



2023 Commuter Choice Annual Report Technical Memorandum

NoVaTransit.org | @NoVaTransit
2300 Wilson Boulevard, Suite 230
Arlington, VA 22201
(703) 524-3322

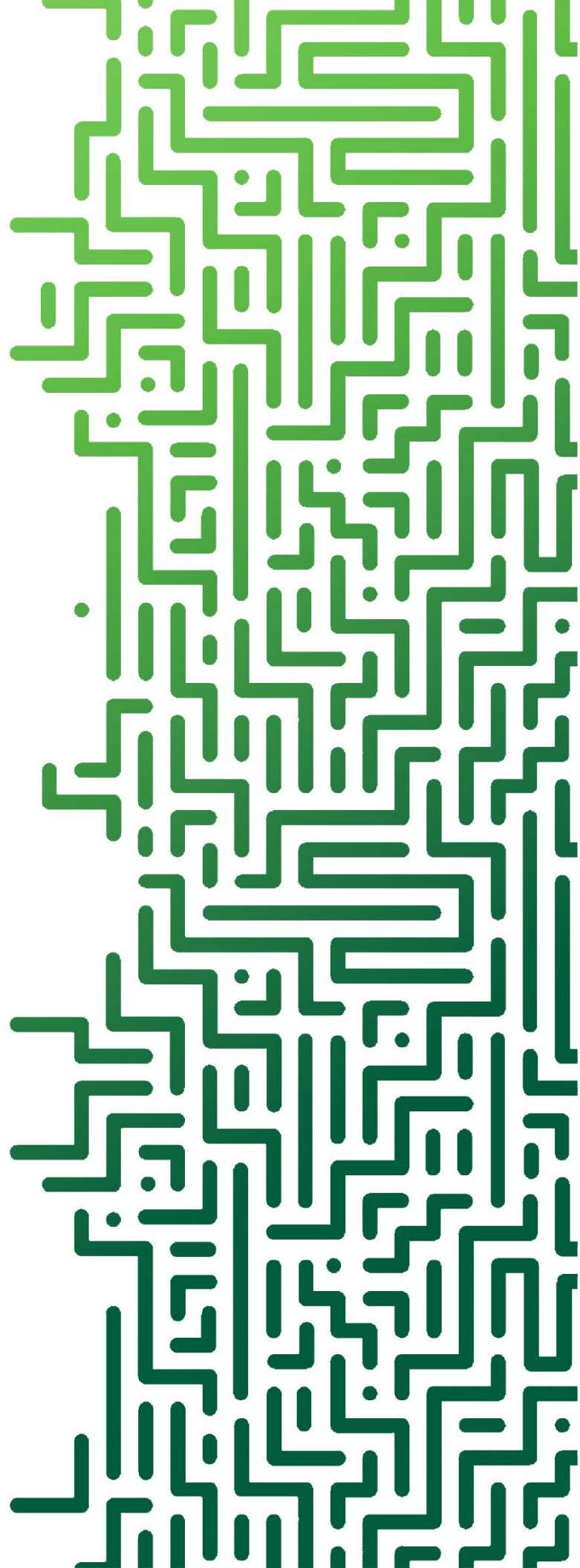




Table of Contents

1. Introduction	2
2. Background	3
3. Throughput Computation Methodology and Results	9
4. Regional Benefits Estimation Approach and Results.....	14
5. Conclusion.....	20
Appendix A: Projects Included in the Regional Benefits Estimation	21

1. Introduction

This memorandum describes how the Northern Virginia Transportation Commission (NVTC) calculated the benefits of projects funded to date by the Commuter Choice program as identified in the Project Performance portion of the [2023 Commuter Choice Annual Report](#). Table 1 summarizes the number of projects funded through Commuter Choice through fiscal year (FY) 2023. These projects were evaluated primarily on their ability to support corridor improvement goals of moving more people (also referenced as “maximizing person throughput”) and implementing transit and other transportation improvements that improve mobility, support new and diverse travel choices, and enhance transportation safety and travel reliability.

Table 1: Commuter Choice Funded Projects

<u>Category</u>	<u>Number of Projects</u>
Total Commuter Choice Projects	58
I-66 Commuter Choice since FY 2017	41
I-395/95 Commuter Choice since FY 2020	17
Projects with Performance Included in the FY 2023 Annual Report	
Projects in Service in Spring 2023, I-66	11
New or Enhanced Bus Service	7
Access to Transit	1
Transportation Demand Management	3
Projects in Service in Spring 2023, I-395/95	9
New or Enhanced Bus Service	6
Transportation Demand Management	3

The 2023 Annual Report presents Commuter Choice projects’ benefits in two ways. For one, the report presents the people moved through the I-66 Inside the Beltway and I-395/95 corridors each weekday by projects active in spring 2023, the time of year that NVTC’s project agreements specify annual performance data collection. Moving more people is one of the overarching improvement goals and serves as a reasonable proxy for the attractiveness and effectiveness of the transportation improvements created. In spring 2023, 11 operational I-66 Commuter Choice projects provided 1,117 passenger trips through the corridor each weekday, while nine operational I-395/95 Commuter Choice projects provided 4,837 passenger trips each weekday, for a total of 5,954 trips each weekday across the two program corridors.

The 2023 Annual Report also estimates the benefits that Commuter Choice projects have provided to Northern Virginia’s economy and quality of life since the first projects began operation in 2017. The total benefits, estimated using nationally recognized tools and factors applied to the usage of each project and how commuters shifting to the project would be reasonably likely to adjust their travel, are:

- 1,155,461 hours of total travel time savings for commuters
- \$31,958,253 in regional economic benefits from reduced travel delay
- 104,740,501 fewer vehicle miles traveled
- \$14,513,982 in fuel expenditures saved
- 131 automobile crashes avoided
- A 69% reduction in greenhouse gas (GHG) emissions relative to drive-alone travel
- 5,105,595 total project trips

