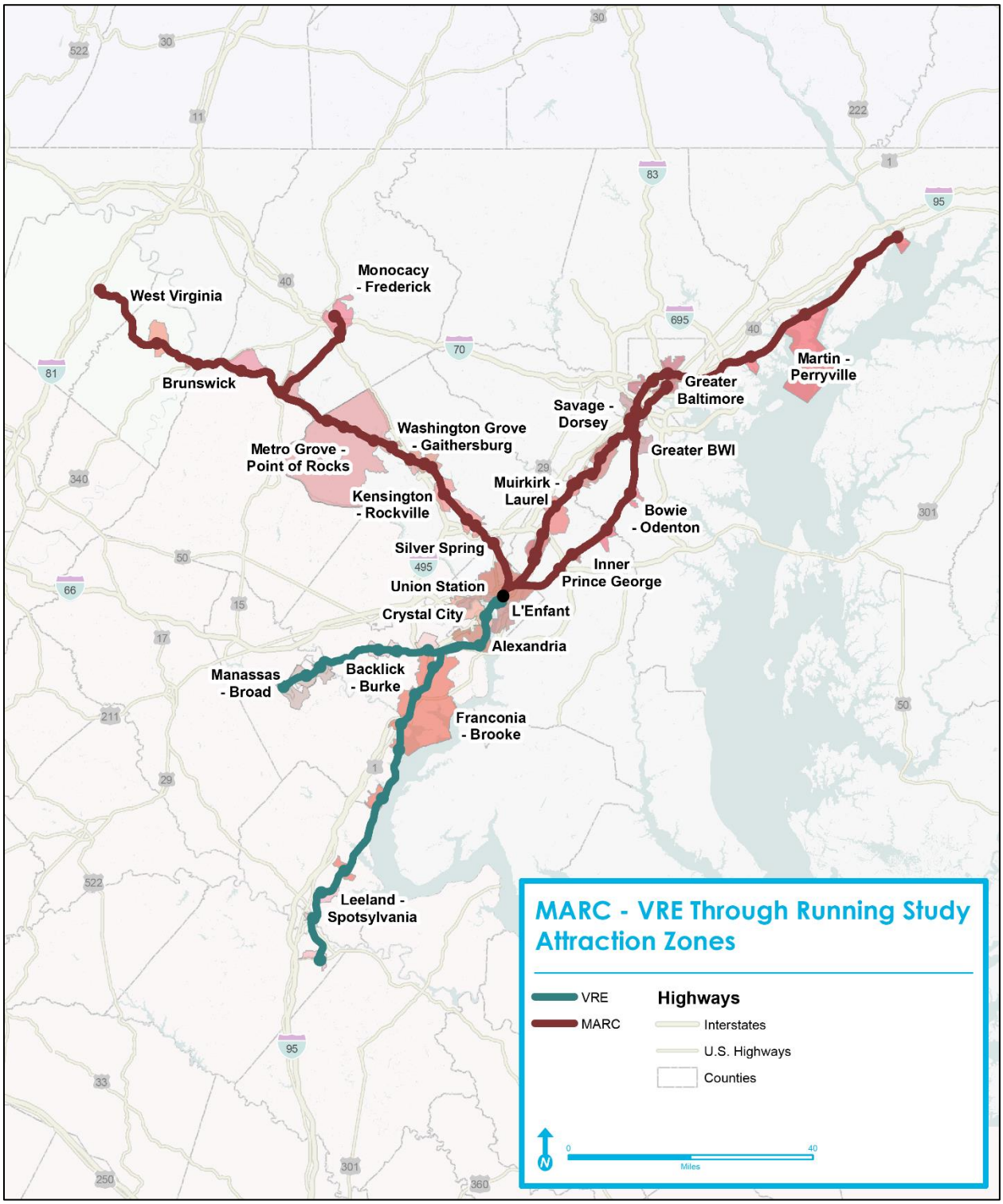
3.3.2. Attraction Zones

Over 1.4 million jobs are located within the attraction zones of run-through service. The attraction zones are significantly smaller than production zones overall because unlike production zones, few riders are driving from rail stations to their trip attractor. Like with the production zones, many attraction zones still extend over a larger geographic area than a station's immediate surroundings.

Some of the outlying attraction zones are fairly large; this is driven by the size of their TAZs more than the distance commuters travel from these stations to their final destinations. MARC and VRE serve the region's largest employment centers, with the notable exception of Tysons Corner and Reston in Virginia (both of which are a one-seat ride to L'Enfant by Metrorail). There are several key non-employment destinations within the catchment area that could generate travel demand for run-through service, such as:

- **Airports:** Ronald Reagan National Airport, Washington-Dulles International Airport, and Baltimore/Washington Thurgood Marshall International Airport; with the completion of the Silver Line Phase II, all three regional airports will be a single transfer from one another by rail transit.
- **Tourist Destinations:** Several regional tourist destinations are within the rail travel shed, including historic town centers (Fredericksburg, Frederick, Old Town Alexandria); National Parks such as Fredericksburg and Spotsylvania National Military Park, Manassas National Battlefield Park, and the National Mall and Memorial Parks in Washington, D.C.; the centers of Baltimore and Washington, D.C.
- **Convention Centers:** These include the major convention centers in Downtown Washington, D.C. and Baltimore.
- **Universities**: Johns Hopkins University; University of Maryland (UMD) campuses in Baltimore, Baltimore County and College Park; George Washington University; Georgetown University, George Mason University Arlington Campus; Virginia Tech Alexandria Campus; American University; University of the District of Columbia; Catholic University; and University of Mary Washington.
- **Military Installations:** Pentagon, Mark Center, Fort Belvoir, Fort Meade, Joint Base Myer-Henderson Hall, Foreign Service Institute, Marine Corps Base Quantico, Joint Base Anacostia-Bolling, and Washington Navy Yard, among others.

Figure 6: Grouped Attraction Zones



**Note: Zones are shaded to help differentiate boundaries between zones.*

3.4. Travel Demand Volumes

The study team used CTPP and the MSTM to estimate demand between PA zones. The CTPP has a dataset that captures home and work locations nationwide at the Census TAZ level. The MSTM is a traditional travel demand model with several trip purpose types, base and future years, and a TAZ structure that differs from the Census.

