Tri-Cities Area MPO STBG and CMAQ Project Review, Selection, and Funds Allocation Process

Approved September 8, 2022

Revised November 14, 2024

Prepared for
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Acknowledgment

Prepared in cooperation with the U.S. Department of Transportation, Federal Highway Administration, Federal Transit Administration, Virginia Department of Rail and Public Transportation, Virginia Department of Transportation, and Tri-Cities Area Metropolitan Planning Organization member jurisdictions and agencies.

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Introduction

This report describes the process to identify, select and fund transportation projects for inclusion in the Tri-Cities Area Metropolitan Planning Organization (MPO) Metropolitan Transportation Improvement Program. The Metropolitan Transportation Improvement Program (TIP) is a prioritized and financially constrained list of transportation projects for the MPO study area. The process described throughout this report is to be used for all proposed and existing projects using federal Surface Transportation Block Grant Program (STBG, formerly known as RSTP) and Congestion Mitigation and Air Quality Improvement (CMAQ) program funds. The process will be undertaken annually and will include the programming of funds over a six-year period. Eligible applicants for STBG projects include MPO member jurisdictions or agencies within the MPO Study Area; eligible applicants for CMAQ projects include those MPO member jurisdictions or agencies within the area previously defined by the Environmental Protection Agency as non-attainment for Ozone.

The report is divided into two sections:

A. Project Selection Process for STBG Funds
B. Project Selection Process for CMAQ Funds

The process developed for projects using STBG funds includes three major steps: 1) application process and preliminary screening; 2) project evaluation; 3) project prioritization and selection. The first part of this report provides a detailed description for each of these steps.

The process developed for projects using CMAQ funds includes four major steps: 1) application process and initial screening; 2) emissions analysis of eligible projects; 3) project ranking; 4) project recommendation and approval. The second part of this report provides a detailed description for each of these steps.

Below is the regular schedule each year for the STBG/CMAQ allocation process.

Table 1: Regular STBG/CMAQ Schedule

Action #	Description	Month
1	MPO call for a new candidate list for scoring	September
2	Project sponsors apply for new STBG/CMAQ projects, providing candidate project background information to TCAMPO staff, including scope of work, schedule and graphic concept showing project location/footprint.	Sept. 30
2A	Administrators of existing STBG/CMAQ projects provide updated cost estimates and schedules to reflect any additional funds needed. All current estimates and schedules need to be reflected in VDOT"s system by Jan/Feb	Jan/Feb
3	TCAMPO, VDOT, and project sponsors meet to discuss existing project statuses and new project applications	October/ November
4	TCAMPO Staff requests necessary information from VDOT re: traffic history, safety information, etc.	November
5	VDOT provides application validation findings re: cost estimates, scope, sketch, constructability, etc.	January
6	TCAMPO scores candidate projects and develops draft priority list	January
7	MPO - TAC reviews results of candidate project scoring and VDOT's recommended draft allocation plan for the SYIP & recommends for Policy Committee approval for public review.	February/March
8	MPO Policy Committee reviews and approves results of candidate project scoring and VDOT's recommended draft allocation plan for the SYIP for public review	March
9	VDOT puts the Draft allocations into GENMOD	March 15
10	CTB revises and approves Draft SYIP for public review	April
11	MPO – Policy Committee reviews the proposed final allocation plan for the SYIP (based on updates and the public comments) & approves the final allocation plan.	April/May
12	VDOT SYIP Public Hearings	April/May
13	CTB reviews/approves the Final SYIP	June
14	New SYIP funding available	July 1
15	CPDC staff and VDOT staff maintain STBG/CMAQ Funding Allocation Plan	Continuous
16	Project sponsor(s) and implementing agency execute project agreements if project begins in first year of new SYIP (new MTIP amendments if needed, too)	TBA

Section A:
Surface Transportation Block Grant Program

I. STBG Program Goals

The following goals for the use of STBG funds are:

- STBG funds should be allocated and implemented in a manner consistent with the current federal and CTB guidelines for their use.
- STBG funds should be allocated when needed for each phase.
- STBG funds should be used, whenever possible, to leverage other available fund sources to complete a project. This is particularly the case in SMART SCALE application rounds.

II. Guidelines for New Projects

Funding of new projects is considered with priority given to funding existing STBG projects. A new project is defined as any project that is not currently found in the MPO's historical STBG allocation tracking sheets. The historical tracking sheets cover every project selected by the MPO to receive allocations of STBG funds and track all approved allocation transfers between projects.

III. Policies and Procedures Governing the Competitive STBG Project Selection Process

<u>Funding limit:</u>

Since this program (as of FY23) receives only $3.5 million per year, the request for STBG funding for new projects is limited to $7 million per project.

<u>Implementation Schedule and Project Selection</u>

Project selection and allocation process covers funding for six fiscal years. Project selection and allocations will be determined based on the goal of providing needed funds to existing STBG projects identified on the MPO tracking sheets. Priority will be given to funding existing STBG projects in need of additional funding to complete the MPO approved phases.

Consideration will be given to funding proposed new projects following a review of existing project needs. In addition to information provided in the proposed project application, an applicant's (i.e. jurisdiction or agency) current allocations to existing projects will be considered along with the applicant's record of progress in completing its existing projects. Priority consideration will be given to those applicants with existing projects that have been fully funded and are scheduled for completion.

STBG Application Process and Screening

MPO staff will provide electronic copies of the application forms to eligible applicants and the forms will be accessible on the Crater Planning District Commission (CPDC) web site. A time frame will be established to govern the return of the applications. Once received, projects will be initially screened for the following:

- Project meets all applicable requirements under Code of Federal Regulations
- Project is consistent with the current Tri-Cities Area MPO Long-Range Transportation Plan
- Project is well defined
- Reasonable data and cost estimates are provided for the project

STBG Project Evaluation and Methods

Once the initial screening process has been completed, projects are placed into one of the six categories shown below and then scored accordingly. Projects with insufficient data or late submittals are not included in the process and are dropped from any further consideration.

The evaluation criteria and methods to be used in scoring the candidate STBG projects are included in Appendix A. The scoring is patterned after the *Plan2045* project scoring methods.

A team including MPO, VDOT District, and VDOT Environmental staffs evaluates all projects according to the approved criteria. MPO staff then prepares a list of candidate projects that have been scored and ranked by category. The list of candidate projects is then submitted to TAC for review and recommendation to the MPO Policy Committee.

The six categories used to score candidate STBG projects are as follows:

1. Highway capacity, accessibility, and operational improvements
   - Roadway Widening, New Facility/Interchange, Intersection/Interchange Improvements
   - Corridor Operational Improvements
   - Bridge Rehabilitation
   - TDM Projects (Park and Ride, etc.)

2. Intermodal Transportation Projects

3. Transit
   - New Service, Expansion of Existing Service, Facilities, etc.
   - Vehicle Replacement/Purchase

- Other Transit Projects

4. Planning Studies

5. Intelligent Transportation Systems

6. Active Transportation Projects
   - Bicycle Projects
   - Pedestrian Projects

IV. STBG Project Selection and Prioritization

Following development of MPO staff review and recommendation based on the previous discussed process, TAC reviews, discusses, and revises candidate projects and allocations as appropriate. Projects are recommended for funding based on the following:

- Project score/rank
- Funding availability
- Other criteria (prior commitments, federal/state mandates, etc.)

Selected projects are assigned to fiscal years based on priority and on project readiness. The final prioritized list of projects is then submitted to the MPO for review and approval. Once approved by the MPO, staff works with VDOT to include each project's allocations in the *Virginia Transportation Six Year Improvement Program*. Selection of projects for inclusion in the MPO's Transportation Improvement Program is based on policies and procedures for programming projects in the MTIP (requires consideration of federal funds obligation requirements as set forth by state and federal policies).

Continued Funding of Projects

Once a project has been selected by the MPO and has received initial STBG funds, the project may continue to receive the necessary allocations required to fully fund its most current estimated cost for MPO approved phases.

These projects will not be required to compete for STBG funds unless the scope and/or cost of the project changes as per the following guidelines:

> If the cost estimate and scope of an individual STBG funded project should change by 10% or *less* - leading to the need for increased allocations to the project in question, the locality/agency should notify MPO staff with a request and justification to continue funding the project and exclude the project from the competition for STBG allocations. TAC will then review the request and recommend committing actual or future year STBG funds to preserve the project.

If the cost estimate and scope of an individual STBG funded project should change by *more* than 10% - leading to the need for increased allocations to the project in question, the locality/agency should notify MPO staff with a request and justification for a change in the funding. TAC will then review the request and may recommend to the MPO one or any combination of the following:

- Scale back the project scope
- Use local funds
- Use urban funds
- Use secondary funds
- Use existing STBG funds from another project
- Use future STBG allocations
- Use future non-STBG funds
- Have the project re-enter the competitive project selection process
- Drop the project

Guidelines Concerning Surplus STBG Funds

At the discretion of the Policy Committee, allocations determined to be surplus may be held in place for seeking additional funds or be returned for reallocation.

Section B:
Congestion Mitigation & Air Quality Improvement Program

I. CMAQ Program Goals

CMAQ funds are allocated by the MPO to those projects that best meet the following set of goals for the use of CMAQ funds:

- Achieves highest reduction in volatile organic compounds (VOC) and nitrogen oxides (NO_x)
- Improve air quality over the long term
- Provide funding for mix of forward thinking and traditional projects
- Projects of regional significance should be given preferential consideration
- CMAQ funds should be used, whenever possible, to leverage other available fund sources to complete a project. This is particularly the case in SMART SCALE projects.

II. Guidelines for New Projects

Funding of new projects is considered with priority given to funding existing CMAQ projects. A new project is defined as any project that is not currently found in the MPO's historical CMAQ allocation tracking sheets. The historical tracking sheets cover every project selected by the MPO to receive allocations of CMAQ funds and track all approved allocation transfers between projects.

III. Policies and Procedures Governing the Competitive CMAQ Project Selection Process

Funding Limits:

Since this program (as of FY23) receives only $1.3 million per year, the request for CMAQ funding is limited to $2.5 million per project.

Implementation Schedule and Project Selection

Project selection and allocation process covers funding for six fiscal years. Project selection and allocations will be determined based on the goal of providing needed funds to existing CMAQ projects identified on the MPO tracking sheets. Priority will be given for funding for existing projects in need of additional funds to complete the MPO approved phases.

Consideration will be given to funding proposed new projects following a review of existing project needs. In addition to information provided in the proposed project application, an applicant's (i.e. jurisdiction or agency) current allocations to existing projects will be considered along with the applicant's record of progress in completing its existing projects. Priority consideration will be given to those applicants with existing projects that have been fully funded and are scheduled for completion.

RideFinders Yearly Allocation Guidelines and Requirements

RideFinders will receive an annual baseline allocation of $35,000 in CMAQ allocations; the base amount will be evaluated and adjusted annually based on changes to the consumer price index. In addition to receiving CMAQ funds, RideFinders is eligible to apply for project or program element funding through the STBG application process.

CMAQ Application Process and Screening

Tri-Cities Area MPO staff will provide application forms to MPO jurisdictions and agencies in advance. The application forms will be available in an electronic format and they will be accessible via the Tri-Cities Area MPO (TCAMPO) web site and through e-mail distribution. A time frame will be established to govern the return of the applications. Once received, projects will be initially screened for the following:

- Project meets all applicable requirements under Code of Federal Regulations
- Project is consistent with the current Tri-Cities Area MPO Long-Range Transportation Plan
- Project is well defined
- Reasonable data (including data required for the emissions analysis) and cost estimates are provided for the project

Continued Funding of Projects

Once a project has been selected by the MPO, and has received initial CMAQ funds and is noted will be fully funded for needed phases, the project may continue to receive the necessary allocations required to fully fund its most current estimated cost for MPO approved phases.

These projects will not be required to compete for CMAQ funds unless the scope and/or cost of the project changes as per the following guidelines:

> If the cost estimate and scope of an individual CMAQ funded project should change by 10% or *less* - leading to the need for increased allocations to the project in question, the locality/agency should notify MPO staff with a request and justification to continue funding the project and exclude the project from the competition for CMAQ allocations. TAC will then review the request and recommend committing actual or future year CMAQ funds to preserve the project.

If the cost estimate and scope of an individual CMAQ funded project should change by *more* than 10% - leading to the need for increased allocations to the project in question, the locality/agency should notify MPO staff with a request and justification for a change in the funding. TAC will then review the request and may recommend to the MPO one or any combination of the following:

- Scale back the project scope
- Use local funds
- Use urban funds
- Use secondary funds
- Use existing CMAQ funds from another project
- Use future CMAQ allocations
- Use future non-CMAQ funds
- Have the project re-enter the competitive project selection process
- Drop the project

Guidelines Concerning Surplus CMAQ Funds

At the discretion of the Policy Committee, allocations determined to be surplus may be held in place for seeking additional funds or be returned for reallocation.

Introduction

In 2021, the Tri-Cities Area Metropolitan Planning Organization (TCAMPO) was awarded a grant through the Virginia Office of Intermodal Planning and Investment's (OIPI) Growth and Accessibility Planning (GAP) Technical Assistance program. In its application, the MPO identified that while they already fulfill certain federal performance regulations regarding setting and adopting targets, they expressed a desire for technical assistance in the development of a quality, ongoing, performance-based planning and programming system.