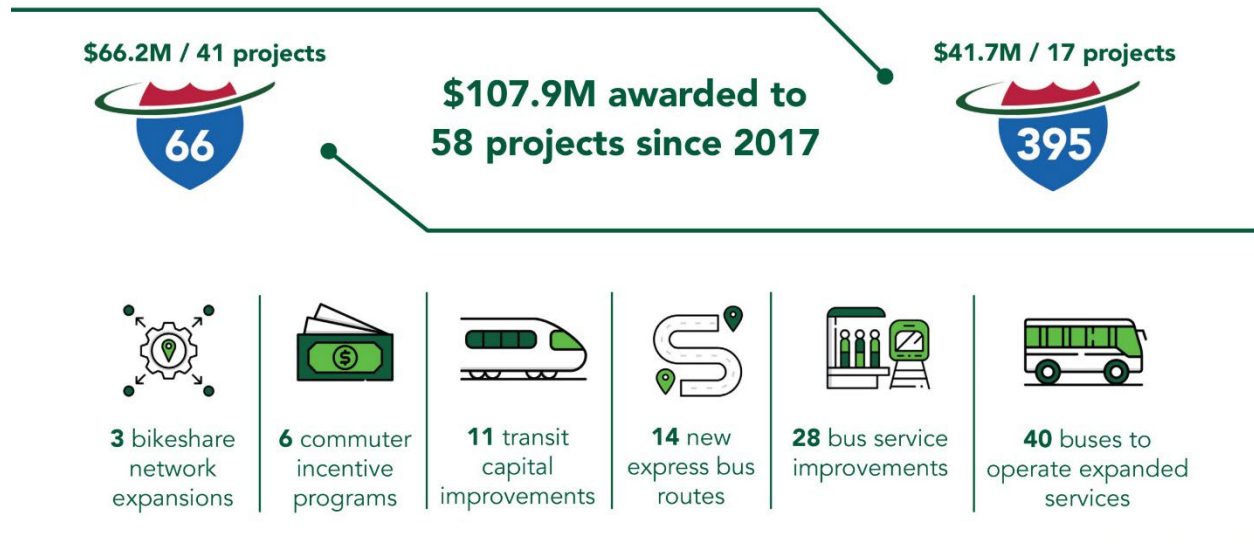
2. Background

Commuter Choice invests toll revenues in public transit and other multimodal transportation projects along two expressway corridors, I-66 Inside the Beltway and I-395/95, that benefit the corridors’ toll payers by moving more people and expanding transportation options. NVTC manages Commuter Choice in partnership with the Commonwealth of Virginia and, on the I-395/95 corridor, the Potomac and Rappahannock Transportation Commission (PRTC).

Commuter Choice Awards to Date

Through FY 2023, Commuter Choice has funded 58 projects, some of which have received multiple installments of funding support, totaling \$107.9 million of reinvestment of toll revenues into multimodal improvements. About \$45 million has been awarded for long-lived capital assets including bus purchases, park-and-ride lot construction and capital improvements to bus stops that will benefit commuters for years to come. I-66 Commuter Choice funded 41 projects in four rounds of funding while I-395/95 Commuter Choice funded 17 projects in two rounds of funding. The totals do not include the \$48.4 million I-395/95 Commuter Choice FY 2024-2025 Program of Projects that was approved in June 2023 for implementation beginning in FY 2024.

Figure 1: Commuter Choice Awards Through FY 2023



NVTC has classified each project funded to date under one of the following categories, even though many projects include elements of more than one category:

- **New or Enhanced Bus Service** - Up to 24 months of operating subsidies for new commuter, local and on-demand bus routes or improvements to existing routes, such as more frequent service or route extensions. New and enhanced bus service projects often include the purchase of buses needed to operate the expanded service, while some include improvements to bus stops or park-and-ride facilities served by the route.
- **Access to Transit** - Pedestrian and bicycle access improvements, such as bikeshare system expansions, from residential areas to nearby transit stations, hubs and stops.
- **Rail Capital** - Capital improvements to Metrorail and Virginia Railway Express facilities, such as construction or expansion of rail stations.
- **Park and Ride** - Construction or enhancement of park and ride lots serving commuter buses, vanpools and carpools.
- **Transportation Demand Management (TDM)** - Campaigns to reduce drive-alone commute trips. While earlier projects focused on education and outreach on alternative options, NVTC now requires standalone TDM projects to center on direct incentives to commuters to entice changes in their travel behavior.
- **Roadway Operations** - Operational and safety strategies and capital improvements to roadways that parallel or connect with I-66 inside the Beltway or I-395/95. Projects to implement dedicated bus lanes are included in the roadway operations category.

Project Selection Process

NVTC’s Commuter Choice project selection process strongly emphasizes the outcomes of a multiple-measure technical evaluation approach. The technical evaluation process effective¹ in

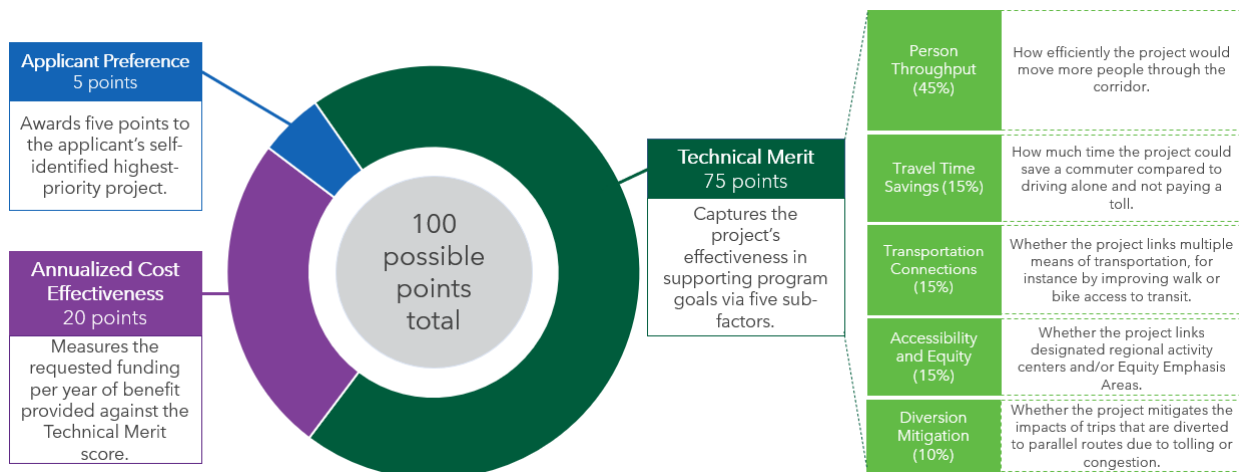
¹ Adopted in 2022. However, prior processes also allotted the most emphasis to the Technical Merit factors that derive from the corridor improvement goals [identified in the two corridor programs’ governing memoranda of agreement.](#)