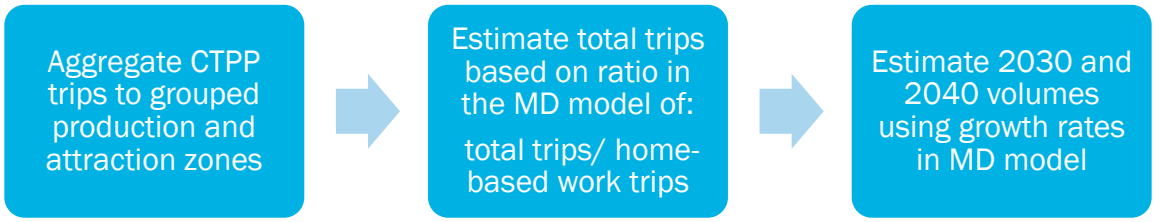
Developing Base Volumes Using CTPP Data

To initiate the travel demand volume estimation process, the study team aggregated CTPP and Maryland model data to the production and attraction zones defined for this study. The resulting CTPP and Maryland model travel volumes were validated against commuter railroad O&D survey data collected by MARC and VRE. CTPP data was used to develop a base figure representing commute trip volumes; the MSTM was used to develop factors that would expand CTPP trip volumes to represent total trips. To estimate total trips in the base year, the study team multiplied the ratio of total trips to home-based work trips in the Maryland model by the number of CTPP trips for each station pair. The study team found that this methodology yielded figures that better conformed with observed passenger volumes on the MARC and VRE systems than if MSTM data was used alone.

Forecasting 2030 and 2040 Travel Volumes

To estimate total trips in each future year, growth rates were calculated for each grouped zone pair between the base year and 2030 and the base year and 2040. These growth rates were then applied to the base year trips in each station pair. **Figure 7** summarizes the process used to estimate trip demand between stations.

Figure 7: Trip Demand Estimation Methodology



Data Limitations

There are several known limitations to CTPP data and data from the MSTM.

For CTPP:

- The data is a sample that only asks about home to work travel over the previous week.
- The data is limited to home to work travel and does not include home-based non-work trips or non-home-based trips.

For MSTM:

- The data is calibrated at the state level and therefore the data becomes less accurate at the individual TAZ to TAZ level when using outputs that have not been re-calibrated for a specific use.

Overall, the limitations of each dataset are mitigated when both are combined to conduct this analysis.

3.5. Calculating Existing Rail Travel Volumes by Origin and Destination

Data Cleaning of Survey Response

Before existing rail O-D survey data could be used, the responses in the *MARC O-D Survey* and *VRE Master Agreement Survey* were recategorized from O&Ds to productor and attractors (PAs). O&Ds and PAs differ in that Origin and Destination are defined in terms of direction of the trip while Production and Attraction in terms of land use associated with each trip end. Because the VRE Survey collected data on the AM Peak in one direction, origins were assumed to be productors and destinations were assumed to be attractors, with riders returning to the same production zone in their reverse afternoon commute. Because MARC provides more bi-directional service, the study team had to look at how respondents coded their O&Ds (from options like "Home", "School", "Work", etc.) in order to establish which end of the trip was the productor and which was the attractor. For example, a trip that started from home and ended at work would have those destinations categorized as productor and attractor, respectively. However, the return trip (from work to home) would use the same designations despite being in the opposite direction, because the home is still the producer of the round trip overall, and the work is still the attractor.

Then, each survey's results were geocoded based on the available data. The VRE survey had coordinates provided for both ends of all 6,015 survey responses, so was 100 percent geo-codable. The MARC survey data provided coordinates for both ends of 2,505 trips out of 3,345, so was 74.8 percent geo-codable. All 8,520 trips' production and attraction points were spatially joined with the respective PA zones in which they fell.

Weighting of Survey Data

After all the geo-codable survey responses were assigned to production and attraction zones, they were weighted to represent average weekday ridership based on the following formula:

$$\frac{Average\ weekday\ boardings\ by\ line^{5}}{Number\ of\ valid\ surveys\ collected\ by\ line} = Survey\ weight$$

Note that the study team categorized Alexandria, Crystal City, and L'Enfant as a separate "VRE Shared Line" service instead of distributing trips produced at these stations between Manassas and Fredericksburg line.

Additional Scaling for Out of Zone Trips

Approximately a quarter of current rail trips either start or end outside of a PA zone. To correctly account for these "out-of-zone" trips, the final ridership estimates for run-through service were scaled up. The team developed separate scale factors for the Manassas, Fredericksburg, VRE Shared Line, Brunswick, and Penn & Camden lines.

$$\frac{Weighted\ Survey\ Responses\ by\ Line}{Weighted\ Survey\ Responses\ by\ Line\ that\ Start\ or\ End\ in\ a\ Catchment\ Zone} = Scaling\ Factor$$

The scaling factor ensures that the final run-through ridership include trips that utilize run-through service but fall outside the PA zones. For example, without the scaling factor, a trip from York, PA to Crystal City, VA via the Penn Line would not have been counted.

[5] VRE Ridership sourced from 2019 VRE TDP, MARC Ridership sourced from 2018 MARC Station Level Ridership.

3.6. Estimating Commuter Rail Mode Share and Developing Final Estimates

The study team inferred the rail mode share of trips within the run-through travel market from the existing mode share of commuter rail between PA zones already served by a one-seat commuter rail trip (e.g. Greater Baltimore to Union Station). All the possible PA zone pairs were placed in three categories:

- Primary Pairs: Zone pairs that are linked by commuter rail and account for the majority of existing rail trips. This is defined as any PA zones that are connected by commuter rail to/from Greater Baltimore, Union Station, Silver Spring, Rockville-Kensington, L'Enfant, Crystal City, or Alexandria. Trips between MARC and Crystal City and L'Enfant were considered primary markets even in the absence of direct commuter rail service as a large number of riders are already making these trips by transferring at Union Station to Metrorail.
- Secondary Pairs: Zones that are linked by commuter rail service but have very limited rail ridership. This group consists largely of suburb or exurban PA zones.
- Non-pairs: Zones that are currently not directly connected by commuter rail service. These includes zones on different commuter rail lines or zones that are not linked by peak direction service (e.g. Alexandria to Manassas in the AM peak).