The purpose of this study is the development of a performance-based planning and programming process that can be managed and maintained over time within the constraints of TCAMPO's limited staffing resources. The methodology presented in this document is intended to be transparent, repeatable, and customizable by TCAMPO staff should the need arise.

Through coordination with TCAMPO staff and the TCAMPO Technical Advisory Committee, measures were developed that focus on five factor areas: Safety, Mobility and Congestion, Accessibility and Equity, Environmental, and Economic Development. These five factor areas align with TCAMPO's Plan2050 Vision, Goals, and Objectives while providing sufficient nuance in supportive measures to evaluate a project's competitiveness for a variety of funding opportunities including SMART SCALE, Congestion Mitigation and Air Quality (CMAQ), and the Surface Transportation Block Grant (STBG, formerly RSTP).

Included measures support the prioritization of all surface transportation projects. This report is separated into two sections. The first provides measures and methodologies for the evaluation and prioritization of highway and roadway projects. These measures are applicable to all manner of roadway projects including segment improvements and intersection improvements. The second component of the report provides measures and methodologies for the evaluation and prioritization of active transportation, transportation demand management (TDM), and transit projects. These methodologies were tested on a sample set of projects and effectively provided scores across a variety of project types including roadway widening, turn lane construction, roundabout construction, bicycle improvement, pedestrian improvement, park and ride lot, and transit improvement.

As is done with SMART SCALE, each project is scored relative to each other for each factor (i.e., the top scoring project receives 100% of the factor score).

Highway and Roadway Projects

1.1 Safety

Safety is weighted at **25%** of the total project score. Safety will be evaluated based on two performance measures weighted as shown in Table 1.

Table 1: Safety Performance Measure Weights

Performance Measure (PM)	PM Weight
S1. Crash Frequency	50%
S2. Crash Rate	50%
Total	100%

S1. Crash Frequency

Description:

This measure calculates the reduction, due to project implementation, in Equivalent Property Damage Only (EPDO) of fatal and injury crashes ($EPDO_{F+I}$).

Explanation of Measure

This measure looks at the reduction in fatal and injury (F+I) crashes over a five-year period attributable to the proposed improvement, weighted by severity. The measure focuses on the reduction in fatalities and injuries experienced by potential users of highway and roadway projects. The expected change in crashes is calculated using crash modification factors related to the project type (CMF).

EPDO is a scale used to standardize crashes based on severity. Virginia has adopted a statewide weighting for use in the SMART SCALE program. The details of this methodology can be found on page 56 of the Round 5 SMART SCALE Technical Guide. For example, a crash resulting in a fatality or severe injury is weighted at 160 times that of a crash with only property damage. The full crash severity weighting values are listed in

Table 2 below.

Table 2: Crash Severity Weights (SMART Scale Round 6)

Crash Severity	Rounded Value	Weighting
Fatal/Severe Injury (K,A)	$2,715,000	170
Non-Incapacitating Injury (B)	$300,000	20
Non-Visible/Possible Injury (C)	$170,000	10
Property Damage Only (O)	$16,000	0

Outcome Measured:

The number of EPDO-weighted fatal and injury crashes ($EPDO_{F+I}$) expected to be reduced due to project implementation.

Data Requirements (GIS layers and documentation):

- **Project Limits**
- **Motor Vehicle Crashes:** Most recent five years of VDOT crash data. Retrieve through ArcGIS by selecting add data from ArcGIS Online, searching 'VDOT Crash' and adding the 'Full Crash' dataset. Then select crashes in and around the project area and export and save the data. **(**)
- **Six-Year Improvement Program (SYIP):** Retrieve from http://syip.virginiadot.org/Pages/allProjects.aspx.
- **Simplified Planning Level Crash Modification Factors (CMF):** drawn from Virginia Smart Scale Planning Level Crash Modification Factors. Retrieve from https://smartscale.org/documents/cmf-list-smart-scale-rd4_fy2022.pdf.

Methodology:

1. Add the Project Limits layer to an ArcGIS Desktop project
2. Create a 250 ft Buffer around the project limits layer
3. Add VDOT 'Full Crash' layer from ArcGIS Online (Add Data from ArcGIS Online and search VDOT Crashes and add 'Full Crash')
4. Use the Select by Location tool to select Crashes that intersect the 250 ft buffer
5. Export and Save the selected crash data by right clicking the Full Crash layer in the table of contents and exporting the data (Data > Export)
6. Add the exported crash layer to your project and open the attribute table. Sort by the Crash Date column and delete rows that are not within the 5-year range of your analysis
7. Review the SYIP to determine if any improvements have been made within the project limits that may have impacted safety. If so, shorten the analysis period to the post-improvement period only by deleting those rows.
8. Select the 250 ft buffer for the project you wish to analyze first.

9. Use the Select by Location tool to select crashes that intersect the 250 ft buffer for your selected project. Visually check that none of the selected crashes are within intersections not directly involved in the improvement, parking lots, parallel roadways such as a frontage road, etc., removing any that clearly fall outside of the intended analysis area.
10. Weight the severity of each crash by EPDO using the table above and the Crash Severity column in the crash data. Calculate the average annual EPDO by summing the total weighted score of all crashes in the project area and divide by the number of years included in the analysis.
11. Find the appropriate CMF for the project improvements. Using the identified CMF, calculate the Percent Expected Crash Reduction (PECR) as follows:
$$PECR = 1 - CMF$$
Most improvements have been standardized for statewide usage.
12. Multiply the PECR by the annual average EPDO of fatal and injury crashes calculated in Step 3 to determine the expected reduction.

S2. Crash Rate

Description:

Reduction in Equivalent Property Damage Only of Fatal and Injury Crashes ($EPDO_{F+I}$) per Hundred Vehicle Miles Traveled (HMVMT) on a roadway segment or per Million Vehicles Entering (MVE) an intersection.

Explanation of Measure

This measure builds on the data and expected crash reductions in measure S.1. Whereas measure S.1. is focused on the overall number of fatal and injury crashes, this measure is focused on the annual rate of fatal and injury crashes per hundred million vehicle miles (segments) or million entering vehicles (intersections). This measure allows for better comparison between projects on routes with different traffic volumes.

Outcome Measured:

The change in the annual rate of fatal and injury crashes weighted by severity ($EPDO_{F+I}$) per HMVMT (segments) or MVE (intersections).

Data Requirements (GIS layers and documentation):

- **Project Limits**
- **Motor Vehicle Crashes:** Most recent five years of VDOT crash data. Retrieve through ArcGIS by selecting add data from ArcGIS Online, searching 'VDOT Crash' and

adding the 'Full Crash' dataset. Then select crashes in and around the project area and export and save the data.

- **Annual Average Daily Traffic (AADT):** Most recent year of VDOT Traffic Volume data. Retrieve through ArcGIS by selecting add data from ARCGIS Online, searching 'VDOT ADT' and selecting the most recent year of traffic volume data. Then select segments in and around the project area and export and save the data.

Methodology:

1. Add the project limits as defined in S.1 (project limits with a 250 ft buffer) to an ArcGIS desktop project
2. Add the AADT layer to the ArcGIS Desktop project from ArcGIS Online (Add Data from ArcGIS Online and search VDOT AADT and add the most recent year)
3. Zoom to the project you are analyzing.
4. Calculate the length of the segments that intersect your study area, including the 250' buffer around the study area. Ignore any segments picked up by the buffer that are on roads not included in the study (e.g., a parallel frontage road, etc.). Segment lengths can be found manually using the measure tool in ArcGIS. If you downloaded or exported the layer Segment length can be generated by a adding a field and doing a field calculate>calculate geometry.
5. Find the AADT for segments that intersect the study area by clicking the segments with the identify tool and locating the value in the AADT field.
6. For segments, calculate the annual traffic volume for the base year in Hundred Million Vehicle Miles Traveled (HMVMT):

$$HMVMT = Length \times AADT \times 365\frac{days}{year}/1{,}000{,}000$$

   For projects that cross multiple segments, the annual traffic volume is calculated as the weighted average volume for all segments. For intersections, the measure is per Million Vehicles Entering (MVE):

$$MVE = \sum \frac{1}{2} AADT_{approach} \times 365\frac{days}{year}/1{,}000{,}000$$

   where $AADT_{approach}$ is the AADT of each intersection approach.
7. Calculate annual EPDO of fatal + injury crashes avoided (measure S.1.).
8. Convert that into the reduced crash rate using the appropriate formula:

$$S2 = {EPDO_{F+I}}/{HMVMT} \quad \text{for segments}$$

   or

$$S2 = {EPDO_{F+I}}/{MVE} \quad \text{for intersections}$$

1.2 Mobility and Congestion

Mobility and Congestion is weighted at **20%** of the total project score. Mobility and Congestion will be evaluated based on two performance measures weighted as shown in Table 3.

Table 3: Mobility and Congestion Performance Measure Weights

Performance Measure (PM)	**PM Weight**
MC1. Demand	50%
MC2. Congestion	50%
Total	100%

MC1. Demand

Description:

This measure calculates the demand for the project based on traffic volumes in and around the project area.

Explanation of Measure

This measure uses Annual Average Daily Traffic to identify the potential volume of users who are likely to benefit from the project.

Outcome Measured:

Weighted average Annual Average Daily Traffic (AADT) of all roads within one quarter mile of the project.

Data Requirements (GIS layers):

- **Project Limits**
- **Annual Average Daily Traffic (AADT):** Most recent year of VDOT Traffic Volume data. Retrieve through ArcGIS by selecting add data from ARCGIS Online, searching 'VDOT ADT' and selecting the most recent year of traffic volume data. Then select segments in and around the project area and export and save the data.

Methodology:

1. Use the buffer tool to create a 0.25-mile buffer (1,320 ft) around the project

location/project segment.

2. Select segments in the AADT data that intersect the project location buffer using the 'Select by Location' tool in ArcGIS.
3. Calculate the mileage for all selected AADT segments in the attribute table (if not already calculated) by adding a new field named 'Mileage', right-clicking the field header and using the 'Calculate Geometry' tool.
4. Add a field named "VMT" to the attribute table in which to calculate Vehicle Miles Traveled for each selected segment. Multiply the AADT field by the Mileage Field using the field calculator to calculate Vehicle Miles Traveled.
5. Calculate the weighted-average AADT for the project by dividing the total VMT of all segments by the total length of all segments:

$$\overline{AADT} = \frac{\sum VMT_n}{\sum Length_n}$$

MC2. Congestion

Description:

This measure estimates the level of traffic congestion in and around the project area.

Explanation of Measure

LOS is the qualitative measure of the travel time during the peak period to the time required to make the same trip at free-flow speeds. A value of LOS A, for example, is the free-flow condition. LOS can be used to determine the severity of congestion along the project area.

Outcome Measured:

Congestion measured as LOS based on the roads that are within a quarter of a mile of the project (weighted by road segment length).

Data Requirements (GIS layers):

- **Project Limits**
- **SPS Data or Streetlight Data** – retrieve using the methodology below.

Methodology:

1. Download the SPS Shapefile (or Streetlight data).

2. Create a 0.25-mile buffer (1,320 ft) around the project location/project segment.
3. Identify the V/C or LOS for each selected segment using the data found in the Streetlight file or SPS data.
4. Score the projects according to the approach in Table 444 below. The table will have you calculate the corresponding Congestion Value as determined based on the level of congestion according to the V/C or LOS. Segments with No Congestion receive a Congestion Value of 0, Low Congestion receive a value of 1, Medium Congestion receive a value of 2, and High Congestion receive a value of 3. The percentage of the project for each level of congestion is then multiplied by the Congestion Value provide a score for each level of congestion. All those scores are then added together to determine the congestion score for the project.

Table 44: Congestion Approach

Thresholds	Level/ Description	Congestion Value on 0-3 scale. (higher score = more congestion)
<.50 V/C or LOS A	*No Congestion*	**0**
.50 - .60 V/C or LOS B	*Low Congestion*	**1**
.60 - .80 V/C or LOS C	*Med Congestion*	**2**
>.80 V/C or LOS D, E, F	*High Congestion*	**3**
Total		Total Project Congestion Value

1.3 Equity and Accessibility

Equity and Accessibility is weighted at **20%** of the total project score. Equity and Accessibility will be evaluated based on four performance measures weighted as shown in Table 6. Fifty percent of the project score for this goal measure is only applicable to Environmental Justice Areas (EJ Areas) to make the project scoring process equitable.

Table 55: Equity and Accessibility Performance Measure Weights

Performance Measure (PM)	**PM Weight**
EA1. Access to Jobs	25%
EA2. Access to Jobs (EJ Areas)	25%
EA3. Access to Non-Work Destinations	25%
EA4.Access to EJ Non-Work Destinations (EJ Areas)	25%
Total	100%

EA1. Access to Jobs

Description:

Access to jobs within a specified distance of the project (based on Functional Classification) for all populations.

Note: The following four Accessibility performance measures calculate access to jobs or destinations within a specified distance of project improvements. This distance is an estimate of what can be traveled in 10 minutes on various road types as determined by their Functional Classification.