FY 2023 (Figure 2 below) allots 75 of the 100 possible points to factors related to how well proposed projects meet corridor improvement goals. The factors capture:

- The efficiency by which the project would move more people,
- The travel time savings that commuters would realize from using the project relative to a non-tolled driving trip,
- The extent to which the project would improve connections between modes of transportation,
- The extent to which the project would improve access to regional activity centers, and
- The ability of the project to absorb car trips that might be diverted onto parallel streets due to tolling or high-occupancy vehicle restrictions.

Other criteria in the process capture the project’s cost effectiveness (in terms of the technical merit score relative to the funding request, taking the useful life of project elements into account) and whether the proposed project is the applicant’s top priority out of those that they submitted for funding consideration.

Figure 2: Commuter Choice Technical Evaluation Process



NVTC’s Strategies to Maximize Program Benefits

NVTC has implemented program-wide strategies to maximize the benefits of Commuter Choice funds to I-66 Inside the Beltway and I-395/95 toll payers and mitigate the risks of underperforming projects, including:

- **Limiting operations projects to a maximum of 24 months of support at a time.** Transit service improvements, bikeshare operations, TDM campaigns and any other projects with ongoing operating expenses must successfully recompute under a subsequent call for projects to receive a further installment of operating support. The 24-month limit provides grant recipients a reasonable amount of time to develop a viable service but limits the program’s commitments where services cannot meet performance expectations despite good-faith efforts by grant recipients.
- **Mandating measurable outcomes across project types.** For TDM projects in particular, NVTC found that generalized outreach and education campaigns did not allow for ready quantification of the number of commuters that began using transit or

alternatives to driving alone as a result of the campaign. NVTC therefore now requires standalone TDM strategies to focus on direct incentives to commuters, as these can be targeted specifically to toll payers and have directly measurable usage outcomes that do not require surveying.

- **Encouraging proposals for capital projects with long-lived benefits.** Capital projects that support the program’s goals can benefit toll payers over decades of useful life and the overall project benefits are less susceptible to short-term fluctuations in travel demand. Eligible types of capital project include construction or expansion of park and ride lots, bus stop enhancements, transit priority improvements and improvements to Metrorail and/or Virginia Railway Express facilities. About \$45 million has been awarded to date for long-lived capital assets and improvements, some of which were in the process of being implemented in spring 2023.

Annual Performance Requirement

The Memoranda of Agreement (MOA) with the Commonwealth of Virginia that govern the Commuter Choice program (dated [2021](#) for I-66 Commuter Choice and [2022](#) for I-395/95 Commuter Choice) require NVTC and, for the I-395/95 corridor, PRTC, to submit an annual report on Commuter Choice to the Commonwealth Transportation Board. The MOAs for both corridors require the report to address the following:

1. *A description of projects selected for funding in the past fiscal year and the benefits that were the basis for evaluation and selection of each such project;*
2. *A review of projects funded in past fiscal years describing the degree to which the expected benefits were realized or are being realized;²*
3. *For any project that is not providing substantially similar benefits to those that were the basis for its evaluation and selection, an evaluation of the viability of a plan to modify the project or redeploy the assets to other eligible projects that are expected to provide greater benefits; and*
4. *Proposed uses of residual, unobligated balances of program funds carried over from prior years and interest earned on such funds.*

The summary figures in the Project Performance portion of NVTC’s [2023 Commuter Choice Annual Report](#) present both the average weekday passenger trips (person throughput)³ on projects in service in spring 2023 and an estimate of the broader range of Commuter Choice projects’ benefits to date, based on project person-throughput figures reported each year and comparing travel using each respective project relative to driving alone. The person-throughput results in particular, as summarized in the Annual Report and detailed in this memorandum, allow for an assessment of how well funded projects are realizing their anticipated benefits:

² Required beginning in 2020 for the I-66 corridor program and 2022 for the I-395/95 corridor program. NVTC now reports performance data for both corridors.

³ Defined as the number of additional people moving through the corridor – including by expressway, parallel commuter routes and/or parallel rail transit lines – as a result of the project.

- Maximizing the number of people moving through the corridor is one of the two overarching improvement goals in each corridor. Person-throughput increases also serve as a reasonable proxy for the less tangible improvement goal of implementing transit and other transportation improvements that improve mobility, expand transportation options and enhance transportation safety and travel reliability.
- Each project's estimated person-throughput increase is therefore the clearest indication of its anticipated ability to support the corridor improvement goals and benefit toll payers, as well as a clear target for measuring actual project performance. The estimate is a significant part of the eligibility review (in terms of assuring that the project will benefit toll payers) and technical evaluation.⁴ For funded projects, this throughput increase is then specified in the project agreement and the performance measures identified in the agreement are intended to allow NVTC to compute an actual increase from the performance data provided by the recipient.

The [2023 Commuter Choice Annual Report](#) summarizes the status of each of the active projects included in the computation and, in cases of projects that are not performing at or close to targets, describes steps NVTC and recipients are taking to address the performance concerns.

The estimates of the total number of trips taken on projects to date and reductions in vehicle-miles traveled, travel time and automobile crashes, meanwhile, help depict the program's support for the mobility, safety and reliability aspects of the improvement goals. The benefit estimates, the approaches to which are detailed in Section 4, are high-level and strictly contextual. Most would be difficult to measure empirically; individual projects are not evaluated or tracked against them.

The throughput results and benefit estimates provide a comprehensive view of Commuter Choice's benefits to I-66 and I-395/95 toll payers and more broadly to Northern Virginia's economy and quality of life.