By comparing existing commuter rail ridership between PA zones to overall travel demand, the study team was able to estimate the commuter rail mode share for trips between primary and secondary PA zone pairs. The higher mode share for primary market trips was then applied to any run-through PA pairs which included Greater Baltimore, L'Enfant, Crystal City, Silver Spring, Rockville-Kensington, or Alexandria zones. The lower secondary market mode share was applied to all other run-through PA pairs. The team deviated from this methodology in only one case: trips to/from L'Enfant or Crystal City and Greater Baltimore. While the number of trips between these zones is not very high compared to other run-through travel flows, existing ridership, and CTPP data show that these trips have a very high rail mode share. This makes logical sense as there are limited alternatives for transit trips between Washington, D.C.'s and Baltimore's Central Business Districts.

Once mode shares were applied to total travel volumes between PA zones, the scaling for out of zone trips was applied to arrive at the final ridership estimate for run-through service. The following formula summarizes the approach:

$$Rail\ Mode\ Share \times Total\ Travel\ Volume_{PA\ zone\ pair\ xy} \times Scaling\ Factor = Final\ Ridership\ Estimate_{PA\ zone\ pair\ xy}$$

3.7. Limitations of Approach

The methodology outlined above takes a simplified approach to estimating travel demand and does not account for certain factors such as induced demand. Additional commuter rail trips could occur due to higher mode share of future trips being taken on commuter rail, or new trips occurring due to the availability of a new travel option. Induced demand could be a result of reduced travel time, fewer or no transfers, reduced costs, or improved first/last mile options. The analysis assumes that these factors remain unchanged. Implementation of run-through service could change the distribution and number of trips within the study area and induce changes to land-use and density around stations that would further alter demand, Higher or lower frequency of service will also affect the travel demand. In short, the study takes a conservative approach to estimating run-through travel demand.

4. TRAVEL DEMAND ANALYSIS RESULTS

The travel demand analysis started by identifying the number of weekday MARC and VRE riders who end their trip in the other railroad's service area. These riders are making the equivalent of a run-through trip but these trips require transfers to reach their final destination.

The second set of findings focus on the total volume of trips in the run-through market. These represent any trip, regardless of mode, forecasted to go from the production zone of one railroad to the attraction zone of another. These figures are based solely on the travel volume analysis derived from CTPP and MSTM data.

Finally, the analysis estimates the average weekday ridership for run-through service. These figures reflect the expected volume of run-through trips between all potential production and attraction zone pairs in the run-through market.

4.1. Existing Run-Through Travel

Today there are approximately 13,900 "run-through equivalent" weekday trips on MARC and VRE. These trips include any instance a MARC rider starts or ends their trip in the VRE service area or a VRE riders starts or ends their trip in the MARC service area. Most of these trips are completed by combining commuter rail with Metrorail and other local transit services. Run-through service potentially eliminates the number of transfers for many of these riders. For example, MARC riders to L'Enfant Plaza would no longer have to board the Red Line Metrorail at Union Station and transfer at Gallery Place to the Green or Yellow lines.

Trips between the Penn & Camden lines and VRE Shared Line account for 78 percent of run-through equivalent trips today. **Table 7** summarizes ridership by line pair.

Table 7: Existing Run-Through Equivalent Trips by Line Pair

Line Pairs	2016-2018 Ridership
VRE Shared Line <–> Penn & Camden	10,800
Brunswick<–>VRE Shared Line	2,800
Manassas<–>Penn & Camden	200
Fredericksburg<–>Penn & Camden	100
Brunswick<–>Fredericksburg	-
Brunswick<–>Manassas	-
Total	13,900

4.2. Summary of Run-Through Market

The team estimates that just over 400,000 trips per day occurred in 2015 between the VRE and MARC service areas. This figure represents the total number of motorized trips between MARC PA zones and VRE PA zones or vice-versa. The results of the analysis suggest that the predominant travel flow within the service areas are trips produced in Maryland (notably Prince George's County, Montgomery County, and Baltimore) and attracted to destinations within Washington, D.C. and Arlington. L'Enfant is by far the largest attractor of trips in the run-through market, accounting for 71 percent of trips. Within Maryland, Silver Spring and Rockville are the largest attractors for trips produced within the VRE service area.

Between 2015 and 2040, the run-through market is projected to see a 19 percent increase in total trips from 400,000 per weekday to 475,000 per weekday (see **Table 8**). This growth in travel will occur in an area that is already highly constrained by infrastructure. The greatest growth by absolute number of trips will occur between the Penn & Camden lines and the VRE Shared Line.

Table 8: Total Travel Volumes between Production and Attraction Zones by Line Pairs

Line Pairs	2015	2030	2040
VRE Shared Line <–> Penn & Camden	208,900	241,500	260,300
Brunswick<–>VRE Shared Line	166,000	166,300	182,000
Brunswick<–>Manassas	9,800	10,200	10,700
Manassas<–>Penn & Camden	5,600	9,300	9,100
Brunswick<–>Fredericksburg	5,300	6,400	6,800
Fredericksburg<–>Penn & Camden	5,100	6,400	6,600
Total	**400,700**	**440,100**	**475,500**

The **Appendix** features a full matrix of 2030 travel volumes between all run-through production and attraction zone pairs.

4.3. Estimate of Run-Through Travel Demand

The study found that run-through rail service could attract up to 16,200 trips per day by 2030. This represents an increase of 2,300 trips over the 13,900 "run-through equivalent" trips taken today by MARC and VRE riders.

The greatest production zones for run-through trips are Inner Prince George's County, Baltimore, Silver Spring, and Rockville-Kensington zones, all of which are in Maryland. The greatest attraction zones for run-through trips are L'Enfant, Crystal City, and Alexandria. Overall trip production is more widely distributed among zones than trip attraction. Implementing run-through service could double ridership at L'Enfant and increase ridership at Crystal City by one-third compared to VRE's projected 2030 ridership at those stations.

The analysis suggests that the largest commuter rail run through market exists between the Penn & Camden lines and VRE Shared Line. By 2030, run-through service could attract approximately 11,600 trips along this corridor between Baltimore and Alexandria, increasing to 12,400 by 2040.[6] Based on the O&Ds of current MARC and VRE riders, a majority of these trips already occur on MARC and VRE but require additional transfers and potentially longer travel-times than if run-through service was available.