Explanation of Measure

A project's potential for improving access to employment centers can be related to the project's proximity to those employment centers. A project with close proximity to employment centers is likely to serve a higher number of users who will benefit from the project. This measure evaluates access to employment in both the plan year and the horizon year. Note that declining employment estimates in the horizon year may produce negative scores.

Outcome Measured:

Access to employment opportunities for all populations within a distance of project implementation.

Data Requirements (GIS layers):

- **Project Limits**
- 2017 Base year and 2050 Horizon Year total employment (RRTPO and TCAMPO SE TAZ data)
- **VDOT Road Centerline with Functional Classification** View here https://www.virginiaroads.org/maps/VDOT::functional-classification-web-map/explore?location=37.510502%2C-77.555950%2C11.78 or retrieve through ArcGIS by selecting add data from ARCGIS Online, searching 'VDOT Functional Class' and adding the Functional Classification layer. Then select segments in and around the project area and export and save the data.

Methodology:

1. Select TAZs that have their center within the appropriate distance of the project based on the highest functional classification of the roads in the project using the

Table 6 66. Selection can be made by:

- Using the buffer tool to create a buffer of the appropriate distance around the project
- Selecting TAZs that have their center in each modal buffer via the 'Select By Location' tool in ArcGIS.

Table 6 6: Buffer Distance

Functional Class	Buffer Size (mi)
Principal Arterial	10
Minor Arterial	7.5
Major Collector	5

2. Calculate the sum of total employment in selected TAZs using the 'Statistics' option from the right click menu of the 'TotEmp' (Total Employment Field) of the TAZ attribute table for both 2017 and 2050.

EA2. Access to Jobs (EJ Area)

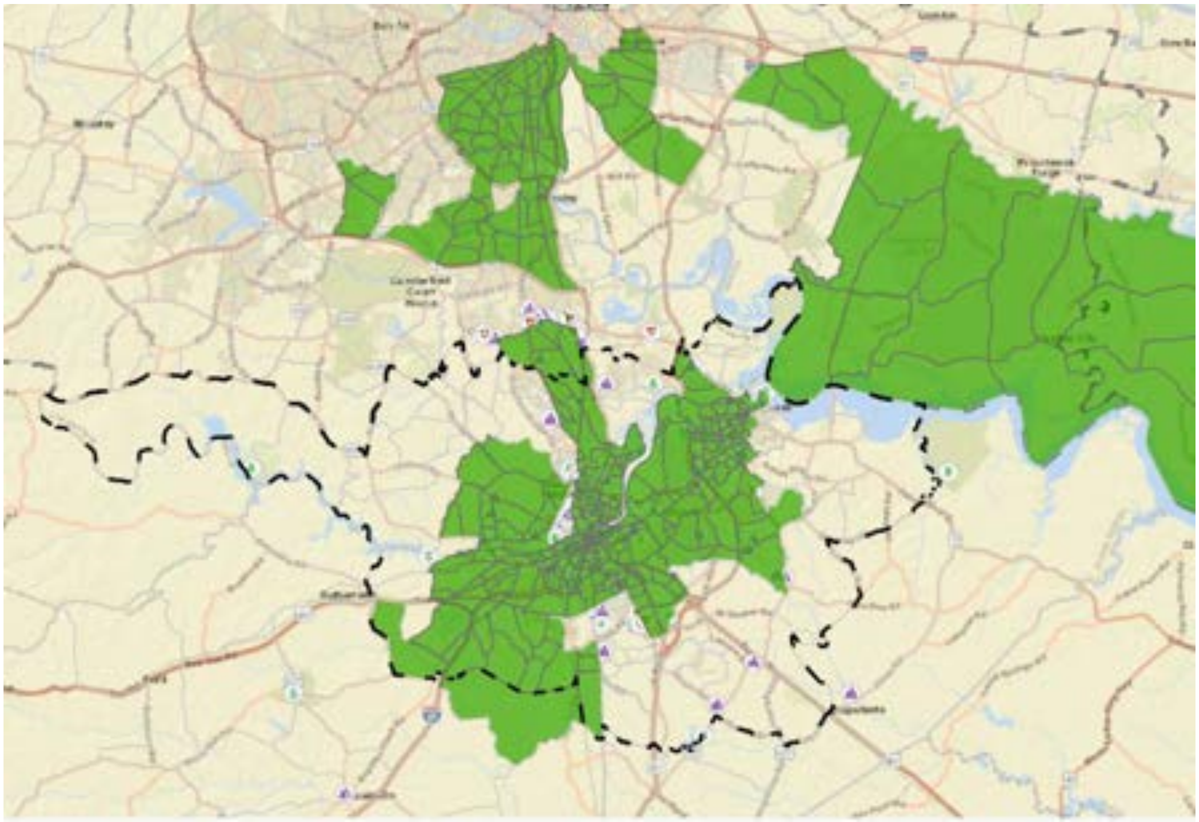
Description:

Access to jobs within a specified distance of the project (based on Functional Classification) for Environmental Justice (EJ) populations.

Explanation of Measure:

This measure is similar to the previous Measure (EA1) except that Access to Jobs is calculated only for Environmental Justice Areas within the TCAMPO Metropolitan Planning Area (MPA) boundary (and southern RRTPO MPA) and for the respective EJ Populations residing within the EJ Areas. EJ populations include minority, low income, and limited English proficiency populations. EJ Areas in the Tri-Cities region are identified in Figure 1.

Figure 1: Environmental Justice Areas in the Tri-Cities Region



<u>Outcome Measured</u>:

Access to employment opportunities for EJ Populations within a distance of project implementation for all populations.

<u>Data Requirements (GIS layers):</u>

- **Project Limits**
- 2017 Base year and 2050 Horizon Year total employment (RRTPO and TCAMPO SE TAZ data) with EJ areas defined
- **VDOT Road Centerline with Functional Classification** View here https://www.virginiaroads.org/maps/VDOT::functional-classification-web-map/explore?location=37.510502%2C-77.555950%2C11.78 or retrieve through ArcGIS by selecting add data from ARCGIS Online, searching 'VDOT Functional Class' and adding the Functional Classification layer. Then select segments in and around the project area and export and save the data.

Methodology:

1. Use a definition query to limit the TAZ data (both 2017 and 2050) to only include TAZs that fall within the EJ areas.
2. Select TAZs that have their center within the appropriate distance of the project based on the highest functional classification of the roads in the project using Table 4. Selection can be made by selecting TAZs that have their center in the modal buffers (Created in EA1, Step 1) via the 'Select By Location' tool in ArcGIS.
3. Calculate the sum of total employment in selected EJ TAZs using the 'Statistics' option from the right click menu of the 'TotEmp' (Total Employment Field) of the TAZ attribute table for both 2017 and 2050.

EA3. Access to Non-Work Destinations

Description:

Access to non-work destinations within a distance of the project (based on Functional Classification) for all populations.

Explanation of Measure:

This measure is similar to EA1 but instead of jobs it measures the access to destinations as a result of planned project improvements. For this analysis - grocery stores, pharmacies, schools, colleges, health care facilities, parks, libraries, and government centers are considered as non-work destinations.

Outcome Measured:

Access to non-work destinations within a distance of project implementation for all populations.

Data Requirements (GIS layers):

- **Project Limits**
- 2017 Base year and 2050 Horizon Year total populations and total employment (RRTPO and TCAMPO SE TAZ data)
- **VDOT Road Centerline with Functional Classification** View here https://www.virginiaroads.org/maps/VDOT::functional-classification-web-map/explore?location=37.510502%2C-77.555950%2C11.78 or retrieve through ArcGIS by selecting add data from ARCGIS Online, searching 'VDOT Functional Class' and adding the Functional Classification layer. Then select segments in and

around the project area and export and save the data.

- **Non-Work Destinations:** (defined above) layer(s) created by Tri Cities staff

Methodology:

1. Select all non-work destinations within the appropriate distance of the project based on the highest functional classification of the roads in the project using table 4. Selection can be made by selecting Non-Work Destinations that intersect the modal buffers (Created in EA1, Step 1) via the 'Select By Location' tool in ArcGIS.
2. Note the number of destinations selected.
3. Select TAZs that have their center within the appropriate distance of the project based on the highest functional classification of the roads in the project using Table 4. Selection can be made by selecting TAZs that have their center in the modal buffers (Created in EA1, Step 1) via the 'Select By Location' tool in ArcGIS.
4. Calculate the sum of total employment and the sum of total population in selected TAZs using the 'Statistics' option from the right click menu of the header of the 'TotEmp' and 'TotPop' fields of the TAZ attribute table for both 2017 and 2050.
5. Add a 'SqMi' field to the TAZ layer (formatted as 'double' to accommodate decimals). Right click the column header and select 'calculate geometry' and calculate the square mileage into that field.
6. Calculate population density with access to Non-Work Destinations by multiplying the total number of reachable destinations (from step 1) by the total population plus total employment and divide that number by the area.

$$\left(\sum Dest_{Non\text{-}work,n} \times \sum Pop_n + Emp_n\right) / \sum Area_n$$

where

$Dest_{Non\text{-}work,n}$ = the weighted non-work destinations accessible to the n TAZ
Pop_n = the population of the n TAZ
Emp_n = the employment of the n TAZ
$Area_n$ = the area (mi2) of the n TAZ

EA4. Access to Non-Work Destinations (EJ Areas)

Description:

Access to non-work destinations within a distance of the project (based on Functional Classification) for Environmental Justice (EJ) populations.

Explanation of Measure:

This measure is similar to (EA3) except that Access to Non-Work Destinations is calculated for only the EJ populations instead of the entire population. EJ Areas for the Tri-Cities region are identified in Figure 1.

Outcome Measured:

Access to non-work destinations within a distance of project implementation for EJ populations.

Data Requirements (GIS layers):

- **Project Limits**
- 2017 Base year and 2050 Horizon Year total populations and total employment (RRTPO and TCAMPO SE TAZ data) with EJ areas defined
- **VDOT Road Centerline with Functional Classification** View here https://www.virginiaroads.org/maps/VDOT::functional-classification-web-map/explore?location=37.510502%2C-77.555950%2C11.78 or retrieve through ArcGIS by selecting add data from ARCGIS Online, searching 'VDOT Functional Class' and adding the Functional Classification layer. Then select segments in and around the project area and export and save the data.
- **Non-Work Destinations:** (defined above) layer(s) created by Tri Cities staff

Methodology:

1. Select all non-work destinations within the appropriate distance of the project based on the highest functional classification of the roads in the project using Table 6 6. Selection can be made by selecting Non-Work Destinations that intersect the modal buffers (Created in EA1, Step 1) via the 'Select By Location' tool in ArcGIS.
2. Note the number of destinations selected.
3. Use a definition query to limit the TAZ data (both 2017 and 2050) to only include TAZs that fall within the EJ areas
4. Select TAZs that have their center within the appropriate distance of the project based on the highest functional classification of the roads in the project using Table 6 6. Selection can be made by selecting TAZs that have their center in the modal buffers (Created in EA1, Step 1) via the 'Select By Location' tool in ArcGIS.
5. Calculate the sum of total EJ employment and the sum of total population of selected EJ TAZs using the 'Statistics' option from the right-click menu of the header of the 'TotEmp' and 'TotPop' fields of the TAZ attribute table for both 2017

and 2050.

6. Add a 'SqMi' field to the TAZ layer (formatted as 'double' to accommodate decimals). Right click the column header and select 'calculate area' and calculate the square mileage into that field.
7. Calculate the population density with access to Non-Work Destinations by multiplying the total number of reachable destinations (from step 1) by the total population plus total employment and divide that number by square miles.

$$\left(\sum Dest_{Non\text{-}work,n} \times \sum EJPop_n + EJEmp_n\right) / \sum Area_n$$

where

$Dest_{Non\text{-}work,n}$ = the weighted non-work destinations accessible to the n EJ TAZ
$EJPop_n$ = the population of the n EJ TAZ
$EJEmp_n$ = the employment of the n EJ TAZ
$Area_n$ = the area (mi2) of the n EJ TAZ

1.4 Environment

Environment is weighted at **10%** of the total project score. Environment will be evaluated based on one performance measure weighted as shown in Table 7.