Typical Project Performance Reporting Requirement

Grant recipients are required to provide performance data to NVTC annually to determine the actual increase in person throughput for each funded project.⁵ Each project agreement identifies specific performance measures that will allow NVTC to compute the throughput increase, as well as days for which to report data to provide a representative picture of usage of the project. Where possible, the performance reporting parameters are consistent among similar projects. An example of typical performance reporting parameters for an enhanced bus service is as follows:

- Performance Measures: Report average morning peak-period inbound ridership as well as average total daily ridership for the expansion trips.

⁴ NVTC works closely with applicants to ensure that the throughput estimates carried into the eligibility review and technical evaluation are reasonable, using transit ridership forecasting tools, past project performance and professional judgment.

⁵ For transit service projects, the reporting requirement applies to active service improvements. Capital and certain other project types require reporting for five years from opening or implementation of the project.

- Collection Period: Data should be collected over a two-week period in March or April. Chosen period should not include any holiday periods and the weekday average should be calculated from Tuesdays, Wednesdays, and Thursdays during the period.
- Reporting: Report data to NVTC in a technical memorandum outlining the following:
 1. Data collection methodology
 2. Data collection dates
 3. Results - data
 4. Notes (if necessary)

Most projects, regardless of category, specify a similar data collection period. Mid-week (Tuesday, Wednesday, or Thursday) days in March and April typically represent commute travel at its peak, given schools in session and no major holidays.

Summary Findings

Table 2 summarizes morning peak period and daily ridership for the projects that were in service in spring 2023 by corridor. The daily totals correspond to those in the [2023 Commuter Choice Annual Report](#)'s Project Performance section. As Commuter Choice only funds new and enhanced transit services, facilities and other travel options, NVTC assumes the ridership to represent additional trips in each corridor ("person throughout improvements").

Table 2: Person Throughput Improvements for Projects in Service in FY 2023

Metric, Operational and Completed Projects	Both Corridors (I-66 and I-395/95)	I-66 Corridor Projects Only	I-395/95 Corridor Projects Only
Total Actual Throughput Improvement, AM Inbound	1,693	574	1,119
Total Weekday Ridership Increase	5,954	1,117	4,837

Table 3 presents the estimated program-wide benefits by corridor since Commuter Choice began in 2017.

Table 3: Estimated Program Benefits by Corridor Since 2017

Metric	Both Corridors (I-66 and I-395/95)	I-66 Corridor Projects Only	I-395/95 Corridor Projects Only
Total Travel Time Savings for Project Users (hours)	1,155,461	785,230	370,231
Total Travel Time Cost Savings	\$31,958,253	\$21,959,702	\$9,998,551
Total Vehicle Miles Traveled Reduction	104,740,501	69,376,828	35,363,673
Total Fuel Expenditure Savings for Commuters	\$14,513,982	\$9,492,362	\$5,021,620
Total Vehicle Crashes Avoided	131	88	43
Percentage GHG-Equivalent Emissions Reduction	69%	70%	69%
Total Project Trips	5,105,595	2,448,093	2,657,502

3. Throughput Computation Methodology and Results

NVTC computed the person throughput increase for each project that was in service in spring 2023 based on the performance target/reporting requirements specific to the project and data provided by each grant recipient. Information on the scope of each project and the specific uses of Commuter Choice funding is provided in the [2023 Commuter Choice Annual Report](#). The projects are broken out below by type; not all possible types of project are represented by those currently in service.

New Bus Service Projects

All the new bus service projects currently supported by Commuter Choice provide only peak-period, peak-direction service (i.e., inbound toward Arlington or D.C. during the morning rush hours and outbound in the reverse direction in the afternoon rush hours). NVTC obtained ridership data from grant recipients at the trip level or aggregated by morning or afternoon service. The calculation methodology, actual throughput, and goal throughput for the eight new bus service projects that were active in spring 2023 are shown in Table 4. Descriptions of

all Commuter Choice-funded bus service improvements are included in the [2023 Commuter Choice Annual Report](#).

Table 4: FY 2023 Person Throughput Improvements for New Bus Service Projects

Project	Grantee	Corridor	Calculation Method	Person Throughput		
				AM Inbound		Daily Actual
				Goal	Actual	
Fairfax Connector Express Bus Service between Vienna/Fairfax-GMU and Pentagon Metrorail	Fairfax County	I-66	Averages of reported total AM and daily midweek ridership, March 21-30, 2023	170	119	237
New Bus Service from Haymarket to Rosslyn	OmniRide	I-66	AM and daily average midweek ridership from April 25-May 4, 2023	40	30	59
Loudoun County Transit Metro Connection from New Purcellville Park and Ride	Loudoun County	I-66	AM and daily average midweek ridership, May 2-11, 2023	50	11	21
New Bus Service from Purcellville to DC	Loudoun County	I-66	AM and daily average midweek ridership, May 2-11, 2023	30	26	52
New Bus Service from Stone Ridge to Pentagon	Loudoun County	I-66	AM and daily average midweek ridership, May 2-11, 2023	40	18	35
New Bus Service to the Pentagon with Gambrill and Backlick North Park and Ride Improvements	Fairfax County	I-395/95	Averages of reported total AM and daily midweek ridership, March 21-30, 2023	125	163	325
New Bus Service from Staffordboro to Downtown D.C.	OmniRide	I-395/95	AM and daily average midweek ridership from April 25-May 4, 2023	52	119	242
New Bus Service from Staffordboro to the Pentagon	OmniRide	I-395/95	AM and daily average midweek ridership from April 25-May 4, 2023	60	157	249

Enhanced Bus Service Projects

Generally, all enhanced bus service projects were required to report average weekday ridership. However, Commuter Choice supports a range of bus service enhancements, including:

- Route extensions to existing bus routes
- Discrete additional trips on existing commuter bus routes (e.g., two additional morning peak-period trips and two additional afternoon peak-period trips)
- Shorter headways on existing bus routes (e.g., buses arrive every 10 minutes during rush hours rather than every 15 minutes)

The throughput computation approach therefore varied depending on the nature of the enhancements and the data that grantees provided. The nature of the service enhancement, calculation methodology, actual throughput, and goal throughput for the seven enhanced bus service projects operating in Spring 2023 are summarized in Table 5. Descriptions of all Commuter Choice-funded bus service improvements are included in the [2023 Commuter Choice Annual Report](#).

