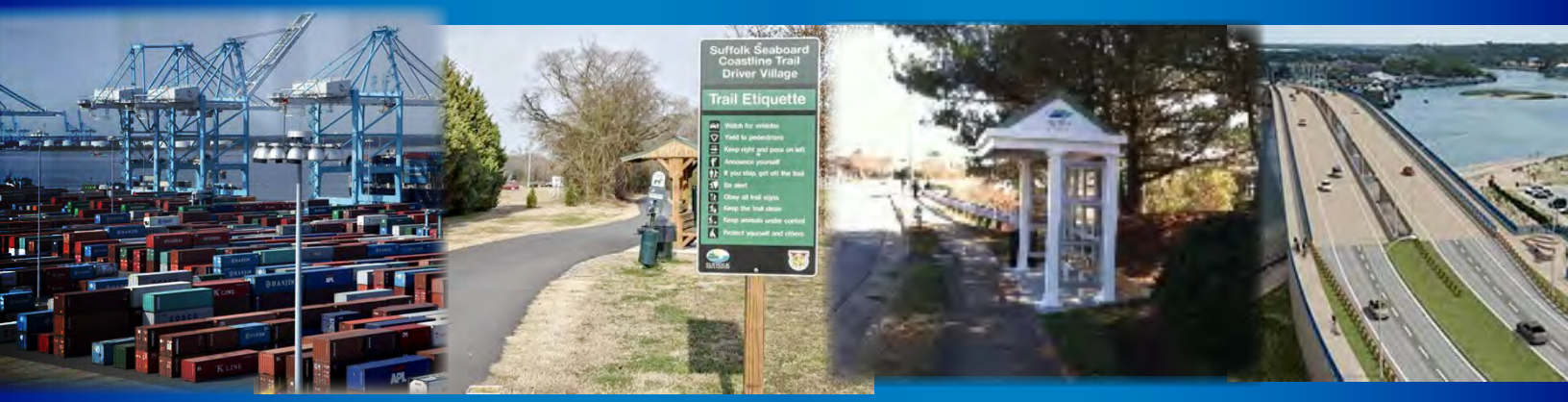
HAMPTON ROADS TRANSPORTATION PLANNING ORGANIZATION



CMAQ/RSTP PROJECT SELECTION PROCESS 2024

HAMPTON ROADS TPO

T25-08

OCTOBER 2025

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ABSTRACT

This report summarizes the 2024 selection process for projects to be funded under the Congestion Mitigation and Air Quality Improvement Program (CMAQ) and Regional Surface Transportation Program (RSTP). Projects selected for funding as part of this process received allocations of CMAQ/RSTP funds for Fiscal Year 2031.

ACKNOWLEDGMENTS

Prepared in cooperation with the U.S. Department of Transportation (USDOT), Federal Highway Administration (FHWA), and Virginia Department of Transportation (VDOT). The contents of this report reflect the views of the Hampton Roads Transportation Planning Organization (HRTPO). The HRTPO is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the FHWA, VDOT or Hampton Roads Planning District Commission. This report does not constitute a standard, specification, or regulation. FHWA or VDOT acceptance of this report as evidence of fulfillment of the objectives of this planning study does not constitute endorsement/approval of the need for any recommended improvements nor does it constitute approval of their location and design or a commitment to fund any such improvements. Additional project level environmental impact assessments and/or studies of alternatives may be necessary.

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HAMPTON ROADS TRANSPORTATION PLANNING ORGANIZATION
CMAQ/RSTP PROJECT SELECTION PROCESS

2024

This report was included in the Unified Planning Work Program for Fiscal Year 2025, which was approved by the Board of the Hampton Roads Transportation Planning Organization on May 16, 2024, and updated on November 21, 2024.

PREPARED BY:

OCTOBER 2025 **T25-08**

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The Background section describes the HRTPO CMAQ/RSTP project selection process and associated public participation activities.

Section III – CMAQ Project Selection
The CMAQ Project Selection section describes the process by which projects were selected to receive allocations of CMAQ funds, including detailed information for each project and a map of project locations (if applicable).