Table 7: Environment Performance Measure Weights

Performance Measure (PM)	PM Weight
E1. Sensitive Features	100%
Total	100%

E1. Sensitive Features

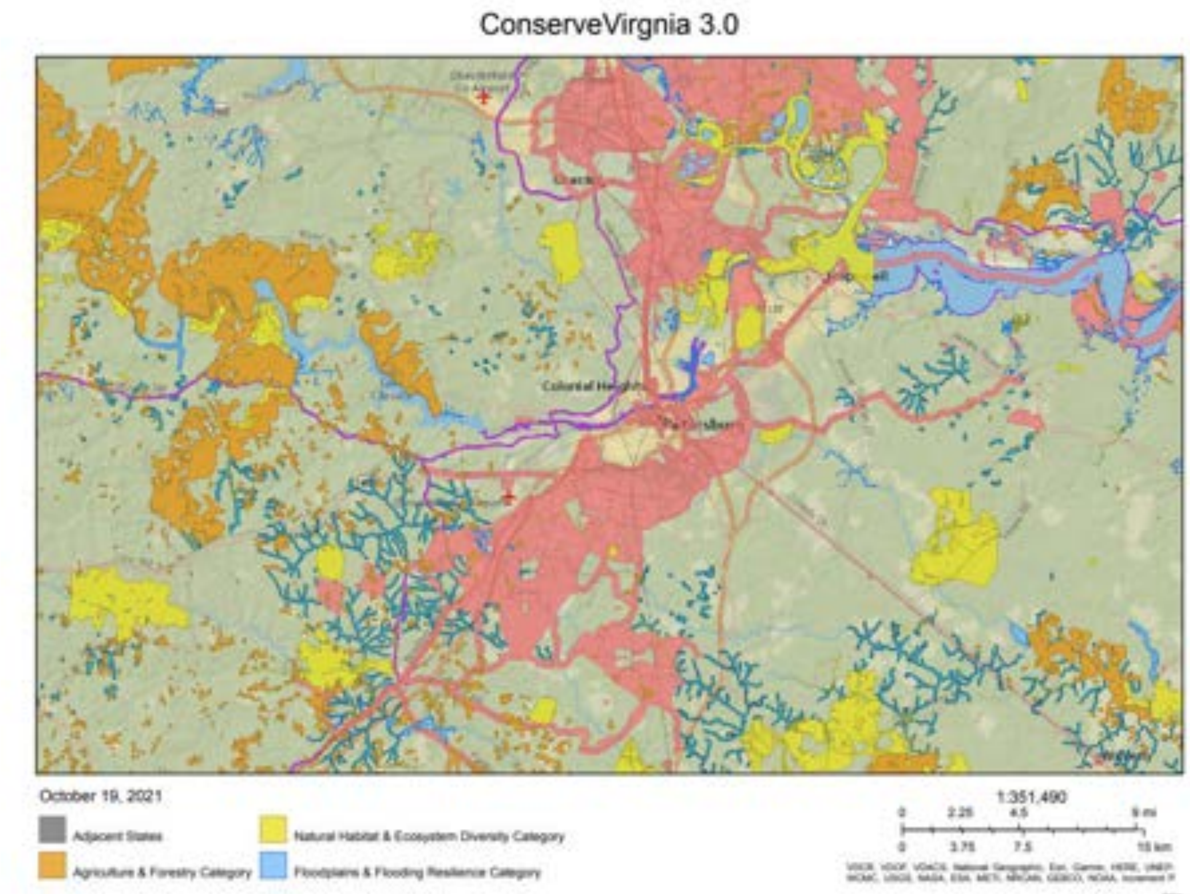
Description:

Ratio of scaled number of acres of Wetland, Resiliency Water Hazard Zone, and Conserved Lands within ¼ mile of the project limits to total acreage within ¼ mile of the project limits.

Explanation of Measure:

Infrastructure projects have impacts on watersheds, wetlands, and habitats among many other aspects of the natural environment. Additionally, building in environmentally sensitive areas such as floodplains or storm surge areas can result in reduced functionality during storms. Beyond the natural areas, lands are sometimes set aside for public use or conserved from development due to natural, agricultural, or historic value - a value that can be impaired by adjacent development. This measure seeks to weigh the potential for negative impacts of a project on the environment and conserved lands. Figure 2 shows the environmentally sensitive and conservation lands in the Tri-Cities Area from the Virginia Department of Conservation and Recreation (DCR).

Figure 2: Environmentally Sensitive and Conservation Lands in the Tri-Cities Area



Outcome Measured:

Ratio of environmentally sensitive and conservation lands within ¼ mile of the project limits to total acreage within ¼ mile of the project limits. This measure is an inverse measure meaning that a project with no impacts will receive the highest score.

Data Requirements (GIS layers):

- **Project Limits**
  Conservation Lands: VA Department of Conservation and Recreation. Retrieve from https://www.dcr.virginia.gov/natural-heritage/cldownload
- **Wetlands :** VA Fish and Wildlife Service. Retrieve from https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/

- **Flood Hazards:** Federal Emergency Management Agency. Retrieve from https://msc.fema.gov/portal/advanceSearch
- **Flooding Risk Assessment: VTrans** (Vulnerability – SLR Intermediate, Intermediate-High, and Extreme; an indication of seal level rise risk). Retrieve from https://vtrans.org/interactvtrans/map-explorer

Methodology:

1. Limit the FEMA Flood Hazard layer to the 100 year flood plain by setting a Definition Query so that only the 'AE' Zone is selected.
2. Create Intermediate Flooding Risk polygon layers by using the buffer tool to create a 200 ft buffer around the VTrans Flooding Risk Assessment layers at intermediate vulnerability and above.
3. Use the dissolve tool to dissolve all environmentally sensitive and conservation areas into one feature (Flood Hazard Zone AE, DCR Conservation Lands, Wetlands, and Flood Risk level at the Intermediate level and above).
4. Use the buffer tool to create a ¼-mile buffer around the project limits.
5. Run the 'intersect' tool on the buffered project limits and the dissolved environmental and conservation area features to determine the areas of overlap between the two la.
6. Calculate the total areas of the ¼ mi buffered layer around the project and the intersect layer with environmentally sensitive and conservation areas by adding a field (Double format to allow for decimal places) named "SqMi" to the attribute tables of both layers. Then use the 'Calculate Area' dialogue from the right-click menu of the column header to calculate square mileage for all features of both layers.
7. Reduce the overlap area (intersect layer) based on the project tier adjustment factor shown in
8. Table 8 8 below and the formula:

   Overlap Area (mi^2) × Adjustment Factor = Impact Area

Table 8 8: Sensitive Features Adjustment Factor

Project Tier	Adjustment Factor
Tier I (CE)	10%
Tier 2 (EA)	30%
Tier 3 (EIS)	50%

Note: The Project Tier is determined by the type of environmental document required, a Categorical Exclusion (CE), Environmental Assessment (EA), or Environmental Impact

Statement (EIS).

1.5 Economic Development

Economic Development is weighted at **25%** of the total project score. Economic Development will be evaluated based on the performance measures weighted as shown in Table 9.

Table 99: Economic Development Performance Measure Weights

Performance Measure (PM)	**PM Weight**
ED1. Job Growth	60%
ED2. Access to Freight Jobs	20%
ED3. Proximity to Activity Centers	20%
Total	100%

ED1. Job Growth

Description:

This measures the relation between job growth and proposed improvements and evaluates the change in jobs by TAZ from 2017 to 2050 in the project vicinity.

Explanation of Measure:

This measure is focused on the relation between job growth and proposed improvements. This measure looks at the change in jobs by TAZ from 2017 to 2050 within a specified distance of the project based off of Functional Classification.

Outcome Measured:

Total number of expected new jobs served by the project.

Data Requirements (GIS layers):

- **Project Limits**
- 2017 Base year and 2050 Horizon Year total employment (RRTPO and TCAMPO SE TAZ data)
- **VDOT Road Centerline with Functional Classification** View here

https://www.virginiaroads.org/maps/VDOT::functional-classification-web-map/explore?location=37.510502%2C-77.555950%2C11.78 or retrieve through ArcGIS by selecting add data from ARCGIS Online, searching 'VDOT Functional Class' and adding the Functional Classification layer. Then select segments in and around the project area and export and save the data.

Methodology:

1. Use the buffer tool to create a buffer of the appropriate distance around the project based on the highest functional classification of the roads in the project using Table 1010.
2. Select TAZs that have their center in each modal buffer via the 'Select By Location' tool in ArcGIS.

Table 1010: Economic Development Buffer Size

Functional Class	Buffer Size (mi)
Principal Arterial	10
Minor Arterial	7.5
Major Collector	5

2. Sum the 2017 jobs and sum the 2050 jobs for the selected TAZs You can do this by right clicking the 2017 and 2050 jobs columns in the attribute table and clicking Statistics while the appropriate TAZs (from steps 1 and 2) are selected.
3. Calculate the total job growth for the project area by subtracting the total 2017 jobs from the total 2050 jobs.

ED2. Access to Freight Jobs

Description:

Proximity to freight jobs.

Explanation of Measure:

This measure calculates the number of freight jobs within the vicinity of the transportation project. This measure is an indicator of a project's potential to improve the movement of goods.

Outcome Measured:

Improvement's proximity to industrial and economic development areas.

Data Requirements (GIS layers):

- **Project Limits**
- **MPO Boundary layer**
- **Tri Cities Employment blocks:** (Census block layer including freight employment), Retrieve via methodology below.
- **VDOT Road Centerline with Functional Classification** View here https://www.virginiaroads.org/maps/VDOT::functional-classification-web-map/explore?location=37.510502%2C-77.555950%2C11.78 or retrieve through ArcGIS by selecting add data from ARCGIS Online, searching 'VDOT Functional Class' and adding the Functional Classification layer. Then select segments in and around the project area and export and save the data.

Methodology:

1. Use the buffer tool to create a buffer of the appropriate distance around the project based on the highest functional classification of the roads in the project using Table 6.
2. Retrieve Census Blocks with freight employment by visiting the Census OnTheMap page at https://onthemap.ces.census.gov/
3. Load a KML file of the MPO boundary by clicking the start tab and select Import from KML (KML file can be created by adding an MPO Boundary layer to your GIS project and using the conversion tools to convert layer to KML). Choose the KML of the MPO boundary and click 'Import'.
4. Once the KML is uploaded, click on 'Zoom to imported shapes' and then 'Select all Polygons', and finally 'Continue with Selected Features'. Confirm selection to continue.
5. Select 'Perform Analysis on Selection Area'. Select Analysis Settings and select 'All Jobs', then select 'Go' to run report. Download the results shapefile.
6. Add the shapefile to your GIS project. The shapefile will be center points of census blocks.
7. Add a field named "FreightEmp' to the block points shapefile. Right click the field and select 'Field Calculator'. To generate freight employment, sum the following fields: cns01 (Agriculture, Forestry, Fishing, and Hunting), cns02 (Mining, Quarrying, and Oil and Gas Extraction), cns05 (Manufacturing), cns06 (Wholesale Trade), and cns08 (Transportation and Warehousing).
8. Select the census block points that intersect each modal buffer via the 'Select By Location' tool in ArcGIS.
9. Calculate the sum of freight employment of the selected blocks using the 'Statistics' option from the right-click menu of the 'FreightEmp' (Freight Employment) field of the block points attribute table.

ED3. Proximity to Activity Centers

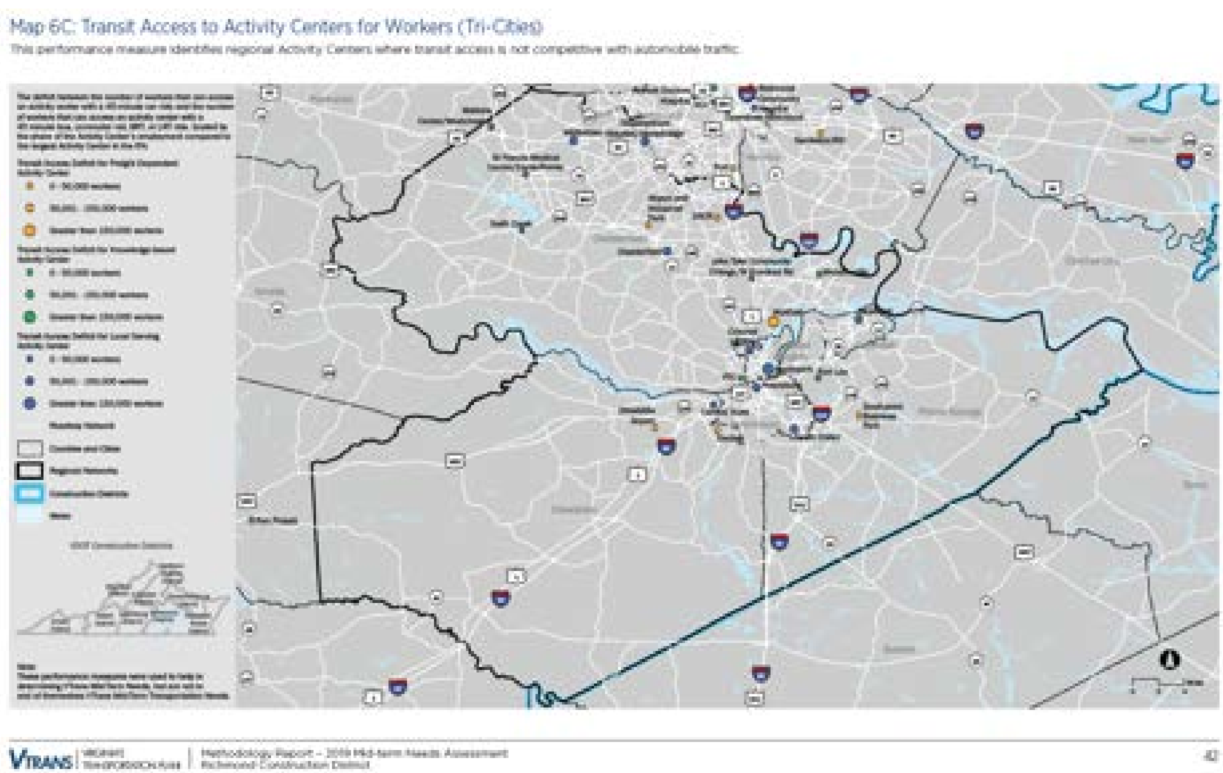
<u>Description:</u>

Increase in the Activity Center units adjacent to the project from 2017 to 2050.