Table 5: FY 2023 Person Throughput Improvements for Enhanced Bus Service Projects

Project	Grantee	Corridor	Calculation Method	Person Throughput Increase		
				AM Inbound		Daily Actual
				Goal	Actual	
Enhanced Bus Service from Gainesville to Pentagon	OmniRide	I-66	AM and daily average midweek ridership from April 25-May 4, 2023	160	211	421
Stone Ridge Enhanced Transit	Loudoun County	I-66	AM and daily average midweek ridership, May 2-11, 2023	76	32	55
Enhanced Bus Service from Dale City to Ballston	OmniRide	I-395/95	AM and daily average midweek ridership from April 25-May 4, 2023	28	39	68
Enhanced Bus Service on Prince William Metro Express	OmniRide	I-395/95	AM and daily average midweek ridership from April 25-May 4, 2023	24	61	119
Enhanced Bus Service on Route 1 Local	OmniRide	I-395/95	AM and daily average midweek ridership from April 25-May 4, 2023	16	17	69
Enhanced Bus Service from Van Dorn Metro to the Pentagon	City of Alexandria / DASH	I-395/95	Increase over expected ridership levels absent the service improvement, April 16-29, 2023	137	325	2,216

Project	Grantee	Corridor	Calculation Method	Person Throughput Increase		
				AM Inbound		Daily Actual
				Goal	Actual	
Enhanced Bus Service from Mark Center to Potomac Yard	City of Alexandria / DASH	I-395/95	Increase over expected ridership levels absent the service improvement, April 16-29, 2023	71	186	1,445

Access to Transit

One operational access to transit project, a bikeshare expansion in Fairfax County, reported performance information for FY 2023, as shown in Table 6. Descriptions of all Commuter Choice-funded access to transit projects, including projects that did not report performance data because they have not yet been fully implemented, are included in the [2023 Commuter Choice Annual Report](#).

Table 6: FY 2023 Person Throughput Improvements for Access to Transit Projects

Project	Grantee	Corridor	Calculation Method	Person Throughput Increase		
				AM Inbound		Daily Actual
				Goal	Actual	
I-66 Corridor Vienna/Merrifield Bike Share Expansion	Fairfax County	I-66	Average beginning and ending trips on Tuesday, Wednesday and Thursday at County stations within a 3-mile radius of any Metrorail station, April 11-20, 2023	400	5	10

Transportation Demand Management (TDM)

NVTC computed person-throughput improvements for four TDM projects active in FY 2023, as shown in Table 7. Descriptions of all Commuter Choice-funded TDM projects, including projects that did not report performance data, are included in the [2023 Commuter Choice Annual Report](#).

Table 7: FY 2023 Person Throughput Improvements for TDM Projects

Project	Grantee	Corridor	Calculation Method	Person Throughput Increase		
				AM Inbound		Daily Actual
				Goal	Actual	
TDM Strategy - I-66 Corridor Vanpool Parking Benefit	OmniRide	I-66	N/A; no vanpools enrolled as of spring 2023	98	0	0
I-395/95 Corridor Vanpool Monthly Incentive	OmniRide	I-395/95	AM and daily ridership averages from trip-level ridership data from all Tue., Wed. and Thur., March 21-30, 2023	105	52	104
TDM Strategy - Fare Buy-Down on Bus Service from Reston North to Crystal City	Fairfax County	I-66	Averages of reported total AM and daily midweek ridership above baseline levels, March 21-30, 2023	16	56	94
TDM Strategy - Fare Buy-Down on I-66 Commuter Choice Bus Service	Prince William County	I-66	AM and daily average midweek ridership above baseline levels from April 25-May 4, 2023 (Note: some ridership gains were attributed to OmniRide projects per SPAs)	200	67	133

4. Regional Benefits Estimation Approach and Results

NVTC followed the approaches outlined in this section to estimate the regional economic and quality of life benefits of Commuter Choice funding to date. The benefits were aggregated across all fiscal years since Commuter Choice began in 2017 and reflect all projects that reported person-throughput data in at least one of the years. [Appendix A](#) shows the projects included in the regional benefit estimations and for which fiscal years, based on when NVTC received throughput performance data from the recipient. NVTC performed the computations on a per-project, per-year basis.

The benefit estimates are intended to be high-level and contextual, as noted in Section 2. In lieu of being able to measure the benefits empirically, which would be challenging to impossible given their nature, NVTC estimated most by contrasting how commuters might reasonably travel with and without each project based on professional judgment, then aggregated the results across all projects and years. For some of the benefits, NVTC applied factors from nationally recognized tools to the savings in travel times and vehicle mileage. Fundamental to the analysis for each project was the identification of a sample morning peak-period commute trip from a hypothetical residential location to a hypothetical worksite that would plausibly involve travel on or via the project. NVTC constructed these trips consistent with the guidelines that it follows⁶ to estimate the travel time savings for proposed Commuter Choice projects, using Google Maps, transit timetables and information from Commuter Choice funding applications to develop the trips and obtain information on the length and duration of the legs. For consistency, the hypothetical worksites were all at an eastern point in Arlington County (Rosslyn, Crystal City or the Pentagon), unless the project was a transit service bringing commuters directly into downtown Washington, D.C.

The home-to-work trip without each project, referenced in the sections below as the “baseline” scenario, was assumed in all cases for simplicity and consistency to be a drive-alone, non-toll paying trip from end to end. The trip with the project, referenced as the “project” scenario, generally entailed one of the following:

- For most Commuter Choice transit improvements and transit-focused incentive campaigns: Drive-alone travel from the home location to a nearby transit stop, station or park-and-ride that the project is improving or serving, then a transit ride (on the project if it is a new or enhanced service) to the worksite, involving additional transfers if needed. (If the project is a new or enhanced local bus route or a facility improvement in a walkable environment, where drive access would be unlikely, the home location is assumed to be adjacent to or a short walk from the project.)
- For Commuter Choice vanpool-focused projects: Drive-alone travel from the home location to a transit stop, station or park-and-ride, then a vanpool ride (using toll roads as applicable) to the worksite.
- For Commuter Choice access to transit projects: Walk or bicycle travel using the project from the home location to a transit stop, station or park-and-ride facility, then travel via transit to reach the worksite. “Project” trips for access to transit projects do not include any driving.