Section IV – RSTP Project Selection
The RSTP Project Selection section describes the process by which projects were selected to receive allocations of RSTP funds, including detailed information for each project and a map of project locations (if applicable).

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Section I
Executive Summary

EXECUTIVE SUMMARY

As the Metropolitan Planning Organization (MPO) for the Hampton Roads area, the Hampton Roads Transportation Planning Organization (HRTPO) is responsible for project selection and allocation of funds under two federal funding programs – the Congestion Mitigation and Air Quality (CMAQ) Improvement Program and the Regional Surface Transportation Program (RSTP). The process used by the HRTPO to select projects to receive funds from these two programs is referred to as the CMAQ/RSTP Project Selection Process. The project selection process is conducted annually, normally beginning in July. The approved funding allocations are for Fiscal Year 2031 and are advanced under the CMAQ and RSTP initiatives. The CMAQ program provides federal funding for projects that improve air quality. RSTP funding is available more generally for a wide variety of transportation project categories.

This report summarizes the work of selecting CMAQ and RSTP projects during the 2024 CMAQ/RSTP Project Selection Process. Selected projects received awards of CMAQ or RSTP funds for Fiscal Year (FY) 2031 (July 2030 – June 2031). The region conducts the CMAQ/RSTP Project Selection Process annually. CMAQ and RSTP project selections and allocations were developed with the assistance of two groups: the Transportation Programming Subcommittee (TPS) and the Transportation Technical Advisory Committee (TTAC). These groups, which include staff member representatives from all HRTPO member jurisdictions and partner agencies, provide recommendations and technical support to the HRTPO Board on matters that concern the transportation planning and programming process. The complete competitive process used to solicit, evaluate, and select projects to receive funds from these two programs has been approved by the HRTPO Board and is documented in the *Guide to the HRTPO CMAQ/RSTP Project Selection Process* (https://www.hrtpo.org/264/Congestion-Mitigation-Air-Quality-Improv).

For FY 2031, it is estimated that approximately $37M in RSTP funding will be available to the region. However, before soliciting any new project requests, the funding requirements of current projects with “Penciled-in” needs in FY 2031 must be reviewed and considered. “Penciled-in” requests are funding requests included in an original CMAQ or RSTP project application for years beyond the first year for which funds were requested.

Since the “penciled-in” amounts for previously approved RSTP projects exceed the anticipated available funding in FY 2031, the Hampton Roads Transportation Planning Organization (HRTPO) Board recommended at its July 18, 2024 meeting not to accept new projects for the 2024 RSTP Project Selection Process. Instead, all available FY 2031 RSTP funding will be directed to previously approved projects.

For the CMAQ selection process, it was determined that approximately $13 million of the $15.4 million total projected to be available in FY 2031 CMAQ funding would remain for distribution after consideration of all “penciled-in” amounts. Consequently, new CMAQ project applications were accepted during this funding cycle. For the 2024 CMAQ Project Selection Process, HRTPO staff received applications for 29 proposed CMAQ projects. HRTPO staff evaluated and scored the proposed projects using the methodologies approved by the TTAC and HRTPO Board as outlined in the Guide to the HRTPO CMAQ and RSTP Project Selection Process in the following link.

https://www.hrtpo.org/DocumentCenter/View/685/Guide-to-the-HRTPO-CMAQ--RSTP-Project-Selection-Process-PDF?bidId=

Based on the funding recommendations developed by TPS and TTAC, the Hampton Roads Transportation Planning Organization (HRTPO), on January 16, 2025, approved $49.7M in funding from the CMAQ and RSTP programs for 31 individual improvement projects all across the region.

For the CMAQ program, new funding recommendations include nine traffic signal system upgrades, two transit bus replacement programs, one intersection improvement, and three pedestrian enhancements and improvements. The largest single award is $6,000,000 to Hampton Roads Transit (HRT) for bus vehicle replacement. The full 2024 CMAQ project selection process is reviewed in detail in Section III.