<u>Explanation of Measure:</u>

This measure calculates the number of VTrans Activity Centers for the Tri-Cities MPO area and Walthall within a specified distance of the project (based on Functional Classification). Figure 3 shows the VTrans Activity Center in the Tri-Cities Area.

Figure 3: VTrans Activity Centers in the Tri-Cities Area



<u>Outcome Measured:</u>

Number of Activity Center served by the project.

Data Requirements (GIS layers):

- **Project Limits**
- VTrans Activity Centers (plus Walthall)
- **VDOT Road Centerline with Functional Classification** View here https://www.virginiaroads.org/maps/VDOT::functional-classification-web-map/explore?location=37.510502%2C-77.555950%2C11.78 or retrieve through ArcGIS by selecting add data from ARCGIS Online, searching 'VDOT Functional Class' and adding the Functional Classification layer. Then select segments in and around the project area and export and save the data.

Methodology:

1. Use the buffer tool to create a buffer of the appropriate distance around the project based on the highest functional classification of the roads in the project using Table 6.
2. Select activity centers that intersect each modal buffer via the 'Select By Location' tool in ArcGIS.
3. Open the attribute table for the Activity Centers layer and note the number of selected records.

Active Transportation, TDM, and Transit Projects

2.1 Safety

Safety is weighted at **25%** of the total project score. Safety will be evaluated based on four performance measures weighted as shown in Table 1.

Table 1111: Safety Performance Measure Weights

Performance Measure (PM)	PM Weight
S.1. Crash Frequency	50%
S.2. Crash Rate	50%
Total	100%

S.1. Crash Frequency

Description:

Reduction in fatal and injury crashes weighted by crash severity due to project implementation.

Explanation of Measure:

This measure looks at the reduction in fatal and injury crashes over a five-year period attributable to the proposed improvement, weighted by severity. The measure focuses on the reduction in fatalities and injuries experienced by potential users of the active transportation, travel demand management (TDM), and transit projects. The expected change in crashes is calculated using crash modification factors related to the project type (CMF).

Weights for crash severity are related to Equivalent Property Damage Only (EPDO) values for crash severity. EPDO is a method used to standardize crashes based on severity. Virginia has adopted a statewide weighting for use in the Smart Scale program. For example, a crash resulting in a fatality or severe injury is weighted as heavily as 16 times that of a crash with only property damage. Raw weights listed in Table 1111 that are from Smart Scale's safety scoring methodology[1] were converted to final weights by dividing by the sum of the raw weights (190). This conversion ensures that values used to weight crash types sum to 100%. These final weights were applied to crashes of each type to calculate a score for this measure.

[1] Office of Intermodal Planning and Investment (2022). *SMART SCALE Technical Guide*. Table 6.2: EPDO Crash Value Conversion. Retrieved from https://www.smartscale.org/documents/2022/SMART-SCALE-Technical-Guide-02022022.pdf.

Table 12: Crash Severity Weights (SMART Scale Round 6)

Crash Severity	Rounded Value	Raw Weight	Final Weight
Fatality/Severe Injury (K and A)	$2,715,000	170	85.0%
Moderate Injury (B)	$300,000	20	7.50%
Mild Injury (C)	$170,000	10	5.0%

Outcome Measured:

The change in the annual expected number of fatal and injury crashes over five years is weighted by severity, where weights are derived from dollars amounts associated with crash severity for calculating EPDO values.

Data Requirements/Analytical Tools (Active Transportation Projects):

- **Population (block group level):** U.S. Census Bureau (2020). American Community Survey (ACS) 5-year estimates. Table B01003 (Total Population).
- **Commute mode share (block group level):** U.S. Census Bureau (2020). American Community Survey (ACS) 5-year estimates. Table B08134 (Means of Transportation to Work by Travel Time to Work).
- **Block group shapefile:** U.S. Census Bureau (2020). Cartographic Boundary Files. Retrieved from https://www.census.gov/geographies/mapping-files/time-series/geo/carto-boundary-file.html.
- **National commute mode share:** Bureau of Transportation Statistics (2015). Retrieved from https://www.bts.gov/content/commute-mode-share-2015.
- **Average commute time for pedestrians and bicyclists (national):** U.S. Census Bureau (2021). *Travel Time to Work in the United States: 2019*. Figure 4: Average Travel Time to Work by Means of Transportation: 2019. American Community Survey Reports. Retrieved from https://www.census.gov/content/dam/Census/library/publications/2021/acs/acs-47.pdf.
- **Average commute speed for pedestrians and bicyclists:** Office of Intermodal Planning and Investment (2021). *Technical Guide for the Identification and Prioritization of the VTrans Mid-Term Needs*. Page 25. Retrieved from https://vtrans.org/resources/VTrans_Mid-term_Technical_Guide.pdf.
- **Share of total bike/ped mileage in U.S. and share of work trip bike/ped mileage in Virginia:** Federal Highway Administration (2017). National Household Travel Survey.

Retrieved from https://nhts.ornl.gov/.

- **Number of fatalities by bicyclists and pedestrians in one year:** National Highway Traffic Safety Administration (2019). *National Statistics*. Retrieved from https://www-fars.nhtsa.dot.gov/Main/index.aspx.
- **Crash modification factor (CMF) associated with installing shared-use path for avoiding automobile-vehicle collisions:** Federal Highway Administration. Crash Modification Factor Clearinghouse. Retrieved from http://www.cmfclearinghouse.org/detail.cfm?facid=9250#commentanchor.
- **Reduction in the chance of a location being an automobile-pedestrian crash site due to the presence of a sidewalk:** McMahon, P. J. (2002). An analysis of factors contributing to "walking along roadway" crashes research study and guidelines for sidewalks and walkways (Vol. 1). DIANE Publishing. Retrieved from Google Books.
- **Ratio of pedestrian injuries to fatalities and bicyclist injuries to fatalities in Virginia:** Drive Smart Virginia. 2021 Annual Report. Retrieved from https://www.drivesmartva.org/about-dsv/annual-report/.
- **Ratio of A, B, and C pedestrian injuries and bicyclist injuries in Virginia to the total number of pedestrian injuries and bicyclist injuries in Virginia*:** Virginia Department of Transportation (2022). "Full Crash" layer. Updated April 28, 2022. Accessed May 25, 2022. Retrieved from https://oipi-stp.maps.arcgis.com/home/item.html?id=101101cecac34f28b38c0846e847bd0b.
    - *K-Fatal Injury, A-Suspected Serious Injury, B-Suspected Minor Injury, C-Possible Injury, and O-No Apparent Injury (Source: Model Minimum Uniform Crash Criteria, 5th Edition. Retrieved from https://www.nhtsa.gov/mmucc-1).

Data Requirements/Analytical Tools (TDM Projects and Transit Projects):

- **Linear Referencing System (LRS):** VDOT LRS (version 21.1). Retrieved from https://vdot.maps.arcgis.com/apps/MapAndAppGallery/index.html?appid=7ad6fb5c1f9148ff986db843e7f7b67c#!.
- **Point crash locations:** Virginia Department of Transportation (2022). "Full Crash" layer. Updated April 28, 2022. Accessed May 25, 2022. Retrieved from https://oipi-stp.maps.arcgis.com/home/item.html?id=101101cecac34f28b38c0846e847bd0b.
- **Annual average daily traffic (AADT) at the segment level:** Virginia Department of Transportation (2019). Pathways to Planning.
- **Vehicle occupancy:** 2017 National Household Travel Survey (NHTS). Retrieved from https://nhts.ornl.gov/.

Methodology (Active Transportation Projects):

1. Estimate number of potential project users.
    - Establish a shed in which potential bike and pedestrian users of the project may be located by creating a half-mile buffer around each project.

- Calculate number of pedestrian and cyclist commuters within the buffer based on U.S. Census data, specifically Table B08134 (Means of Transportation to Work by Travel Time to Work) of the American Community Survey (ACS).
    - ACS includes bicyclist mode share along with taxi and motorcycle. National mode share by the Bureau of Transportation Statistics (https://www.bts.gov/content/commute-mode-share-2015) shows bicyclist commute mode share to be approximately 1/3 of the total of these three modes. Therefore, multiply the number of commuters by bicycle, taxi, and motorcycle within each block group by 1/3 to estimate the number of bicycle commuters.
    - Intersect the ½-mile buffer with the block groups and calculate the share of the block group area that is within the buffer.
    - Multiply the share by the number of bicyclist and pedestrian commuters in the block group.
- Account for the fact pedestrian and bicycle commuters will only use the project for commuting when it is on their way to work. Without knowing where each pedestrian and bicycle commuter works and therefore which direction they travel to work, it is assumed that commuters' directions of travel are evenly distributed, meaning that only ¼ travel toward or within 45 degrees of the project. To account for the fact that commuters will only use the project when it is along their route, multiply the number of bicyclist and pedestrian commuters in each block group by ¼.
- Estimate the number of pedestrian and bicycle commuters using the project by summing the block-group level estimate from the previous bullet.

2. Estimate fatality risk per pedestrian / cyclist mile traveled.

- $ped\ fatality\ risk\ per\ mile = \ 2019\ pedestrian\ fatalities \times 0.15/(260\ work\ days\ \times 2\ ways\ per\ commute\ \times average\ commute\ speed\ (mph) \times average\ commute\ time\ in\ hours\ \times number\ of\ nationwide\ ped\ commuters)$
- $cyclist\ fatality\ risk\ per\ mile = \ 2019\ cyclist\ fatalities \times 0.21/(260\ work\ days\ \times 2\ ways\ per\ commute\ \times average\ commute\ speed\ (mph) \times average\ commute\ time\ in\ hours\ \times number\ of\ nationwide\ bike\ commuters)$
    - Where,
        - $2019\ cyclist\ fatalities$ and $2019\ pedestrian\ fatalities$ are the number of fatalities among cyclists and pedestrians respectively in the United States in 2019 based on National Highway Traffic Safety Administration data.
        - $average\ commute\ speed\ (mph)$ is the average commute speed for bicyclists or pedestrians depending on the equation as assumed by the Office of Intermodal Planning and Investment.
        - $number\ of\ nationwide\ ped\ commuters$ and $number\ of\ nationwide\ bike\ commuters$ are the number of commuters who use pedestrian and bike modes nationwide

based on data from the Bureau of Transportation Statistics.

- 0.15 and 0.21 are the share of pedestrian and bicyclist mileage in the U.S. that is associated with travel to or from work according to the 2017 NHTS.

3. Estimate "no build" fatalities around project locations.
   - $Annual\ pedestrian\ fatalities = 365\ days\ per\ year \times project\ length\ in\ miles \times daily\ ped\ users \times ped\ fatality\ risk\ per\ mile$
   - $Annual\ bicyclist\ fatalities = 365\ days\ per\ year \times project\ length\ in\ miles \times daily\ cyclist\ users \times cyclist\ fatality\ risk\ per\ mile$
   - Where,
     - $daily\ ped\ users$ and $daily\ cyclist\ users$ are from step 1.
     - $ped\ fatality\ risk\ per\ mile$ and $cyclist\ fatality\ risk\ per\ mile$ are from step 2.
4. Estimate reduction in fatality risk due to project types.
   - These risk reductions are based on relevant research or crash modification factors (CMFs)
     - **Pedestrian risk reduction:** According to McMahon (2002), the presence of a sidewalk can reduce the chance of a location being a crash site by 88.2%.
     - → 88.2% risk reduction
     - **Pedestrian risk reduction:** According to Crash Modification Factors Clearinghouse, installing a share-used path can reduce vehicle-bike collisions by 25%.
     - → 25% risk reduction
   - If these risk reductions are not relevant to the project type, additional crash modification factors can be obtained from the Crash Modification Factors Clearinghouse[2] or from standard crash modification factors prepared by the Virginia Department of Transportation.
5. Estimate reduction in fatalities due to projects.
   - $reduction\ in\ ped\ fatalities = ped\ risk\ reduction \times annual\ pedestrian\ fatalities$
   - $reduction\ in\ cyclist\ fatalities = cyclist\ risk\ reduction \times annual\ cyclist\ fatalities$
   - Where,
     - $annual\ cyclist\ fatalities$ and $annual\ pedestrian\ fatalities$ are from step 3
     - $ped\ risk\ reduction$ and $cyclist\ risk\ reduction$ are from step 4
6. Estimate injury reduction by severity.
   - Calculate reduction in serious injuries based on ratio of 13 pedestrian

[2] FHWA (2022). Crash Modification Factors Clearinghouse. Retrieved from http://www.cmfclearinghouse.org/index.cfm.

injuries to one fatality and 39 cyclist injuries to one fatality.
- Split among A, B, and C injuries for pedestrians and cyclists based on ratio of each to total injuries.

7. Calculate reduction in severity weighted crashes.
    - Multiply the avoided injuries of each type by the severity weights in.
    - Multiply by 5 to account for five-year time period.