⁶ See Chapter 4 of the [Commuter Choice Recipient Handbook](#)

Figure 3 illustrates examples of “baseline” and “project” trips.

Benefits arise where Commuter Choice projects afford commuters shorter travel times and/or less travel by personal vehicle than non-toll drive-alone trips, thus also reducing the incidence of automobile collisions, volume of automobile greenhouse gas emissions and commuters’ out-of-pocket fuel expenses, and generating economic benefits for the region. The operation of new or enhanced bus service carries greenhouse gas and vehicle miles traveled (VMT) implications, however, and the benefit estimations presented in this section appropriately account for these impacts of Commuter Choice-funded transit service improvements.

Figure 3: Comparison of Sample ‘Baseline’ and ‘Project’ Hypothetical Home-to-Work Trips

Commuter Choice Project Type	Baseline Trip Scenario Components	Project Trip Scenario Components
New or Enhanced Bus Service	Drive Alone	Drive Alone Transit
Vanpool	Drive Alone	Drive Alone Vanpool
Access to Transit	Drive Alone	Bike/Walk Transit

The sections below outline the computation approach for each category of benefit. All computations were performed at the level of each project for each year that data was available and then aggregated across all projects and years.

Annual Trips

NVTC first computed the project’s daily person-throughput increase from the performance data provided by the recipient for the year in question. In cases where only morning peak-period data was reported, NVTC doubled the morning peak-period result. To convert daily to annual trips, NVTC multiplied the daily figure by 261, the approximate number of non-holiday weekdays per year.⁷

Vehicle Miles Traveled Reduction

NVTC then computed the reduction in annual VMT for the project. First, the “baseline” automobile VMT was computed as the product of two elements:

1. The one-way home-to-work driving distance. The one-way distance used in the calculation was the average length in miles of the Google Maps non-toll routing options; and
2. The number of annual project trips. As noted above, each “baseline” trip was assumed to be non-toll, drive-alone. The number of baseline annual vehicle trips is therefore the same as the number of annual trips on the project.

⁷ While any individual commuter is unlikely to make the same trip on every possible workday of the year, there are assumed to be enough prospective riders making similar trips that the volume of daily trips is reasonably consistent over the course of the year.

For any legs of the “project” trip involving automobile travel, the VMT was computed in the same fashion (the one-way driving distance multiplied by the number of annual project trips). And for trip legs involving vanpools, the number of trips was divided by 4, simulating the typical minimum occupancy of a vanpool.

If the Commuter Choice project included the operation of transit service, the attributable annual bus VMT was computed by the following steps, to reflect the full revenue operation of the service regardless of its usage:

- a. Estimate weekday morning bus VMT by multiplying the end-to-end bus route distance by the number of one-way weekday morning in-service bus trips supported by Commuter Choice;
- b. Convert the figure to daily by doubling it;
- c. Convert the figure to annual by multiplying by 261, the approximate number of non-holiday weekdays per year.

NVTC drew from funding applications for the number of trips and traced the transit routing as closely as possible in Google Maps to obtain the end-to-end distance.

Finally, the annual VMT reduction was obtained by subtracting the total annual “project” VMT (including drive-alone, bus and/or vanpool elements) from the annual “baseline” (drive-alone) VMT.

Figure 4 shows a sample VMT reduction computation for a Commuter Choice bus service project.

Hours of Delay Saved

NVTC estimated delay savings by first computing the travel time savings (if any) for each trip by subtracting the end-to-end “project” trip travel time from the end-to-end “baseline” trip travel time, both in minutes. For driving segments, the travel time was assumed to be the midpoint of the full range of potential non-toll travel times identified by Google Maps, reflecting the variability of day-to-day travel. For trips with multiple segments by transit, the overall travel time included waiting time between the segments.

To convert from minutes per trip to hours per year, NVTC multiplied the per-trip time difference by the number of annual project trips, then converted from minutes to hours by dividing by 60.

Regional Economic Benefits from Reduced Travel Delay

NVTC performed a similar computation to that for hours of delay saved, but just involving the in-vehicle portions of the “baseline” and “project” trips – in other words, when the commuter was aboard a moving vehicle, as opposed to waiting for a bus or train (or walking or bicycling).

The resulting total annual difference in in-vehicle travel times was multiplied by \$29.40, the assumed average value of a Northern Virginia commuter's hour of travel time saved. The figure represents the [United States Department of Transportation's \(USDOT\) time savings valuation](#) for business travel.⁸ While USDOT suggests use of a lower personal travel value for commute trips, the business travel value aligns more closely with how Northern Virginia commuters are likely to value their time based on predominant income levels.⁹

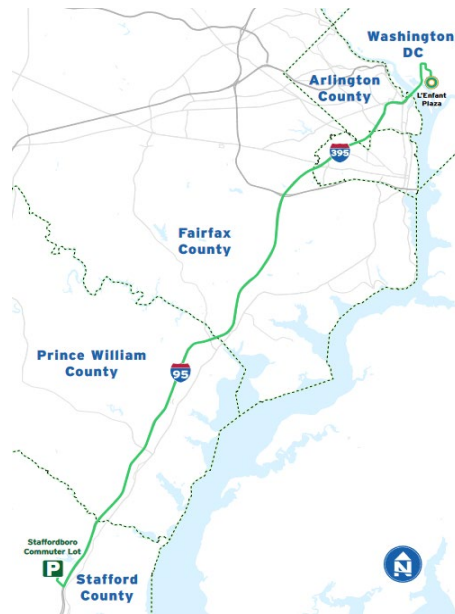
⁸ 2016 Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis. Figures were provided in 2020 dollars.

⁹ Specifically, the levels assumed in the Metropolitan Washington Council of Governments' regional travel demand forecasting. See the [User's Guide for the COG/TPB Gen2/Version 2.4 Travel Demand Forecasting Model](#), p. 181. The hourly rate of \$27.70, corresponding to households earning between \$50,000 and \$100,000, was assumed to be most applicable (in 2007 dollars; not inflated to current levels).