Laskin Road improvements in Virginia Beach represent the largest RSTP funding allocation at approximately $9.23 million. Reflecting the great flexibility of the RSTP program, the remaining twelve funding allocations are divided between the regional travel demand management program, six highway widening and improvement projects, two traffic signal system improvement programs, one safety enhancement effort, two new pedestrian paths, and implementation support for a new transit service. The full 2024 RSTP project selection process is reviewed in detail in Section IV.

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Section II
Background

INTRODUCTION

The Hampton Roads Transportation Planning Organization (HRTPO) is the Metropolitan Planning Organization (MPO) for the Hampton Roads region of Virginia. As such, it is a federally mandated transportation policy board comprised of representatives from local, state, and federal governments, transit agencies, and other stakeholders, and is responsible for transportation planning and programming for the Hampton Roads Metropolitan Planning Area (MPA). The MPA is comprised of the cities of Chesapeake, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, and Williamsburg; the counties of Isle of Wight, James City, and York; and a portion of the City of Franklin and the Counties of Gloucester and Southampton. Among its functions, the HRTPO since the early 1990's has been responsible for project selection and allocation of funds under two federal programs – the Congestion Mitigation and Air Quality (CMAQ) Improvement Program and the Regional Surface Transportation Program (RSTP). More recently, the HRTPO has also been charged with making project selection and funding allocations decisions for the federal Carbon Reduction Program (CRP), which is managed under a separate process.

The CMAQ Program provides funding to state departments of transportation (DOTs), local governments, and transit agencies for projects and programs that help meet the requirements of the Clean Air Act by reducing mobile source emissions and regional congestion on transportation networks. Eligible CMAQ funded activities include efforts such as transit improvements, travel demand management strategies, congestion relief efforts (such as high occupancy vehicle lanes), diesel retrofit projects, alternative fuel vehicles and infrastructure, and medium- or heavy-duty zero emission vehicles and related charging equipment. This funding is intended for areas designated by the U.S. Environmental Protection Agency (EPA) as nonattainment or maintenance areas with regard to the National Ambient Air Quality Standards (NAAQS).

Transportation Conformity is a critical process mandated by the Clean Air Act to ensure that our regional transportation plans and programs align with federal and state air quality goals. It helps make sure transportation activities do not worsen air quality or delay the attainment of National Ambient Air Quality Standards (NAAQS), which are set by the Environmental Protection Agency (EPA) to protect public health and the environment.

The transportation conformity rule only applies in areas that do not currently meet or have not met the NAAQS in the past. The EPA designates these areas as nonattainment or maintenance areas, respectively. While the Hampton Roads region currently meets all NAAQS, it was previously in maintenance for the 1997 eight-hour ozone NAAQS. Although this standard was revoked by the EPA in 2015, the South Coast Air Quality Management District v. EPA court decision reinstated the requirement for conformity determinations in areas like Hampton Roads, which are now classified as "orphan maintenance areas."

Due to the region's status as an orphan maintenance area, the Hampton Roads region is subject to streamlined transportation conformity requirements for updates and amendments to the Long-Range Transportation Plan (LRTP) and Transportation Improvement Program (TIP). These requirements involve conducting a Regional Conformity Assessment (RCA) that focuses on

consultation, fiscal constraint, and proper documentation to maintain compliance with air quality standards.

The Surface Transportation Program (STP) provides federal funding that may be used by states and localities for a wide range of highway and transit projects. Regional Surface Transportation Program (RSTP) funds are STP funds that are apportioned to specific regions within a state.

This report summarizes the work of selecting CMAQ and RSTP projects during the CMAQ/RSTP Project Selection Process of 2024. Projects selected received allocations of CMAQ or RSTP funds for FY 2031.

ELIGIBLE RECIPIENTS

Eligible recipients of CMAQ and RSTP funds in Hampton Roads include the localities within the MPA, Hampton Roads Transit (HRT), the Williamsburg Area Transit Authority (WATA), Suffolk Transit, state transportation agencies, the Virginia Port Authority, National Park Service, and the HRTPO.