The analysis also found ridership demand between the Brunswick and VRE Shared Line, at 4,300 trips per weekday by 2030. This commuter rail travel market showed the largest increase in ridership over current run-through equivalent trips.

The analysis suggests limited demand for run-through service south of Alexandria. On all the MARC and VRE lines, demand for run-through service drops toward each line's outbound terminus. **Figure 8** and **Figure 9** illustrate run-through ridership by production and attraction zone for 2030.

[6] The analysis showed no demand for run-through service on the Penn Line north of Baltimore

Table 9: Total Run-Through Ridership by Line Pairs

Line Pairs	2015	2030	2040
VRE Shared Line <–> Penn & Camden	9,900	11,600	12,400
Brunswick<–>VRE Shared Line	4,300	4,300	4,700
Brunswick<–>Fredericksburg	100	100	100
Brunswick<–>Manassas	100	100	200
Manassas<–>Penn & Camden	0	100	100
Fredericksburg<–>Penn & Camden	0	0	0
Total	14,400	16,200	17,500

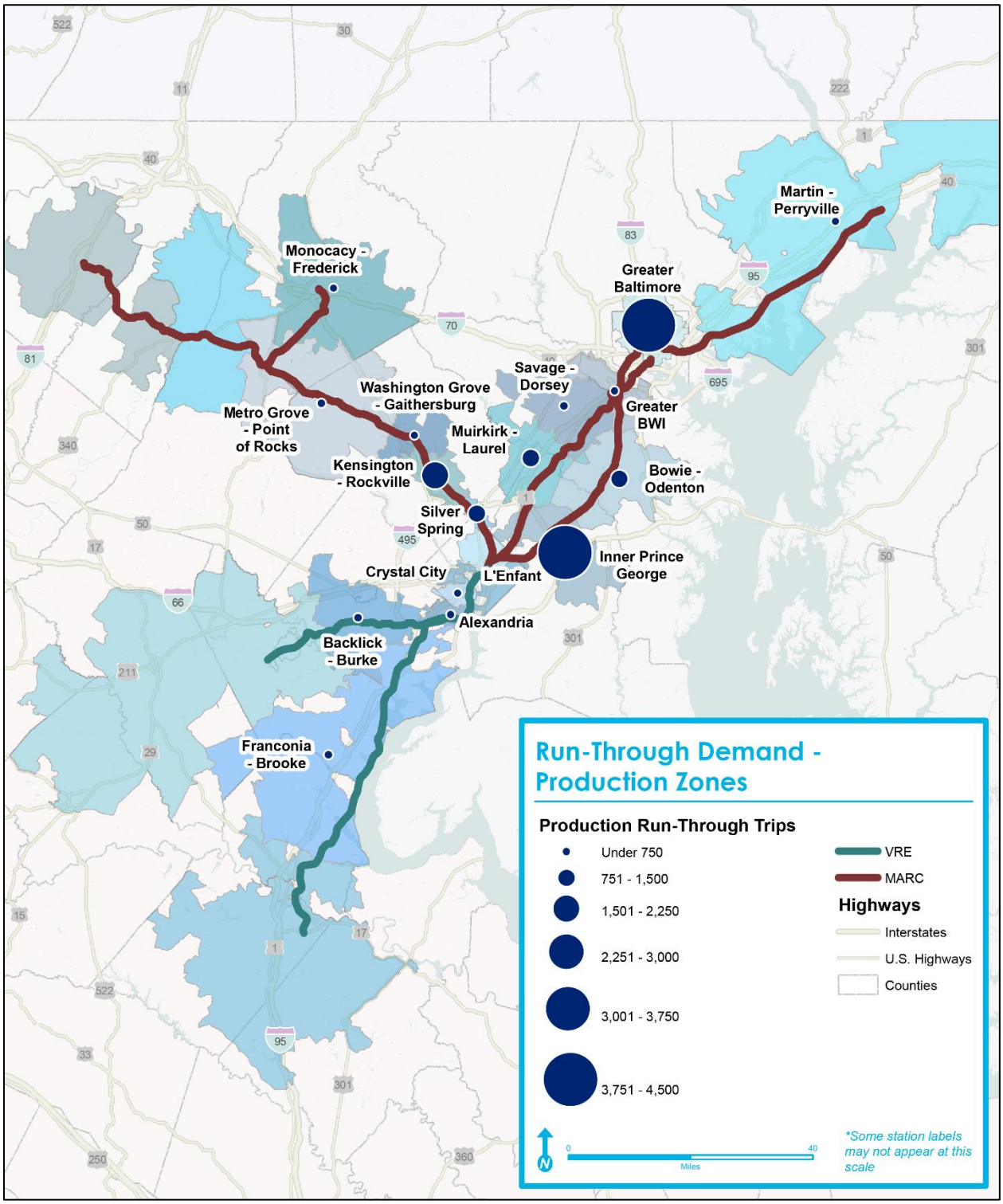
Table 10: Top Production and Attraction Zones by Travel Demand and Percentage Share of Trips, 2030

Attraction Zones	Run-Through Average Daily Rail Ridership		Average Daily Trips on All Modes		Production Zones	Run-Through Average Daily Rail Ridership		Average Daily Trips on All Modes	
L'Enfant	13,000	81%	313,600	73%	Inner Prince George's County	4,200	26%	129,800	28%
Crystal City	1,500	9%	45,000	10%	Baltimore	3,900	11%	10,300	15%
Alexandria	500	3%	17,600	4%	Kensington-Rockville	1,600	8%	62,300	12%
Kensington-Rockville	300	2%	12,100	3%	Silver Spring	1,300	8%	48,800	9%
Silver Spring	300	2%	10,600	2%	Muirkirk-Laurel	1,300	6%	38,300	6%
Baltimore	200	1%	6,800	2%	Bowie-Odenton	900	4%	26,400	6%
Inner Prince George's County	200	1%	9,900	1%	Washington Grove-Gaithersburg	600	3%	22,600	4%
Franconia-Brooke	100	0%	8,000	2%	Savage-Dorsey	500	3%	15,700	4%
Backlick-Burke	0	0%	2,900	1%	Martin-Perryville	500	3%	18,600	3%
Muirkirk-Laurel	0	0%	5,900	1%	L'Enfant	400	2%	13,100	2%
Washington Grove-Gaithersburg	0	0%	2,100	0%	Monocacy-Frederick	300	22%	12,300	2%
Metro Grove-Point of Rocks	0	0%	2,100	0%	Metro Grove-Point of Rocks	200	1%	9,900	2%
Savage-Dorsey	0	0%	1,200	0%	Backlick-Burke	200	1%	8,400	2%