Figure 4: Sample Vehicle Miles Traveled Reduction Computation

The steps to estimate the VMT reduction associated with OmniRide’s Staffordboro to Downtown D.C. express bus service, a Commuter Choice-funded route, for FY 2022 were as follows. For this project, the hypothetical ‘home’ location was a residential area two miles from the Staffordboro Commuter Lot, where the route picks up passengers in the morning. The work location was assumed to be directly along the route at L’Enfant Plaza in downtown D.C.

1. Baseline automobile VMT: Google Maps’ sole non-toll routing option from home to work is 40.8 miles, using the general-purpose lanes on I-395/95. There were estimated to be 70,731 trips on the OmniRide route during FY 2022, based on 271 reported daily trips in spring 2022 multiplied by 261. (All baseline trips are assumed to be drive-alone, so there is no adjustment to the number of trips for vehicle occupancy.) Baseline automobile VMT is therefore 2,885,825, the result of multiplying 40.8 by 70,731.
2. Project automobile VMT: As noted above, the home location is two (2.0) miles from the Staffordboro lot according to Google Maps. All project trips are assumed to access the lot by driving alone. Project automobile VMT is therefore 141,462, the result of multiplying 2.0 by 70,731.
3. Project bus VMT: Tracing the OmniRide route in Google Maps provides an approximate end-to-end length of 41.5 miles. OmniRide operated five morning one-way trips on the route in FY 2022, all supported by Commuter Choice, so the route’s VMT on a weekday morning is 207.5 (41.5 multiplied by 5). NVTC doubled the morning figure to reach the estimated daily bus VMT of 415. Converting the daily figure to annual by multiplying by 261 yields an annual project bus VMT of 108,315 (415 multiplied by 261).
4. Annual VMT reduction: The baseline VMT is 2,885,825 and the total project VMT is 249,777, comprising the project automobile VMT of 141,462 and the project bus VMT of 108,315. The annual VMT reduction for FY 2022, from subtracting the project VMT from the baseline VMT, is 2,636,048.



Automobile Crashes Avoided

NVTC computed the difference in annual automobile VMT between the “baseline” and “project” scenarios and multiplied it by the incidence in 2020 of Northern Virginia automobile crashes. The rate was 1.11 crashes per 1,000,000 VMT.¹⁰

Greenhouse Gas Emissions Reductions

NVTC used the nationally recognized [California Life-Cycle Benefit/Cost Analysis Model](#) (Cal-B/C)¹¹ Excel-based tool to convert the annual VMT changes into estimated greenhouse gas emissions reductions. Cal-B/C identifies the quantity of tailpipe emissions in grams per mile for the greenhouse gases carbon dioxide (CO₂) and nitrogen oxides (NO_x).¹² The emission rates are specific to vehicle type (car or bus) and average travel speed.

To estimate annual “baseline” and “project” greenhouse gas emissions in metric tons:

1. NVTC computed the average travel speed for automobile travel in the “baseline” trip in miles per hour, using the end-to-end travel distance and travel time.
2. NVTC obtained CO₂-equivalent emissions for the “baseline” trip by adding together the following:
 - a. The baseline annual automobile VMT multiplied by Cal-B/C’s grams/mile CO₂ emissions factor for the average travel speed, converted from grams to metric tons of emissions by dividing by 1,000,000, and
 - b. The baseline annual automobile VMT multiplied by Cal-B/C’s grams/mile NO_x emissions factor for the average travel speed, converted from grams to metric tons of emissions by dividing by 1,000,000, then multiplied by 298 to convert the NO_x emissions to CO₂-equivalent.¹³
3. NVTC then performed steps 1 and 2 for the “project” trip:
 - a. For automobile travel, the computation incorporated the project annual automobile VMT and average automobile travel speed in miles per hour.
 - b. For operation of bus transit funded by Commuter Choice, the computation incorporated the total annual revenue bus VMT and the average end-to-end bus travel speed in miles per hour per revenue trip (from the trip distance traced in Google Maps and the one-way travel time provided in online timetables).

The difference in CO₂-equivalent emissions between the “baseline” and “project” travel was then computed. As the absolute impact of a number of metric tons reduced does not have a widely recognized basis for comparison, NVTC aggregated the results across all projects and fiscal years to obtain a percentage reduction in emissions.

¹⁰ [2010-2020 Summary of Crash Data](#). The Virginia Department of Transportation’s Traffic Engineering department maintains the data.

¹¹ Developed by the California Department of Transportation using on-road emissions estimates from the California Air Resources Board’s 2021 EMFAC model and compliant with USDOT guidance on benefit-cost analyses.

¹² Cal-B/C includes projections for various vehicle model years. NVTC used model-year 2024 projections, the closest available to today.

¹³ [EPA Greenhouse Gas Equivalencies Calculator](#).

Fuel Expenditure Savings

NVTC first estimated the number of gallons of fuel that commuters saved annually on their automobile travel under the “project” trip relative to the “baseline” trip using Cal-B/C’s factors for fuel consumption based on average travel speed.¹⁴ For each scenario, NVTC estimated commuters’ annual fuel consumption in gallons by multiplying the applicable Cal-B/C fuel consumption factor (provided in gallons per mile) for the automobile portion of the trip by the annual automobile VMT. NVTC then obtained the fuel consumption reduction by subtracting the “project” fuel consumption from the “baseline” fuel consumption. For fiscal years through FY 2022, NVTC multiplied this difference by \$4, equivalent to approximate early 2022 per-gallon prices (when this analysis was begun), to obtain an estimated total fuel expenditure savings for each project in each year. For FY 2023, the difference was multiplied by \$3.50, reflecting approximate regional average fuel prices in spring 2023.

5. Conclusion

This technical memorandum documents NVTC’s methodology to monitor, report and evaluate person throughput performance for Commuter Choice projects to support the figures included in the Project Performance portion of the [2023 Commuter Choice Annual Report](#). NVTC presented the person-throughput performance for projects active in spring 2023, reflecting a single, straightforward measure that aligns with the corridor improvement goals that any Commuter Choice project must support – specifically, maximizing person throughput and implementing multimodal improvements that improve mobility, support new and diverse travel choices, and enhance transportation safety and travel reliability. NVTC also estimated the benefits since 2017 of Commuter Choice funding to Northern Virginia’s economy and quality of life.