PROJECT SELECTION PROCESS

The process for obtaining CMAQ or RSTP funding for transportation projects is a competitive one. According to the CMAQ/RSTP Project Selection Process that has been approved by the HRTPO Board (https://www.hrtpo.org/DocumentCenter/View/685/Guide-to-the-HRTPO-CMAQ--RSTP-Project-Selection-Process-PDF?bidId=), all project proposals are analyzed by HRTPO staff using a specific set of evaluation criteria. The proposed projects are then ranked based on the results of the analyses. All proposed projects must be consistent with the current HRTPO Long-Range Transportation Plan (LRTP). The LRTP is a fiscal constrained transportation plan for the Hampton Roads MPA with a planning horizon of at least 20 years.

The Transportation Programming Subcommittee (TPS) – taking into account the available funding, policies, and priorities of the HRTPO and Commonwealth Transportation Board (CTB) and using the ranked project lists as a guide – produces a list of recommended projects and funding allocations for consideration by the Transportation Technical Advisory Committee (TTAC) and the HRTPO Board.

The schedule used for the 2024 CMAQ/RSTP project selection process is listed below. Table 1 on the following page details the available funding, current funding allocations, and available totals currently held in reserve for both the CMAQ and RSTP programs under consideration and discussion during the current project selection process.

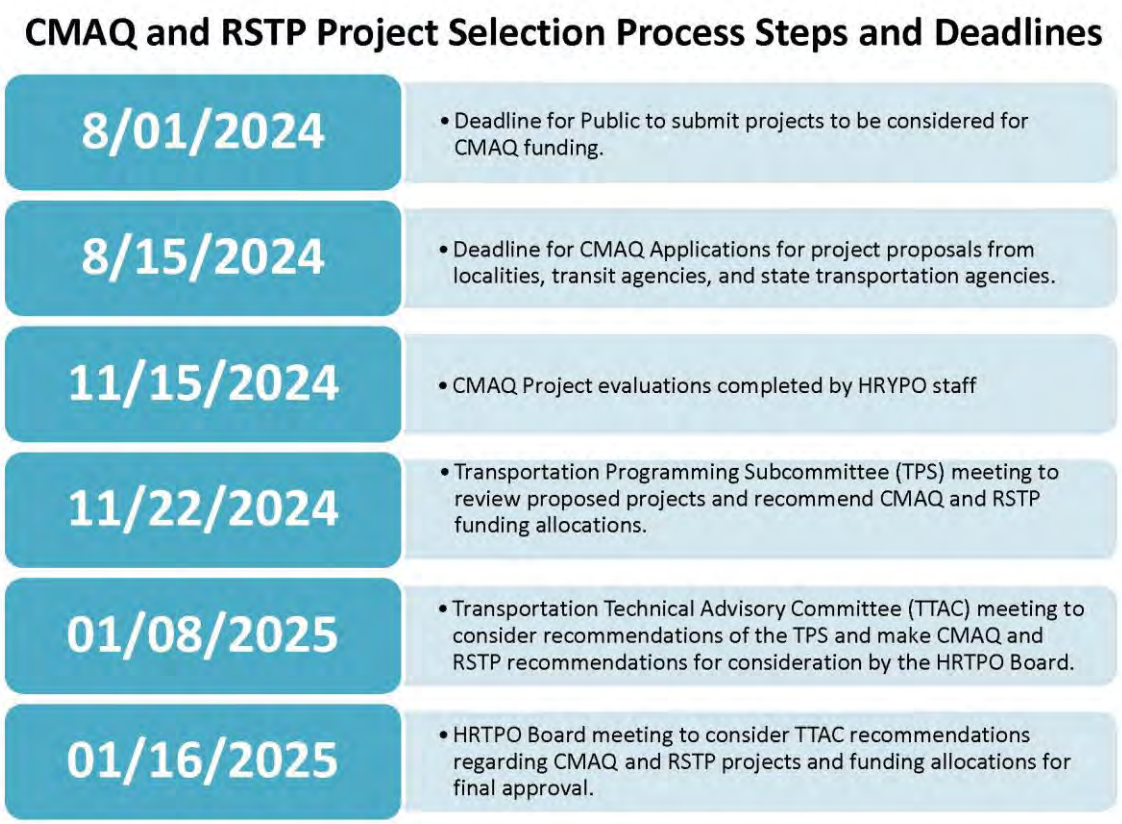


Table 1 | FY 2026-2031 CMAQ and RSTP Funding: Available Funding, Current Allocations, and Reserves