Attraction Zones	Run-Through Average Daily Rail Ridership		Average Daily Trips on All Modes		Production Zones	Run-Through Average Daily Rail Ridership		Average Daily Trips on All Modes	
Monocacy-Frederick	0	0%	1,000	0%	Alexandria	200	1%	7,600	1%
Manassas-Broad	0	0%	1,000	0%	Crystal City	200	1%	5,400	1%
Greater BWI	0	0%	200	0%	Greater BWI	100	0%	2,600	1%
Bowie-Odenton	0	0%	100	0%	Franconia-Brooke	100	0%	4,800	1%
Brunswick	0	0%	0	0%	Manassas-Broad	0	0%	2,700	1%
Leeland-Spotsylvania	0	0%	0	0%	Brunswick	0	0%	600	0%
Martin-Perryville	0	0%	0	0%	West Virginia	0	0%	0	0%
West Virginia	0	0%	0	0%	Leeland-Spotsylvania	0	0%	0	0%
Total	16,100	100%	440,100	100%	Total	16,500	100%	440,200	100%

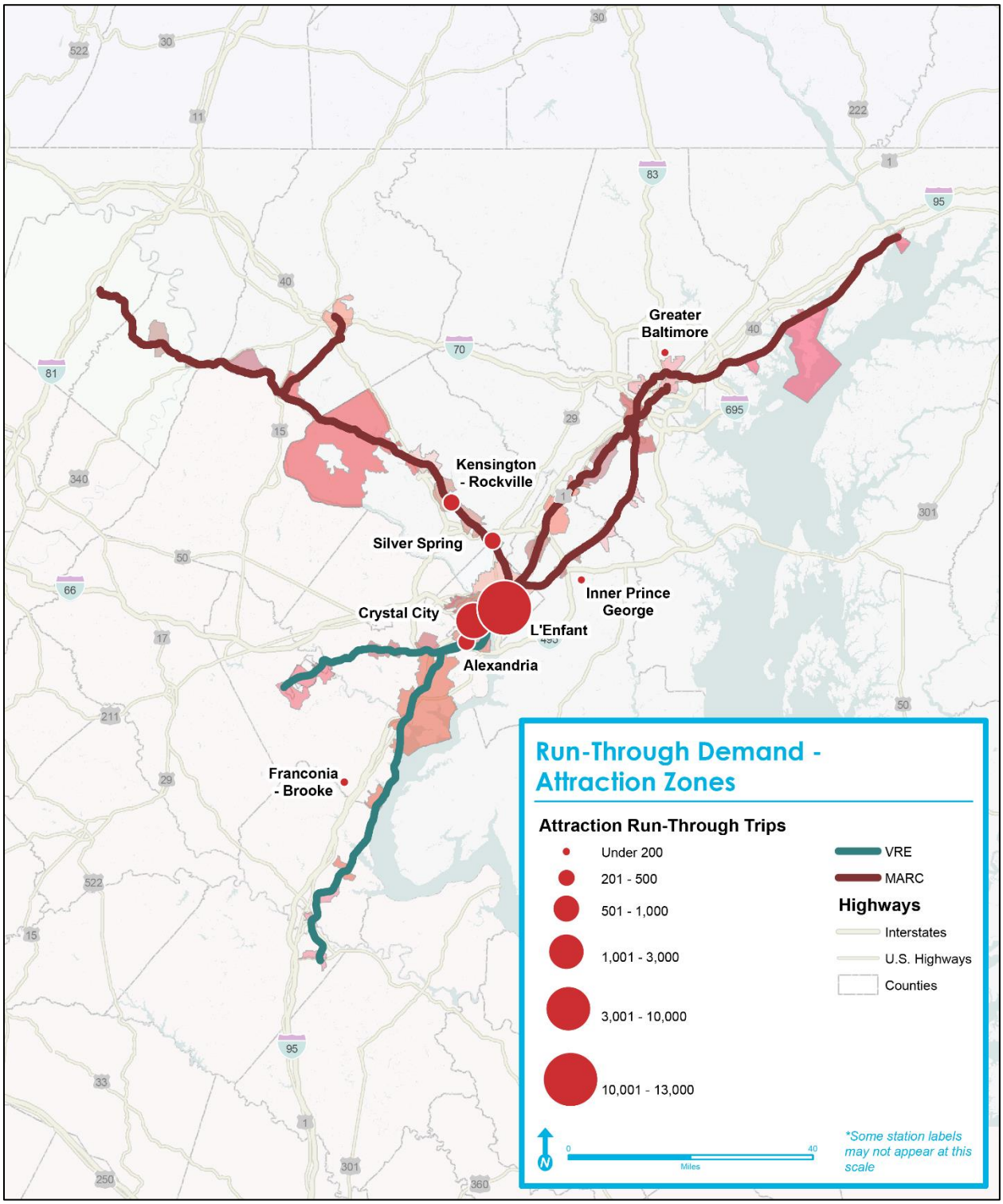
The **Appendix** features a full matrix of 2030 estimated rail travel demand between all run-through production and attraction zone pairs.

Figure 8: 2030 Run-Through Demand Production Zones



**Note: Zones are shaded to help differentiate boundaries between zones.*

Figure 9: 2030 Run-Through Demand Attraction Zones



**Note: Zones are shaded to help differentiate boundaries between zones.*

4.4. Opportunities for Higher Ridership

The run-through ridership estimates presented in this market assessment are based on the current mode share of commuter rail in the region. As such, these numbers reflect the rail system's existing levels of service, with 20 to 60+ minute headways and schedules designed to primarily serve peak-period commuters. The results of this market assessment do not reflect or assume any additional, planned and/or potential service improvements to the MARC or VRE systems. As such, these results may not reflect the full potential for run-through service. Additional analysis would be needed to determine how major changes to commuter rail levels of service impact forecasted run-through ridership.