<u>Methodology (TDM Projects and Transit Projects):</u>

1. Calculate rate of fatalities and injuries on commute routes affected by park-and-ride lot or on transit routes.
    a. Process crash data
        i. Limit crash data to prior 5 years.
        ii. Assign crashes to LRS segments using a 5-foot buffer.
        iii. Summarize number of K, A, B, and C injuries occurring on each segment.
    b. Process AADT
        i. Use overlay route events function in ESRI ArcMap to assign AADT to LRS segments.
    c. Calculate rates of K, A, B, and C injuries per vehicle mile traveled.
2. Reduce VMT on commute routes due to affected by park-and-ride lot or transit routes.
    a. For TDM projects, identify linear referencing system (LRS) roadway segments leading from park-and-ride lot to Richmond CBD. For transit projects, identify LRS segments on the transit route.
    b. For TDM projects, reduce daily VMT on these segments by 90% of the expected lot capacity in each direction to account for use of park-and-ride lot. For transit projects, reduce daily VMT by the expected average daily route ridership divided by average vehicle occupancy (1.65 per 2017 National Household Travel Survey).
        i. **Note:** The multiplier for TDM projects assumes that 90% of the park-and-ride lot capacity is used each day.
3. Estimate fatalities and injuries avoided
    a. Use modified AADT from step 2 to recalculate K, A, B, and C injuries using rates from step 1.
4. Calculate EPDO and Multiply by 5 to Account for Five Years
    a. Calculate EPDO for the number of reduced K, A, B, and C injuries calculated in step 3 using the dollar amounts in

b. Table 2.

S.2. **Crash Rate**

Description:

Reduction in Equivalent Property Damage Only (EPDO) of Fatal and Injury Crashes per Vehicles Miles Traveled (VMT).

Explanation of Measure:

This measure builds on the data and expected crash reductions in Measure S.1. Whereas Measure S.1. is focused on the overall number of fatal and injury crashes, this measure is focused on the rate of fatal and injury crashes per million vehicle miles (segments) or million entering vehicles (intersections). This measure allows for better comparison between projects on routes with different traffic volumes.

Outcome Measured:

The change in the annual rate of fatal and injury crashes weighted by severity (equivalent property damage only) per 1 million vehicle miles (segments) or 1 million entering vehicles (intersections)

Data Requirements/Analytical Tools:

- Not applicable

Methodology (Active Transportation, TDM, and Transit Projects):

1. A score of zero is assigned to active transportation, TDM, and transit projects for this measure. For measure S1, active transportation projects' effects on fatalities and serious injuries depends on pedestrian and bicycling activity rather than a relationship with VMT. Similarly, TDM and transit projects are assumed to change the number of fatalities and serious injuries by changing VMT and keeping crash rates constant.

2.2 Mobility/Congestion

Mobility and Congestion is weighted at **20%** of the total project score. Safety will be evaluated based on four performance measures weighted as shown in Table 3.

Table 1313: Mobility and Congestion Performance Measure Weights

Performance Measure (PM)	PM Weight
M1. Walk Score and Bike Score	50%
M2. Congestion	50%
Total	100%

M1. Walk Score and Bike Score

Description:

Walk Score and Bike Score[3]

Explanation of Measure:

Walk Score and Bike Score measure the ease of getting around on foot or by bike at a given location. The higher the score, the easier it is to get around locally on foot or by bike. Walk Score considers factors such as population density, block length, intersection density, and proximity to amenities, while the Bike Score considers bike infrastructure, hills, destinations, road connectivity, and the number of bike commuters.[4] Higher scores here indicate that an active transportation project is likely to join a network of highly useable active transportation infrastructure.

Outcome Measured:

The ability of potential users to access the project location by bike or on foot, and the potential of the project to integrate into a network of infrastructure and travel by bike or pedestrian modes.

Data Requirements/Analytical Tools:

- **Walk Score and Bike Score downloadable from OIPI's Interact VTrans portal:** Redfin (n.d.). Walk Score and Bike Score. Revied from https://vtrans.org/interactvtrans/map-

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[3] Redfin (2022). Walk Score. Retrieved from https://www.walkscore.com/.
[4] Redfin (2022). Walk Score Methodology. Retrieved from https://www.walkscore.com/methodology.shtml.

explorer?layer=Walk%20Score%C2%AE%2C%20Transit%20Score%C2%AE%2C%20and%20Bike%20Score%C2%AE&field=Walk%20Score%C2%AE&center=-79.42091791156685%2C38.018031417766714&zoom=8.

Methodology (Active Transportation Projects):

1. Calculate project length.
2. Intersect project with Walk Score and Bike Score layer.
3. Recalculate length of each segment resulting from the intersection.
4. Calculate the share of each project belonging to each segment.
5. Calculate the length-weighted average Walk Score and Bike Score for each project.
6. Average the Walk Score and the Bike Score.

Methodology (TDM and Transit Projects):

1. Assign the project the Walk Score and the Bike Score for a park-and-ride location (if a point project) or the centroid of its location (if a line or polygon). For a transit project, if stops have been designated, assign the average of each of the stop's Walk Scores and Bike Scores to the project. If stops have not been designated yet, average Walk Scores and Bike Scores at regular intervals along the affected transit route.
2. Average the Walk Score and the Bike Score together to create a single score for the projects.

M2. Congestion

Description:

This measure estimates the level of traffic congestion in and around the project area.

Explanation of Measure

LOS is the qualitative measure of the travel time during the peak period to the time required to make the same trip at free-flow speeds. A value of LOS A, for example, is the free-flow condition. LOS can be used to determine the severity of congestion along the project area.

Outcome Measured:

Congestion measured as LOS based on the roads that are within a quarter of a mile of the project (weighted by road segment length).

Data Requirements (GIS layers):

- **Project Limits**
- **SPS Data or Streetlight Data** – retrieve using the methodology below.

Methodology:

5. Download the SPS Shapefile (or Streetlight data).
6. Create a 0.25-mile buffer (1,320 ft) around the project location/project segment.
7. Identify the V/C or LOS for each selected segment using the data found in the Streetlight file or SPS data.
8. Score the projects according to the approach in Table 444 below. The table will have you calculate the corresponding Congestion Value as determined based on the level of congestion according to the V/C or LOS. Segments with No Congestion receive a Congestion Value of 0, Low Congestion receive a value of 1, Medium Congestion receive a value of 2, and High Congestion receive a value of 3. The percentage of the project for each level of congestion is then multiplied by the Congestion Value provide a score for each level of congestion. All those scores are then added together to determine the congestion score for the project.

Table 1414: Congestion Approach

Thresholds	Level/ Description	Congestion Value on 0-3 scale. (higher score = more congestion)
<.50 V/C or LOS A	*No Congestion*	**0**
.50 - .60 V/C or LOS B	*Low Congestion*	**1**
.60 - .80 V/C or LOS C	*Med Congestion*	**2**
>.80 V/C or LOS D, E, F	*High Congestion*	**3**
Total		Total Project Congestion Value

Description:

Methodology (TDM Projects and Transit Projects):

1. Join the XD data with the XD network shapefiles. Take the maximum TTI for any one-hour period for each segment.
2. Assign points to each segment based on the maximum TTI (**Error! Reference source not found.**).
3. For TDM projects, identify the segments leading to and from the park-and-ride facility to the Richmond central business district (CBD) via freeways. For transit projects, identify the segments affected by the transit route
4. For TDM projects, calculate each segment's share of the length of all segments on the bidirectional path between the park-and-ride facility and the Richmond CBD.

For transit projects, calculate each segment's share of the length of all segments affected by the transit route.

5. Multiply share by the number of points and sum for each project to calculate a "congestion value" for the project.

2.3 Equity/Accessibility (to Jobs and Non-Work Destinations)/Multimodal

Equity and Accessibility are weighted at twenty-five percent **(25%)** of the total project score. Equity and Accessibility will be evaluated based on four performance measures weighted as shown in Table 1515. Forty percent of the project score for this goal measure is only applicable to Environmental Justice Areas (EJ Areas) to make the project scoring process equitable. Therefore, **Equity** is weighted as ten percent **(10%)** of the total project score, and **Accessibility** accounts for the other fifteen percent **(15%)**.

Table 1515: Equity/Accessibility/Multimodal Performance Measure Weights

Performance Measure (PM)	EA Weight	Total Weight
EA1. Access to Jobs	20%	5%
EA2. Access to Jobs (EJ Areas)	20%	5%
EA3. Access to Non-Work Destinations	20%	5%
EA4.Access to EJ Non-Work Destinations	20%	5%
EA5. Increase Access to Multimodal	20%	5%
Total	100%	25%

EA1. Access to Jobs

Description:

Increase in average job access (Distance of ten miles by auto; three miles by bicycle; and one mile by walking or transit) for all populations.

Explanation of Measure:

Note: The first four Accessibility performance measures are essentially calculating the access to jobs or destinations as a result of planned project improvements.

Access to jobs is calculated for all areas within the TCAMPO Metropolitan Planning Area (MPA) boundary and if needed for all populations residing within the southern RRTPO MPA boundary.

Outcome Measured:

The average access to employment opportunities because of project implementation for all populations.

Data Requirements/Analytical Tools:

- Latest historical LEHD LODES employment data for Census Tracts
- Existing and Committed Highway, Transit, Pedestrian, and Bicyclist Networks (E+C)
- Project Limit Shapefile
- Project Conceptual Sketches (for complex projects like interchanges)
- Bicycle or pedestrian system connectivity changes for active transportation projects (as it relates to filling gaps in existing bike/ped network or the last mile connection to transit service).

Methodology:

1. For all Highway, Transit and Active Transportation Projects:

    3. Prepare GIS data for the transportation network of interest given the project type, the project extents and how they alter network properties, and the geography for employment data.
    4. Run network analysis tools to identify a 15-minute travel shed from the project's intersection point(s) with the existing network or, for new transit stops, the nearest point on the network.
    5. Measure the number of jobs in the portion of the employment geographies that intersect the travel shed.
    6. Add the project geometry and/or alterations to the network.
    7. Rerun the travel shed process.
    8. Measure employment in the new travel shed.
    9. Compare before and after conditions to determine change in access to jobs.

2. For all other projects:

    - The job accessibility is not measured for freight and rail projects.

EA2. Access to Jobs (EJ Areas)

Description:

Increase in average job access (Distance of ten miles by auto, three miles by bicycle; and one mile by walking or transit) for Environmental Justice (EJ) populations.

Explanation of Measure:

This measure is similar to the previous measure (EA1) except the fact that Access to Jobs (EJ areas) is calculated only for Environmental Justice Areas (as defined above) within the TCAMPO Metropolitan Planning Area (MPA) boundary (and southern RRTPO MPA) and for the respective EJ population residing within EJ Areas. Figure 1 shows the EJ Areas in the Tri-Cities region.

Outcome Measured:

The change in average access to employment opportunities as a result of project implementation for the Environmental Justice (EJ) population.

Data Requirements/Analytical Tools:

- All Data/Analytical tools required for EA1.
- EJ areas in the Tri-Cities Region and southern Richmond Region (EJ Flagged TAZs)
- EJ Population (Minority, Low Income, Limited English Proficiency (LEP) population) for 2017 and 2050.

Methodology:

For all Highway, Transit and Active Transportation Projects

- The project is scored for what percentage of the extent is within an EJ zone.

For all other projects:

- The job accessibility for Environmental Justice (EJ) populations is not measured for freight and rail projects.

EA3. Access to Non-Work Destinations

Description:

Access to non-work destinations (similar to SMART SCALE's walking distance methodology) for all populations.

Explanation of Measure:

This measure is similar to EA2 but instead of jobs it measures the access to destinations as a result of planned project improvements. For this analysis - grocery stores, pharmacies, schools, colleges, health care facilities, parks, libraries, and government centers are considered as non-work destinations.

Outcome Measured:

The change in average access to weighted destinations as a result of project implementation for all populations.

Data Requirements/Analytical Tools:

- Bicycle or pedestrian system connectivity changes for active transportation projects (as it relates to filling gaps in existing bike/ped network or the last mile connection to transit service) .
- Destinations (Grocery Stores, Pharmacies, Schools, Colleges, Health Care Facilities, Parks, Libraries and Government Centers) location by TAZs.
- Number of persons and jobs in 1-mile radius
- Existing and Committed Highway and Transit Networks (E+C)
- Project Limit Shapefile
- Project Conceptual Sketches (for complex projects like interchanges)

Methodology

1. For all Highway, Transit and Active Transportation Projects

   Destinations within 75 feet of the project travel sheds calculated for "Access to Jobs".

2. For all other projects

   The access to non-work destinations is not measured for freight and rail projects.

EA4. Access to Non-Work Destinations (EJ Areas)

Description:

Access to non-work destinations (similar to SMART SCALE's walking distance methodology) for Environmental Justice (EJ) populations.

Explanation of Measure:

This measure is similar to the previous measure (EA3) except the fact that Access to Non-Work Destinations (EJ areas) is calculated only for Environmental Justice Areas (as defined above) within the TCAMPO Metropolitan Planning Area (MPA) boundary (and southern RRTPO MPA) and for the respective EJ population residing within EJ Areas. Figure 1 shows the EJ Areas in the Tri-Cities region.