Table 1: FY 2026 - FY 2031 CMAQ and RSTP Funding
Available Funding, Current Allocations, and Reserves

CMAQ	Previous	FY - 26	FY - 27	FY - 28	FY - 29	FY - 30	FY - 31	TOTAL
Marks	$0	$13,855,965	$14,445,885	$14,734,803	$15,029,499	$15,330,089	$15,636,690	
Allocations	$0	$13,855,965	$14,445,885	$14,734,803	$14,981,424	$15,330,089	$14,719,763	
Available	$4,023,682	$0	$0	$0	$48,075	$0	$916,927	$4,988,684

RSTP	Previous	FY - 26	FY - 27	FY - 28	FY - 29	FY - 30	FY - 31	TOTAL
Marks	$0	$36,489,679	$37,947,203	$38,706,146	$39,480,269	$40,269,874	$41,075,271	
Allocations	$0	$36,489,679	$37,947,203	$38,706,146	$37,060,565	$37,078,516	$35,023,932	
Available	$2,794,076	$0	$0	$0	$2,419,704	$3,191,358	$6,051,339	$14,456,477

Franklin and Southampton County Set-aside	$1,878,866

Prepared by VDOT and HRTPO staff (June 20, 2025)

PUBLIC PARTICIPATION

The HRTPO is fully committed to involving and collaborating with the Hampton Roads community in a public involvement process that is grounded in partnership, mutual problem solving, and understanding. In other words, a process whereby the public feels a sense of ownership and satisfaction in knowing their voice has been legitimately heard and their thoughts, ideas, and opinions have the potential to impact future HRTPO decisions. The long term effect that such decisions can have on so many lives makes it critical that the public be provided with ongoing, dynamic opportunities to participate in the planning and programming processes associated with the complex system of roads, mass transit, rail, waterways, pedestrian and bicycle facilities, and related infrastructure that make up the transportation system.

The HRTPO understands “the public” to mean all of those who have the potential to affect or be affected by the Hampton Roads transportation system. From bicyclists to motorists, public transportation users to freight haulers, social to environmental advocates – Hampton Roads residents have a stake in the future of our transportation system. Equally important, the HRTPO recognizes that not all communities and community members have enjoyed the same level of access or representation in transportation and other decisions made by public agencies. Therefore, as part of its public involvement strategy, the HRTPO takes steps to engage with all communities including minorities.

In addition to the invitation for public involvement at the beginning of the process, all formal meetings associated with the CMAQ/RSTP Project Selection Process, including the agendas for meetings of both the Transportation Technical Advisory Committee (TTAC) and HRTPO Board,

included an opportunity for public comment at the start of each session. No public comments regarding the project selection process were received, orally or in writing, during these meetings.

A public notice soliciting CMAQ and RSTP project ideas from the public was posted to the HRTPO website in July 2024. In addition, a CMAQ/RSTP Project Idea Form was provided for use by the public with a submission deadline of August 1, 2024. Project ideas submitted by the public are reviewed by HRTPO staff and then forwarded to the appropriate locality or agency for consideration. No project ideas were received from the public for this cycle.

Section III

CMAQ Project Selection

CMAQ PROJECT SELECTION

In Hampton Roads, projects are selected for funding with CMAQ Improvement Program funds based on the amount of air quality improvement expected per dollar spent. This is analyzed in terms of a reduction in the emissions of Volatile Organic Compounds (VOCs) and Nitrogen Oxides (NOx), which are precursors of ozone depletion. The air quality aspect of the CMAQ analysis allows all types of CMAQ projects to be compared against one another. Details on the policies, procedures, and analysis methodologies used for CMAQ project selection are included in the ***Guide to the HRTPO CMAQ and RSTP Project Selection Process***, which may be accessed on the HRTPO website at https://www.hrtpo.org/DocumentCenter/View/685/Guide-to-the-HRTPO-CMAQ--RSTP-Project-Selection-Process-PDF?bidId=.