5. TECHNICAL CONSIDERATIONS FOR RUN-THROUGH SERVICE

Stakeholders in the region will have to resolve several key operational, mechanical, capacity, infrastructure, and maintenance of traffic considerations before moving forward with run-through service between MARC and VRE. While this study does not identify specific implementation strategies, the study team has evaluated a range of factors that will need to be addressed. Timing is a critical constraint, as over the next ten years several major construction projects along the run-through corridor will commence. Similarly, the level of run-through service can influence demand; the degree and frequency in which each railroad operates in the other's service area will impact the feasibility and form of future operations. Finally, there are several more general considerations that run-through service will have to resolve. These considerations range from technical challenges to governance.

5.1. Planned Coordination and Maintenance of Traffic

As outlined in **Section 2** of this report, implementation of run-through service must navigate rapidly evolving developments in the region's passenger rail infrastructure, such as ongoing work at Union Station and the Transforming Rail in Virginia Program. These series of construction projects introduce more short-term constraints to run-through service but will ultimately help resolve a number of infrastructure constraints that have historically hindered the implementation of run-through service.

Table 11: Ongoing Projects Impact Run-Through Service

Project	Status
Union Station Improvements (Lower Level)	Environmental and Planning
L'Enfant Station and Fourth Track	Planning
Long Bridge	Environmental and Planning
Crystal City Station	Design
Alexandria Fourth Track	Design
Alexandria Station	Design

Union Station has struggled to accommodate growing passenger volumes. The station's "Second Century Plan," aims to double the station's train capacity and triple its passenger throughput. Major planned improvements include reconfiguring the station's lower level during the first phase of track work. These renovations will contribute to the long-term goals of run-through service but at the cost of turning Union Station's lower level tracks into a construction zone. This will limit rail capacity in the short-term as tracks may need to be taken out of service to accommodate construction work.

Similarly, Transforming Rail in Virginia Program and Long Bridge represent a series of major projects that will ultimately create opportunities for run-through service but potentially yields short-term constraints. The reconfiguration, and addition of mainline tracks south of Union Station will greatly expand passenger rail capacity when complete, yet the construction related to these improvements will limit the ability of railroads to reliably maintain existing service, and add new services, including run-through service in the short term.

5.1.1. Short Term Constraints

Many challenges and tasks need to be addressed over the next ten plus years before the full potential for VRE-MARC run-through service would can be realized. The existing infrastructure and host railroad contracts (CSXT, NS, & Amtrak) can accommodate extremely limited service expansions. The Transforming Rail in Virginia Program will enable separation of passenger and freight traffic on the CSXT Richmond, Fredericksburg & Potomac (RF&P) subdivision which will increase the capacity for passenger trains. In the short term, the additional capacity is proposed to be utilized by adding Amtrak and VRE trains.

The lower level platforms at Union Station are unique in their access south to the 1st Street Tunnel and yet are practically inaccessible to MARC's Brunswick Line and to a lesser extent, the MARC Camden Line. For Brunswick and Camden Line trains to access the 1st Street Tunnel, trains must traverse the entirety of Union Station's "throat" from east to west over multiple interlockings.[7] In addition, the lower level platforms are slated to undergo reconfiguration which will hamper operations over the next several years.

Additionally, projects associated with the Transforming Rail in Virginia Program are anticipated to affect stations and tracks in DC and Virginia and cause temporary adverse impacts to operations during construction.

Finally, train crews will need sufficient off-duty time to comply with FRA Hours of Service regulations before crewing the return trip. If the crew ran trains on a reverse schedule in the afternoon rush hour (e.g. Virginia into Maryland), they could do so only if they take sufficient, uninterrupted rest under the HOS regulation to operate the train each day. Each railroad has their own welfare requirements, and crew layover facilities may require modification to be compliant for both MARC and VRE crews.

5.1.2. Long-Term Constraints

Once complete, the proposed infrastructure improvements within the MARC and VRE service areas will make a greater level of service integration possible. Significant region-wide coordination would be needed to implement expanded run-through service. With two commuter rail agencies, two states, Amtrak, at least one Class I railroad and the District of Columbia involved, it would prove challenging to manage the various operating agencies without a review of the institutional structure in place. Such a review will help to address the logistics of dispatching, scheduling and other service elements associated with multi-agency transportation corridors.

5.2. General Considerations

Before run-through service can be implemented, a number of considerations need to be addressed in the following areas: Operational, Mechanical, Capacity and Capital, and Institutional. The study team has included a list of general subjects for consideration and does not represent a final comprehensive list; additional considerations will likely be raised by various stakeholders including the passenger railroad operators. The discussion of considerations is broken into the two timelines discussed above:

- **Short-Term** over the next 10 years capacity constraints will limit the ability of MARC and VRE to operate run-through service across multiple line combinations. The considerations in this section focus on the action-items necessary for *any* level of run-through service.
- **Long-Term** by 2030, capacity along the corridor will increase, making a greater level of run-through service possible. The considerations in this section focus on action-items needed to achieve higher frequency run-through service.

[7] A Station's "Throat" refers to a constricted area at the end of a railroad station where the railroad mainlines divide into platform tracks

5.2.1. Operational

Short-Term Considerations

1. Planning to determine the initial service area for run-through service.
2. The railroads would have to identify crews qualified to operate in both MARC and VRE service area.
3. Crew time on run-through trains would have to be scheduled to ensure compliance with Hours of Service and Uninterrupted Rest/Fatigue Regulations.
4. Rolling stock compatibility with high and low platforms. VRE's existing fleet only has low platform doors.

Long-Term Considerations

1. Increased planning and coordination between all three passenger train operators that accounts for existing operations and planned service expansions.
2. Train crews must be qualified to work in the service area they are assigned. With MARC and VRE operating in two different territories, the two agencies must determine the most effective way to provide a seamless operation through Union Station while assuring that trains are staffed with the properly qualified crew members.
3. Crew time would have to be scheduled to optimize common on-and-off duty points across all trains.
4. Additional access to Union Station lower level platform to enable the planned increase in service volume.