NVTC found that the 20 transit, access to transit and TDM projects in service in spring 2023 provided 5,954 passenger trips each weekday through the I-66 Inside the Beltway and I-395/95 corridors. Further, NVTC estimated the following benefits to date of Commuter Choice funding using nationally recognized tools and factors applied to the usage of each project and how commuters shifting to the project would be likely to adjust their travel:

- 1,155,461 hours of total travel time savings for commuters, amounting to \$31,958,253 in regional economic benefits from reduced travel delay
- 104,740,501 fewer vehicle miles traveled
- \$14,513,982 in fuel expenditures saved
- 131 automobile crashes avoided
- A 69% reduction in greenhouse gas emissions
- 5,105,595 total project trips

¹⁴ Cal-B/C includes projections for various vehicle model years. NVTC used model-year 2024 projections, the closest available to today.

Appendix A: Projects Included in the Regional Benefits Estimation

Project	Grantee	Corridor	Fiscal Years (20-)						
			17	18	19	20	21	22	23
Enhanced Bus Service on AT-1 Plus: West End to Van Dorn Metro	DASH	I-395				X	X		
Enhanced Bus Service from Van Dorn Metro to the Pentagon	DASH	I-395						X	X
Enhanced Bus Service on AT-9: Mark Center to Potomac Yard	DASH	I-395				X	X		
Enhanced Bus Service from Mark Center to Potomac Yard	DASH	I-395						X	X
New Bus Service to the Pentagon with Gambrill and Backlick North Park and Ride Improvements	Fairfax County	I-395				X	X	X	
Renewal of Route 396 Express Bus Service: Backlick North Park and Ride to Pentagon	Fairfax County	I-395							X
New TDM Outreach Campaign for Military Facilities	NVRC	I-395				X			
Enhanced Bus Service from Dale City to Ballston	OmniRide	I-395				X	X		
Renewal of Enhanced Bus Service from Dale City to Ballston	OmniRide	I-395						X	X
Enhanced Bus Service on Prince William Metro Express	OmniRide	I-395				X	X	X	
Renewal of Enhanced Bus Service on Prince William Metro Express	OmniRide	I-395							X
Enhanced Bus Service on Route 1 Local	OmniRide	I-395				X	X		
Renewal of Enhanced Bus Service on Route 1 Local: Quantico to Woodbridge VRE	OmniRide	I-395						X	X
New Bus Service from Staffordboro to Downtown D.C.	OmniRide	I-395				X	X		
Renewal of Bus Service from Staffordboro to Downtown D.C.	OmniRide	I-395						X	X
New Bus Service from Staffordboro to the Pentagon	OmniRide	I-395				X	X		
Renewal of Bus Service from Staffordboro to the Pentagon	OmniRide	I-395						X	X
I-395/95 Corridor Vanpool Monthly Incentive	OmniRide	I-395						X	X
Metrobus Route 2A Peak Period Expansion	Arlington County	I-66		X	X				
Enhanced Bus Service on Metrobus 3Y: Lee Highway-Farragut Square	Arlington County	I-66				X			
Route 55 Peak Period Service Expansion	Arlington County	I-66		X	X				
Expanded TDM Outreach on the I-66 Corridor	Arlington County	I-66						X	

Project	Grantee	Corridor	Fiscal Years (20-)						
			17	18	19	20	21	22	23
Expanded Transit Access, Bike Share	City of Falls Church	I-66				X	X	X	
Metrobus Route 3T Extension and Service Expansion	City of Falls Church	I-66			X	X			
Bicycle Parking Improvements at Manassas VRE Station	City of Manassas	I-66				X			
Fairfax Connector Government Center - Downtown DC, Route 699	Fairfax County	I-66		X	X				
Fairfax Connector Express Bus Service between Vienna/Fairfax-GMU and Pentagon Metrorail	Fairfax County	I-66			X	X	X	X	
Renewal of Bus Service from Vienna Metrorail Station to Pentagon	Fairfax County	I-66							X
Enhanced Bus Service from Government Center to DC	Fairfax County	I-66				X	X	X	
New Bus Service from Stringfellow to L'Enfant Plaza	Fairfax County	I-66					X	X	
I-66 Corridor Vienna/Merrifield Bike Share Expansion	Fairfax County	I-66							X
TDM Strategy - Fare Buy-Down on Bus Service from Reston North to Crystal City	Fairfax County	I-66							X
Loudoun County Stone Ridge Enhanced Transit	Loudoun County	I-66	X	X	X				
Loudoun County Transit Metro Connection Route 88X Extension to Dulles South	Loudoun County	I-66			X	X			
Enhanced Bus Service from Stone Ridge to DC	Loudoun County	I-66				X		X	X
Loudoun County TDM	Loudoun County	I-66		X	X				
Loudoun County Transit Metro Connection from New Purcellville Park and Ride	Loudoun County	I-66			X	X	X		
New Bus Service from Stone Ridge to Pentagon	Loudoun County	I-66						X	X
New Bus Service from Purcellville to DC	Loudoun County	I-66						X	X
Renewal of Purcellville Metro Connection Bus Service	Loudoun County	I-66						X	X
Gainesville to Pentagon Commuter Service	OmniRide	I-66	X	X	X				
Enhanced Bus Service from Gainesville to DC	OmniRide	I-66				X	X	X	
Enhanced Bus Service from Gainesville to Pentagon	OmniRide	I-66				X	X		
OmniRide Linton Hall Metro Direct Bus Service Enhancement	OmniRide	I-66				X	X		
New Bus Service from Haymarket to Rosslyn	OmniRide	I-66				X	X		
Renewal of Bus Service from Gainesville to Pentagon/Navy Yard	OmniRide	I-66						X	X

Project	Grantee	Corridor	Fiscal Years (20-)						
			17	18	19	20	21	22	23
I-66 Corridor Vanpool Monthly Incentive	OmniRide	I-66						X	X
Renewal of Bus Service from Haymarket to Rosslyn	OmniRide	I-66						X	X
TDM Strategy - Fare Buy-Down on I-66 Commuter Bus Service	Prince William County	I-66							X