Outcome Measured:

The change in average access to weighted destinations as a result of project implementation for EJ populations.

Data Requirements/Analytical Tools:

- Same data sources as EA3
- EJ areas in the Tri-Cities Region and southern Richmond Region (EJ Flagged TAZs)
- EJ Population (Minority, Low Income, Limited English Proficiency (LEP) population) for 2017 and 2050.

Methodology

1. For all Highway, Transit and Active Transportation Projects

   Destinations within 75 feet of the project travel sheds calculated for "Access to Jobs".

2. For all other projects

   The access to non-work destinations is not measured for freight and rail projects.

EA5. Access to Multimodal Transportation

Description:

Whether a project includes multimodal elements.

Explanation of Measure:

This measure assigns points for providing multimodal elements in a project

Outcome Measured:

Whether end users of a project have greater access to a variety of transportation modes, including transit, pedestrian, and bicycle facilities.

Data Requirements/Analytical Tools:

- Project modality details.

Methodology:

1. For all Highway, Transit and Active Transportation Projects:

    1. Assign points as follows:
        a. Park and ride or transit improvements = 4 points
        b. Bicycle improvements = 2 points
        c. Pedestrian improvements = 2 points

3. For all other projects:

    - The access to multimodal transportation is not measured for freight and rail projects.

2.4 Environment

Environment is weighted at **10%** of the total project score. Environment will be evaluated based on two performance measures weighted as shown in Table16 16.

Table16 16: Environmental Performance Measure Weights

Performance Measure (PM)	**PM**
E1. Air Quality Impact	50%
E2. Sensitive Features	50%
Total	100%

E1. Air Quality Impact

Description:

Reduction of annual VOC and NOx emissions in metric tons attributed to the project.

Explanation of Measure:

Environmental Protection Agency (EPA) has set National Ambient Air Quality Standards (NAAQS) for six common air pollutants (also known as "criteria air pollutants"). These pollutants can harm health and the environment, and cause property damage. Some of these pollutants are emitted to the atmosphere through passenger vehicle transportation. The pollutant emissions from passenger vehicle transportation include ozone precursors-volatile organic compounds (VOC) and nitrogen oxides (NOx), and other pollutants particulate matter (PM2.5 and PM1O), sulfur oxides (SOx) and carbon monoxide (CO). Since the Richmond/Tri-Cities region historically had issues meeting the ozone standard, the current Air Pollution measure analysis has been streamlined to limit to ozone precursors only (i.e., VOC and NOx). Transportation- related SOx, CO, and PM2.5, PM1O are not a concern in the Richmond/Tri-Cities region. These emissions can be calculated at the project scale on the basis of per-mile factors. This measure seeks to weigh the potential emission reduction due to the change in travel characteristics attributed to the project. If there is reduction in pollutant emission attributed to the project, then the project will be given a score.

Outcome Measured:

Annual reduction of the pollutant emissions in metric tons.

Data Requirements/Analytical Tools:

- **Emissions calculations:** Federal Highway Administration (2022), CMAQ Emissions Calculator Toolkit. Retrieved from https://www.fhwa.dot.gov/environment/air_quality/cmaq/toolkit/.
- **Project length:** Derived from project limit shapefile or geospatial file
- **Vehicle occupancy:** Federal Highway Administration (2017). 2017 National Household Travel Survey (NHTS). Retrieved from https://nhts.ornl.gov/.

Methodology (Active Transportation Projects):

1. Use estimated number of bike or ped users from the safety calculations (regardless of trip purposes). For each project, sum number of bike or ped users. Assume that

half these commuters would otherwise drive.

2. Divide by average vehicle occupancy (1.65 per 2017 National Household Travel Survey) to estimate number of avoided vehicles.
3. Calculate project length in miles. Assume an equal length of vehicles removed from road.
4. Use CMAQ tool to estimate NOx and VOC pollution (kg) removed daily.
5. Convert to annual using number of workdays (260) and metric tons by dividing by 1,000.

Methodology (TDM Projects and Transit Projects):

1. Use CMAQ tool
    a. Year = current year
    b. Change in VMT = park-and-ride lot size x 90% (Assuming 90% of lot is used) for TDM projects or projected daily ridership divided by average vehicle occupancy for transit projects
    c. Trip Distance Source = Average
    d. Typical Trip Distance = Distance from park-and-ride lot to Richmond central business district for TDM project or the estimated trip length of the average transit rider on this route for transit projects. If estimated trip length cannot be estimated, assume half of the route length.
2. Sum of VOC and NOx emissions.
3. Convert NOx and VOC emissions from kg/day to metric tons per year by multiplying by number of workdays in year (260) and converting to metric tons by dividing by 1,000.

E2. Sensitive Features

Description:

Percentage of Wetlands, Resiliency Water Hazard Zones, Conserved Land, Habitat, and Cultural Resources, etc. in 1/4 mile of the project limit (as per DCR map of Conservation Lands Database (ConserveVirginia V3.0).

Explanation of Measure:

Infrastructure projects have impacts on watersheds, wetlands, and habitats among many other aspects of the natural environment. Additionally, building in environmentally sensitive areas such as floodplains or storm surge areas can result in reduced functionality during storms. Beyond the natural areas, lands are sometimes set aside for public use or conserved from development due to natural, agricultural, or historic value - a value that can be impaired by adjacent development. This measure seeks to weigh the potential for negative impacts on the environment and conserved lands from a project. Figure 2 shows the environmentally sensitive and conservation lands in the Tri-Cities Area.

Outcome Measured:

Percentage of environmentally sensitive and conservation lands within 1/4 mile of the project. This measure is an inverse measure meaning that a project with no impacts will receive the highest score.

Data Requirements/Analytical Tools:

Following geographic features datasets in a spatial format like shapefile:

- Conservation Lands Database (by DCR)
- Project limits shapefile

Methodology:

1. Dissolve all environmentally sensitive and conservation areas into one feature.
2. Create a 1/4 mile buffer around each project.
3. Run the union tool to determine the areas of overlap between the buffer and the environmental and conservation areas feature.
4. For each project, reduce the overlap area based on the project tier shown in Table 17 17 and formula: Overlap Area * Adjustment Factor = Impact Area
5. Calculate the impact percentage by dividing the impact area by the total area of the buffer

Table 17 17: Adjustment Factor for Projects

Project Tier	Adjustment Factor
Tier I	10%
Tier 2	30%
Tier 3	50%

2.5 Economic Development

Economic Development is weighted at **25%** of the total project score. Economic Development will be evaluated based on four performance measures weighted as shown in Table 1818.

Table 1818: Economic Development Performance Measure Weights

Performance Measure (PM)	PM Weight
ED1. Job Growth	60%
ED2. Access to Freight Jobs	20%
ED3. Proximity to Activity Centers	20%
Total	100%

ED1. Job Growth

Description:

Increase in the decay weighted quantity of 2017-2050 job growth adjacent to the project.

Explanation of Measure:

This measure is focused on the relation between job growth and proposed improvements. The approach is adapted from Smart Scale Project Evaluation Measures following an approach proposed for the Harrisonburg MPO. This measure looks at the change in jobs by TAZ from 2017 to 2050. Projects are given credit based on the percentage of the TAZ within the buffer.

Outcome Measured:

Total number of expected new jobs served by the project.

Data Requirements/Analytical Tools:

- 2017 Base Year and 2050 Horizon Year employment data by Traffic Analysis Zones (TAZs)
- Tri-Cities Area's TAZs boundary shapefile
- Project limits shapefile

Methodology:

1. Add the project to the GIS map. For each project, create a multiple ring buffer at 1/4 mile increments up to the influence buffer distance based on the project type.

The dissolve option should be left at the default when creating the multiple ring buffer to create distinctive rings.

2. Use the intersect tool to calculate the overlap between each project ring and each TAZ. Filter results to remove features with no overlap.
3. Calculate job increases credited to project for each overlap area using the following formula: Jobs Served = (Future Year Employment - Base Year Employment) * (Overlap Area / Total TAZ Area)
4. Sum jobs served in all overlaps to get the total number of new jobs served by the project.

ED2. Access to Freight Jobs

Description:

Proximity to freight jobs.

Explanation of Measure:

This measure calculates the number of freight jobs within proximity of the transportation project.

Outcome Measured:

Improvement's proximity to industrial and economic development areas.

Data Requirements/Analytical Tools:

- Utilizes same data as "Access to Jobs" with the LEHD LODES data providing the NAICS codes for freight-related employment.

ED3. Proximity to Activity Centers

Description:

Increase in the Activity Center Units adjacent to the project from 2017 to 2050.

Explanation of Measure:

This measure calculates the proximity to VTrans Activity Centers (plus Walthall). Figure 3 shows the VTrans Activity Centers in the Tri-Cities Area.

Outcome Measured:

New Activity Center Units from 2017 to 2050 in the Activity Centers served by project.

Data Requirements/Analytical Tools:

- VTrans Activity Centers geographical dataset (plus Walthall)
- Project limit shapefile

Methodology

- Count the number of activity centers within 1 mile of the project.

Project Scoring

1. Calculate the raw value for all Performance Measures within the five Goal Categories for each project
2. In order to be able to compare scores for multiple projects and across project types, normalize the scores by Performance Measure by dividing all scores by the maximum score for that measure. This score can then be adjusted to a 100-point scale to produce a score that is comparable across performance measures. See Table 19 below for an example. In the event that a measure both negative and has an absolute value greater than the maximum positive score, the minimum normalized value assigned to that measure shall be -100. For example, if the maximum value of a given measure is 137 and a project scores -243 for that measure, the project with the negative score will be assigned a -100 for that measures normalized value.

Table 19: Score Normalization Example

Project Number	Performance Measure Score	Normalize to 0-1 value (Divide all values by Max)	Scale to 0-100 (Multiply by 100)
1	0.76	0.76 / 0.80 = 0.95	(100 x 0.95) = 95
2	0.40	0.40 / 0.80 = 0.50	(100 x 0.50) = 50
3	0.44	0.44 / 0.80 = 0.55	(100 x 0.55) = 55
4	0.80	0.80 / 0.80 = 1.0	(100 x 1.00) = 100
5	0.30	0.30 / 0.80 = 0.375	(100 x 0.375) = 37.5

3. Multiply the normalized measure scores by their respective measure weights
4. Sum the weighted, normalized performance measure scores within each goal area to produce the Goal Value.
5. Multiply each Goal Value by its respective Goal Weight to produce the Weighted Goal Value. This is repeated for all the goal categories.
6. Sum the Weighted Goal Values to produce the project Benefit Score.
7. Record the total project cost for each product.
8. Divide each project's Benefit Score by its Total Project Cost (per $10 million) to determine the Project Score.

All the projects in the 'Universe of Projects' are then ranked based on the Project Score. The project receiving the highest score will be ranked first, followed by the project ranking second and so on.

A project Scorecard template is provided in Appendix 1.

Appendix 1: Test Scores and FY24-29 Scoring/Recommendations

In order to determine the validity of the methodologies presented in this report, TCAMPO identified a sample set of projects that represented a variety of project types in various locations across the MPO area. The projects fell into four categories: Intersection/Operations; Roadway Improvements; Active Transportation; and Transportation Demand Management (TDM). These projects were then tested and scored using the appropriate methodologies respective to the project type. A list of the projects tested follows accompanied by project scores on subsequent pages of this appendix.

Intersections/Operations

- **Rt 156 (Prince George Drive) & Middle Road Roundabout** – SMART SCALE application; $5.7M
  - Convert 2-way stop to one-lane roundabout.
  - No sidewalks, transit, or bicycle elements.
  - Construction of a single lane Roundabout at Middle Road (Route 646) and Prince George Drive (Route 156) to eliminate poor sight distance and reduce the number of vehicle conflict points. Sidewalk will be constructed along the northeast and southeast quadrants of the roundabout and the median along Moncol drive.
- **Boulevard & Westover Rd** – UPC 100501; $1.085M
  - Add WB left turn lane.
  - No sidewalks, transit, or bicycle elements.
  - Project will add turn lane onto Westover Ave along with other intersection improvements.
- **Boulevard & Branders Bridge Rd** – UPC 99194; $629k
  - Add EB right turn lane.
  - Construct right turn lane extension.
- **Temple Ave/Route 1 signal replacement** – UPC 109264; $1.6M
  - Replace signal at intersection of Route 1 and Temple Avenue including sidewalks and boulevard improvements.
- **Temple Ave/Puddledock Intersection** – UPC 105131; $2.9 M
  - Add turn lanes
  - Intersection capacity improvement with adding an extra WB left turn lane and one extra SB receiving lane. The one NB left turn currently shared with thru lane to be separated into an individual left turn lane.

Roadway Improvements

- **Lakeview Ave Minor Widening, Boulevard to Brijidan** – UPC 101288; $5.248M
  - Add center turn lane.
  - Add sidewalks.
  - This project would reconstruct and modernize this street segment to provide an urban cross section consisting of two (2) vehicle travel lanes, one (1) continuous two-way turn lanes, two (2) bike lanes, two (2) sidewalks, storm drain system and landscaping.