5.2.2. Mechanical

Short-Term Considerations

1. Dual mode or diesel locomotives that can operate south of Union Station due to the absence of electrification. The MARC train fleet mostly consists of diesel locomotives, lending to the interchangeability of equipment across operating territories. MARC will need to strategically assign diesel power to specific train sets designated for run-through service.
2. MARC equipment would have to be tested and certified to be interoperable (I-ETMS) Positive Train Control (PTC) operation on CSXT and NS.[8] Similarly, VRE equipment would need to be tested and certified on CSXT.
3. Mileage-based regulatory inspections would have to be increased.
4. Mileage-based regulatory inspections might have to be implemented at additional locations.

Long-Term Considerations

1. All MARC and VRE equipment would have to be tested and certified for PTC operation on CSX, Amtrak and NS, which may include the option to acquire new interoperable coaches and/or locomotives.
2. A new logistics plan governing regulatory inspections and equipment maintenance at all facilities on MARC and VRE would have to be developed.

5.2.3. Capacity and Capital

Short-Term Considerations

1. Crew rest and welfare facilities at suitable turn locations might have to be built. It is unclear whether the existing facilities meet MARC, VRE, and Amtrak requirements.
3. Identify locations where trains can be turned.[9]

[8] I-ETMS is Interoperable Electronic Train Management System

[9] "Turning" of commuter trains refers to a scenario when the orientation of the train is reversed without physically re-orienting the train equipment.

4. Any new rest and welfare facilities in Virginia would have to be built for MARC crews. Sharing of such facilities may need to be considered to accommodate VRE crews depending on how service is structured.
5. The proposed station expansions at L'Enfant and Crystal City would have to be constructed to allow bi-directional operations south of Union Station. Additional VRE stations may also need to be expanded to support bidirectional service.
6. Signals and trackwork may be needed to support more robust bidirectional service than currently exists.

Long-Term Considerations

1. The Transforming Rail in Virginia Program agreement would have to be finalized and infrastructure commitments would have to be fulfilled to enable significant expansion of rail capacity south of Union Station.
2. MARC and VRE would require access to more tracks on the lower level of Union Station to accommodate additional run-through trains without impeding the operations of Amtrak intercity through service.
3. The approach of Brunswick and Camden Line trains to Union Station would have to be configured so that trains utilizing the CSXT (former B&O) Metropolitan Subdivision can more easily access lower level tracks and the 1st Street Tunnel. There are currently no projects planned or programmed to address this challenge.

5.2.4. Institutional

Short-Term Considerations

1. The railroads would need to address revenue and cost sharing, and management of cross-jurisdictional commuter rail operations.
2. Work rule agreements would need to be negotiated that take into account cross-jurisdictional commuter rail operations
3. Provision of Train slots for run-through service would need to be made available prior to the expansion of the Long Bridge and maintained.

Long-Term Considerations

1. Increased run-through service will require extensive business planning.
2. Exploration of new work rule agreements covering all integrated operations.
3. Equipment utilization plan to accommodate fully integrated fleet of cars and locomotives.
4. Coordination between agencies that accommodates the oversight, management, and revenue-sharing needs run-through operations.

6. CONCLUSION

6.1. Overview of Findings

The *Market Assessment and Technical Considerations for VRE-MARC Run-Through Service in the National Capital Region* explores the market potential for run-through service between the MARC and VRE commuter rail systems. For decades, the National Capital Region has discussed the possibility of implementing run-through service through Union Station. Union Station by design functions as a through-station, with trains accessing it from the north and south with several Amtrak trains running through the station today. While there are a range of reasons (e.g. institution, financial) for why commuter rail service has yet to be implemented, a lack of capacity at stations and on the railroad(s) has long inhibited run-through service. Over the next few years several major infrastructure projects are intended to address these limitations.

6.1.1. Travel Demand

An analytical approach was developed to estimate run-through travel demand based on existing commuter rail travel patterns, CTPP trip volumes, and the MSTM. The results of this analysis suggest that a substantial number of people travel each day in each direction between the MARC and VRE service areas. By 2030, 440,000 trips will occur in the run-through market with most trips likely produced in Maryland and attracted to destinations, predominantly work locations, in Washington, DC and Arlington, VA.

While only a small share of the total trips in the run-through market will occur by commuter rail if run-through service was implemented, the assessment found that by 2030, over 16,000 trips a day would be attracted to run-through service. The greatest demand was found on the corridor between Baltimore, MD and Alexandria, VA at 11,600 trips per day. Compared to VRE's 2030 ridership forecasts, run-through service could double ridership at L'Enfant and by a third at Crystal City.

6.1.2. Impacts on Net-Ridership

A substantial percentage of future run-through riders likely use commuter rail today for part of their journey. For example, approximately 10,000 riders make run-through equivalent trips to and from the service areas of the Penn & Camden Lines and the VRE Shared Line, transferring to another mode to reach their destination. This figure is only slightly lower than the estimated ridership of run-through service in 2030. As most run-through riders are traveling to L'Enfant and Crystal City, they already have frequent Metrorail service to their destination, albeit service that requires at least two transfers when travelling from Union Station.

6.1.3. Other Potential Benefits of Run-Through Service

The greatest benefit of run-through service may be simplifying the commutes of riders who today contend with the time, inconvenience, and reliability-impact of having to transfer to another mode. MARC riders travelling to L'Enfant, Crystal City, and Alexandria would no longer need to transfer twice, reducing the level of overcrowding on Metro trains and platforms. Commuter travelling from Northern Virginia to New Carrollton could utilize commuter rail instead of Metrorail. By creating an additional transit link across the Potomac, run-through service increases resiliency in the regional transportation network.

While a peak period VRE trip from Union Station to L'Enfant is eight minutes faster than the equivalent trip on Metrorail, the study cannot accurately predict the travel time savings of run-through service for trips through Union Station. It is anticipated that trains running through Washington will likely require longer dwell times due to passenger volumes experienced at Union Station. Additionally, low level boarding and alighting adds to station dwell time. It is unknown if there will still be a net travel time savings or net increase in travel time resulting from through service.

6.1.4. Implementation Considerations

There are several elements that must be addressed before run-through service can be implemented, including operational, mechanical, capacity, and institutional considerations. Implementation is further complicated by timing; over the next ten years several major infrastructure projects within VRE's and MARC's service area will constrain capacity and operational flexibility for the railroads. Once complete, these improvements will increase operating capacity, and improve operating reliability and efficiency along the corridor – all factors that will benefit run-through service.