- **Dupuy Ave Widening, Boulevard to MLK** – UPC 101287; $5.308M
    - Add center turn lane.
    - Add sidewalks.
    - This project reconstructs Dupuy Avenue providing an urban cross section with 2 vehicle travel lanes, 1 continuous two-way turn lane, 2 bike lanes, 2 sidewalks, pedestrian crossings, storm drain system and landscaping.

Active Transportation

- **Fall Line Trail, Patton Park Through VSU to River Rd** – SMART SCALE application; $7.46M (update)
    - Multiuse trail with bike/ped bridges.
    - Fall Line Trail Segment 1A of the Ashland To Petersburg (ATP) Trail Study: River Road through Virginia State University to Patton Park to Appomattox River Trailhead in Petersburg using VSU and City property. Includes 4,900 foot 10' wide multi-use trail with two bike/ped bridges (Fleets Branch, Appomattox River/Canal) and 200 foot 10' wide multi-use trail stub from ATP Trail to east edge of VSU property (to connect to the future CHART Trail extension).
- **Petersburg Appomattox River Trail, University Blvd to Squaw Valley** - CMAQ application; $1.3M
    - Multiuse trail.
- **Fall Line Trail, River Road/Dupuy Ave to w. Westover Ave** – UPC 118966; $1.416M
    - Multiuse trail.
    - Construct 10' wide multi-use trail (typical section D in ATP Study) from Dupuy Ave to W. Westover Ave (parallel to Meridian Ave) in Chesterfield County; project sheets 2 & 3 of ATP Trail study; mile marker .85-1.3.
- **Colonial Heights Appomattox River Trail Phase IV, Boulevard to Appomatuck Park** – UPC 115182; $534k
    - Multiuse trail.
    - Construct approximately 1800 LF of 8' wide hard surface trail along the Appomattox River in the City of Colonial Heights from the Boulevard (Route 1) to Appamatuck Park, completing the trail between the City's Roslyn Park (and Southpark Mall) and Appamatuck Park, a distance of nearly 2 miles.
- **Boulevard Sidewalk, Temple Ave to "A" Ave**.– UPC 107534; $35k
    - Sidewalk.
    - (PE/RW) Design of sidewalks on both sides of Boulevard from Temple Avenue to "A" Avenue.

TDM

- **Walthall Park and Ride Lot** (new from I-95 Operations and Enhancement); $7.4M
    - Construct new Park and Ride lot.

After running the test scores for the projects above, the scoring process was used for the FY24-29 STBG process. The next page shows the project scores and results/ recommendations.

APPENDIX A – STBG/RSTP SCORING METHODOLOGY (DRAFT UPDATE 01/29/26)

5/4/2023

Project_ID	Project Title	Project Type	Relative Score S1 *12	Relative Score S2 *12.5	M1 relative score *10	M2 relative Score * 10	EA1 relative score *5	EA2 relative score *5	EA3 relative score *5	EA4 relative score *5	EA5 bonus relative score *5	E1 Active relative score *5	E1 Hwy relative score *10	E2 active relative score *5	ED1 relative score *15	ED2 relative score *5	ED3 relative score *5	Weighted Score	Total Estimated Cost	Normalized Score	Rank	
1	Enon Church Rd (Dodd Park - Riverview Dr) Bike and Ped Improvements	Active Transp	0.16	0.54	1.90	10	1.73	0.44	0.53	0.20	5.00	0.73	0	5.00	15.00	3.2	1.67	45.94	$1,550,000	29.64	2	CMAQ #3
2	River Rd (Brickhouse Dr - library) Trail	Active Transp	0.08	0.17	3.83	0	1.28	1.36	2.44	1.48	5.00	0.83	0	5.00	0.43	0.3	3.33	24.07	$2,210,000	10.89	5	CMAQ #4
3	Route 1 (Whitehouse Rd - Harrowgate Rd) Sidewalk and Ped Crossing	Active Transp	0.22	0.39	0.86	7	1.61	1.09	0.34	0.32	2.50	1.16	0	5.00	0.16	0.2	1.67	21.85	$1,405,000	15.55	3	CMAQ #2
4	Appomattox River Greenway Trail Boulevard Spur	Active Transp	0.05	0.29	1.02	3	2.73	2.80	5.00	3.95	5.00	3.92	0	5.00	0.00	0.3	5.00	34.48	$998,870	34.52	1	SMART SCALE FUNDED
5	Appomattox River Greenway Trail Phase 6	Active Transp	0.14	0.00	3.49	0	1.63	2.80	5.00	3.95	5.00	3.30	0	5.00	0.00	0.3	5.00	31.70	$2,230,279	14.21	4	SMART SCALE FUNDED
6	Lakeview Ave. Modernization Phase II (Brijdan to Lakeview Park Rd)	Highway	0.16	0.50	5.63	0	5.00	5.50	2.51	0.78	5.00		10.00	0.00	4.47	5.0	1.67	45.43	$9,830,617	4.62	11	
7	Lakeview Ave. Modernization Phase II CN Alt termini (Brijdan to Lakeside Dr)	Highway	0.14	0.86	5.63	0	5.00	5.00	2.51	0.78	5.00		10.00	0.00	4.47	5.0	1.67	45.28	$5,413,525	8.36	8	
8	Boulevard Modernization (Temple Ave to Essex Rd) sidewalk	Active Transp	0.68	0.41	10.00	7	0.52	0.41	0.65	0.52	2.50	4.11		5.00	3.87	0.0	3.33	38.17	$3,918,645	9.74	6	**RECOMMEND STBG/RSTP**
9	Route 1 North & I-85 Exit 53B Widening (I-85 to Dinwiddie Ave)	Highway	12.50	12.50	10.00	3	3.30	2.92	3.58	4.03	2.50		10.00	0.00	2.10	3.8	1.67	68.22	$8,898,977	7.67	9	
10	UPC 115407 Route 600 & Route 601 Intersection Roundabout	Highway	9.61	10.80	7.87	10	2.21	1.02	2.82	3.17	0.00		10.00	0.00	0.49	2.8	1.67	59.24	$6,131,000	9.66	7	Fully funded with SMART SCALE
11	Cedar Level Road Southern Segment	Highway	1.51	1.85	4.91	7	4.81	4.29	4.96	5.00	5.00		10.00	0.00	10.75	4.8	1.67	61.25	$11,740,389	5.22	10	

Safety - 25%
Mobility/Congestion - 20%
Equity and Accessibility - 20%
Environment - 10%
Economic Development - 25%

Revision Sheet

a) 1.29.2026
   i) Appendix A – STBG/RSTP Scoring Methodology - Corrections
      (1) Corrected Table 9 (Economic Development Performance Measure Weights), Table 13 (Mobility and Congestion Performance Measure Weights) and Table 18 (Economic Development Performance Measure Weights) to include the correct performance measures.

APPENDIX B: CMAQ EVALUATION AND METHODS

Emissions Reduction Analysis of Eligible Projects

Once the initial screening has been conducted, MPO staff, working with VDOT Environmental staff, will confirm the emissions reduction analysis provided on all eligible projects. The MPO's local governments and agencies will be required to provide assistance with emissions analyses, as needed. Emissions are estimated for volatile organic compounds (VOC) and nitrogen oxides (NO_x). Analysis results are tabulated for the eligible projects.

CMAQ Project Ranking and Selection

Project Ranking

CMAQ projects are ranked based on their cost-effectiveness ratios for VOC and NO_x reduction. Each project is analyzed to estimate the impact of the project on VOC and NO_x emissions. The cost per reduction of emissions is computed using the total cost of each project and annualizing the cost over the effective life of the project.

Once all of the projects are analyzed, they are ranked on the basis of their cost-effectiveness ratios. In the cost-effectiveness analysis, the amount of emissions reduction per dollar spent is computed for VOC and NO_x. A rank is then applied for each of these emission types, with a lower rank number indicating greater cost effectiveness.

Finally, the two ranks are combined and these composite ranks are scored with the lower composite rank number indicating greater cost effectiveness.

Project Selection

The MPO TAC receives a ranked set of eligible CMAQ projects, including a staff recommendation for funding. The TAC reviews the staff recommendation and recommends a list of projects and allocations to the MPO for action. Once approved by the policy board, MPO staff works with VDOT to include each project's allocations in the *Virginia Transportation Six Year Improvement Program*. Selection of projects for inclusion in the MPO's Transportation Improvement Program is based on policies and procedures for programming projects in the TIP (requires consideration of federal funds obligation requirements as set forth by state and federal policies).

CMAQ Analysis Methodologies

Projects proposed for CMAQ funding are analyzed for their effectiveness in reducing emissions of VOCs and NOx. The analysis methodologies for various types of CMAQ projects can be divided into the following primary groups:

- Highway Projects
- Non-Highway Projects
- ITS Projects
- Other Projects

Highway Projects

Eligible highway projects include improvements to traffic signal timing and intersection/interchange geometric design, and upgrades to traffic signal systems. Analysis methodologies vary depending on the type of project being evaluated. A brief description of the analysis methods used for each type of highway project is included below.

Isolated Intersection Analysis

This project type refers to improvements at individual intersections that are not part of a coordinated signal system. The projects may include improvements in the geometric design of the intersection and signal timing or improvements in timing only. The change in emissions for a project is based on the change in delay (in hours per day) at the intersection as a result of the project.

Highway Capacity Software is used to compute the intersection delay for the afternoon peak hour with and without the project. Then, using the total number of vehicles entering the intersection during the afternoon peak hour, and the change in intersection delay resulting from the project, vehicle hours of delay are computed for the afternoon peak hour. That value is then converted to vehicle-hours of delay per day by using a seventeen percent conversion factor derived in the *Cost Benefit Model for Intersection Level of Service Improvements,* a study published by the Hampton Roads Planning District Commission in 1997. The idle emissions factors are applied to the vehicle-hours of delay per day to compute the change in emissions of VOC and NO_x for the intersection in units of kilograms per day.

Coordinated Signal Systems

This type of project includes several intersections along a section of roadway for which the signal timing is coordinated to promote progression of traffic along that segment. Most of the projects in this category consist of improvements to signal timing only. The change in emissions for a project is based on the change in average speed (in miles per hour) along the section of roadway as a result of the project.

The initial average speed along the section of roadway is either submitted with the project proposal or taken from one of the RRPDC Regional Travel Time and Speed studies. For the purposes of the emissions analyses, an increase of four miles per hour in average speed will be assumed to occur as a result of coordinated signal system projects. This figure is derived from a series of before and after studies of coordinated signal system improvements conducted by the Hampton Roads Planning District Commission in the early 1990's.

The emissions factors are determined for the "before" and "after" average speeds along the corridor. These factors are multiplied by the daily vehicle-miles traveled (VMT) for the section of roadway to compute the daily change in emissions of VOC and NO_x for the roadway segment in units of kilograms per day.

Countywide and Citywide Signal System Improvements

This type of project includes signal system improvements to a large number of intersections within a jurisdiction. Nearly all of the intersections included in this type of project are part of a coordinated signal system. The projects in this category include improvements to signal equipment and signal timing. The change in emissions for a project is based on the change in average speed (in miles per hour) for the jurisdictional system.

To analyze these projects, countywide or citywide values for average speed and VMT for principle and minor arterials are obtained from a VDOT Air Quality Conformity Analysis. Using the analysis discussed in the section on analyzing coordinated signal systems, a four mile per hour increase in average speed is assumed to result from the project. If the applicant submits additional before and after data and analyses, staff will use this data in lieu of the average value estimated for this category.

The emissions factors are determined for the before and after average speeds. These factors are multiplied by the countywide or citywide daily VMT to compute the daily change in emissions of VOC and NO_x in units of kilograms per day.

Non-Highway Projects

Transit Projects

Transit projects include replacement buses, and new/expanded transit services or facilities. Emissions benefits for most transit projects are based on the predicted reduction in automobile trips and VMT resulting from the project. Projects that involve new or expanded service also take into account the increase in emissions due to the operation of the new transit vehicles. Park & ride lot projects take into account the emissions due to the automobile trips to the lot. Emissions reductions resulting from replacement buses are due to emissions improvements in the newer bus engines and any increase in ridership due to newer vehicles.

Active Transportation (pedestrian/Bicycle) Projects

Air quality benefits of active transportation are calculated as a function of a reduction in the number of automobile trips and VMT. Analysis methods for active transportation projects are typically project specific and may be qualitative or quantitative depending on the type of project and the availability of input data.

Intelligent Transportation Systems (ITS)

A wide array of highway and transit projects are classified as ITS projects, such as:

- Advanced traffic management systems
- Changeable message signs
- Communications improvements
- Video surveillance infrastructure
- Automatic vehicle location and passenger counting for transit purposes
- Emergency vehicle notification systems
- Automatic road enforcement

These projects take advantage of new technologies aimed at improving traffic flow, reducing response time to traffic incidents, improving safety, and providing timely information to the traveling public. Analysis methods for ITS projects are typically project specific and may be qualitative or quantitative depending on the type of project and the availability of input data.

Other Projects

The *other* project category includes Transportation Demand Management and those projects that do not fit into the Highway or Non-Highway groups. Analysis methods for these projects are typically project specific and may be qualitative or quantitative depending on the type of project and the availability of input data.