6.2. Next Steps

This study represents a fresh look at the potential for run-through service against the backdrop of several initiatives that could support the implementation of such a service. Virginia is working on a landmark agreement to acquire and improve a part of the CSXT right-of-way, including the Long Bridge, that would increase capacity for passenger and freight trains; the Long Bridge EIS has identified a locally preferred alternative; and, planning coordination is underway between MDOT MTA and VRE.

This study can support future planning efforts by providing a regional perspective on travel dynamics and where the greatest demand existing for run-through operations. In the short-term, there are several ways the region can progress the planning for run-through service:

- Review of the technical study outlined in this report to inform decision-makers at MDOT MTA and VDRPT/NVTC/VRE on next steps
- The evaluation of existing resources, and future needs by both railroad agencies as it relates to the ability to implement run-through service
- Increase coordination with regional agency stakeholders to evaluate the viability of run-through service and develop a potential strategy that facilitates future implementation of run-through service.

7. APPENDIX

7.1. Matrix of Weekday Run-Through Rail Travel Demand by Production and Attraction Zone Pairs– 2030

		Attraction Zones																				
		Alexandria	Backlick-Burke	Bowie-Odenton	Brunswick	Crystal City	Franconia-Brooke	Greater Baltimore	Greater BWI	Inner Prince George's Co.	Kensington-Rockville	Leeland-Spotsylvania	L'Enfant	Manassas-Broad	Martin-Perryville	Metropolitan Grove – Point of Rocks	Monocacy-Frederick	Muirkirk-Laurel	Savage-Dorsey	Silver Spring	Washington Grove-Gaithersburg	West Virginia	Grand Total
Production Zones	Alexandria			0	0			22	0	35	53				0	10	0	10	2	48	4	0	186
	Backlick-Burke			0	0			101	0	4	53				0	2	1	1	0	28	1	0	192
	Bowie-Odenton	34	1			101	1					0	739	0									877
	Brunswick	0	2			0	0					0	0	1									2
	Crystal City			0	0			39	0	28	29				0	4	10	10	10	35	1	0	166
	Franconia-Brooke			0	0			5	0	3	35				0	2	0	2	1	26	1	0	76
	Greater Baltimore	26	0			205	0					0	3,646	0									3,877
	Greater BWI	5	0			11	1					0	64	0									81
	Inner Prince George's Co.	199	11			438	13					0	3,576	0									4,237
	Kensington-Rockville	79	18			226	32					0	1,276	1									1,632
	Leeland-Spotsylvania			0	0			0	0	0	0				0	0	0	0	0	0	0	0	0
	L'Enfant			2	0			69	2	129	107				0	8	1	21	8	117	26	0	490
	Manassas-Broad			0	0			0	0	1	22				0	1	2	1	0	8	0	0	36
	Martin-Perryville	0	0			0	0					0	440	0									440
	Metro Gove-Point of Rocks	10	2			45	1					0	131	2									191
	Monocacy-Frederick	25	3			67	6					0	176	0									277
	Muirkirk-Laurel	48	1			130	4					0	1,076	1									1,259
	Savage-Dorsey	22	2			65	4					0	402	0									496
	Silver Spring	45	0			133	6					0	1,095	0									1,280
	Washington Grove-Gaithersburg	42	3			99	2					0	422	0									568
	West Virginia	0	0			0	0					0	0	0									0
	Grand Total	536	42	2	0	1,520	70	236	3	200	300	0	13,044	5	0	27	13	47	21	263	35	0	16,363

Blank cells represent non-run-through zone pairs

7.2. Matrix of Weekday Travel Demand (all modes) by Production and Attraction Zone Pairs– 2030

		Attraction Zones																				
		Alexandria	Backlick-Burke	Bowie-Odenton	Brunswick	Crystal City	Franconia-Brooke	Greater Baltimore	Greater BWI	Inner Prince George's Co.	Kensington-Rockville	Leeland-Spotsylvania	L'Enfant	Manassas-Broad	Martin-Perryville	Metropolitan Grove – Point of Rocks	Monocacy-Frederick	Muirkirk-Laurel	Savage-Dorsey	Silver Spring	Washington Grove-Gaithersburg	West Virginia	Grand Total
Production Zones	Alexandria			0	0			902	20	1,425	2,171				0	419	0	419	84	1,973	182	0	7,594
	Backlick-Burke			0	0			4,137	25	989	2,185				0	587	146	289	0	1,169	394	0	9,922
	Bowie-Odenton	1,003	226			2,994	275					0	21,947	0									26,445
	Brunswick	0	404			0	0					0	0	147									551
	Crystal City			0	0			224	0	1,133	1,186				0	168	398	416	396	1,422	48	0	5,389
	Franconia-Brooke			0	0			185	39	791	1,325				0	382	0	568	264	973	285	0	4,812
	Greater Baltimore	775	0			1,141	0					0	8,356	0									10,272
	Greater BWI	151	25			334	186					0	1,899	0									2,595
	Inner Prince George's Co.	5,915	2,117			12,993	2,550					0	106,147	28									129,750
	Kensington-Rockville	3,030	682			8,635	1,204					0	48,710	39									62,299
	Leeland-Spotsylvania			0	0			0	0	0	0				0	0	0	0	0	0	0	0	0
	L'Enfant			68	0			1,390	84	5,246	4,361				0	331	37	869	331	4,786	1,061	0	18,565
	Manassas-Broad			0	0			0	0	312	907				0	214	407	369	116	320	90	0	2,735
	Martin-Perryville	0	0			0	0					0	13,061	0									13,061
	Metro Gove-Point of Rocks	382	597			1,712	258					0	4,995	429									8,373
	Monocacy-Frederick	937	674			2,567	1,352					0	6,724	91									12,344
	Muirkirk-Laurel	1,434	158			3,848	750					0	31,938	155									38,283
	Savage-Dorsey	660	345			1,933	777					0	11,944	0									15,660
	Silver Spring	1,735	0			5,063	232					0	41,815	0									48,845
	Washington Grove-Gaithersburg	1,601	649			3,794	391					0	16,103	95									22,633
	West Virginia	0	0			0	0					0	0	0									0
	Grand Total	17,624	5,876	68	0	45,014	7,975	6,837	167	9,897	12,135	0	313,639	984	0	2,101	989	2,930	1,190	10,643	2,060	0	440,129

Blank cells represent non-run-through zone pairs