To help ensure that all of the necessary information is included with each project proposal, and to provide consistency in the way that project information is submitted, the HRTPO staff developed application forms to be utilized for the submission of CMAQ project proposals. The ***Candidate Project Application Forms*** for the various CMAQ project categories may be accessed on the HRTPO website at https://www.hrtpo.org/264/Congestion-Mitigation-Air-Quality-Improv.

The total CMAQ funding expected to be available for FY 2031, including the 20 percent state match, is approximately $15.4 million. Prior to considering new projects to receive CMAQ allocations, the status of previously approved projects is reviewed to determine whether additional funding is required to allow for the completion of a project or project phase. The review of previously approved projects also includes determining whether those projects are progressing on schedule or whether funds should be:

1. Readjusted to better correspond with any updated implementation schedules, or
2. Reallocated to other projects.

During the 2024 Project Selection Process, four requests were made for additional funding for currently approved “penciled in” CMAQ projects with funding needs in FY 2031. In addition, 29 CMAQ applications for new funding were received, reviewed, and scored. Table 2 lists all new projects proposed for CMAQ funding during the 2024 project selection process. As shown in the table, the 29 candidate projects had a total funding request of approximately $163 million. The total CMAQ funding requested in FY 2031 was $38.6 million.

Table 3 shows the scoring and ranking of the 29 new candidate projects (existing projects are not rescored). As shown in the table, each project was scored and ranked based on its cost-effectiveness in reducing VOC and NOx emissions. The ranks for VOC and NOx reduction were summed to produce the composite ranking. The detailed evaluation and scoring worksheets for each of the CMAQ candidate projects are included in Appendix A.

Table 2 | 2024 New CMAQ Project Applications

Number	Code	Applicant	Project Name	Total Cost	Total CMAQ Request	Total FY-31 Request
1	CH1CM	Chesapeake	Citywide Signal Retiming -- Phases 1-5	$ 750,000	$ 750,000	$ 150,000
2	CH2CM	Chesapeake	Cedar Rd/S Battlefield Blvd Turn Lane	$ 3,600,000	$ 3,600,000	$ 250,000
3	CH3CM	Chesapeake	Cedar Road Sidewalk -- Cedar Lakes to Bartell E	$ 1,200,000	$ 1,200,000	$ 110,000
4	GC1CM	Gloucester County	Providence Road and Route 17 Turn Lane	$ 5,775,254	$ 5,775,254	$ 1,000,000
5	GC2CM	Gloucester County	Greate Road Siedwalk	$ 5,246,185	$ 5,246,185	$ 1,000,000
6	HA1CM	Hampton	Traffic Signal Systems Retiming	$ 1,500,000	$ 1,500,000	$ 1,500,000
7	HR1CM	Hampton Roads Transit	Bus Vehicle Replacement	$ 58,466,000	$ 36,654,500	$ 11,940,500
8	IW1CM	Isle of Wight County	Red Oaks Shared Use Path	$ 2,017,000	$ 2,017,000	$ 2,017,000
9	JC1CM	James City County	Ironbound Road Sidewalk	$ 2,788,459	$ 2,788,459	$ 269,448
10	JC2CM	James City County	Richmond Road Sidewalk Infill Segment 1	$ 1,356,365	$ 1,356,365	$ 240,509
11	JC3CM	James City County	Matoaka Elementary School Sidewalk Improvements	$ 2,618,878	$ 2,618,878	$ 265,980
12	JC4CM	James City County	Transit Stop Improvements	$ 1,250,000	$ 1,250,000	$ 250,000
13	NN1CM	Newport News	Citywide ITS Upgrades	$ 1,500,000	$ 1,500,000	$ 500,000
14	NN2CM	Newport News	Citywide Signal Retiming	$ 1,500,000	$ 1,500,000	$ 500,000
15	NN3CM	Newport News	Warwick Boulevard/Main Street Intersection Improvements	$ 1,100,000	$ 1,100,000	$ 190,000
16	NO1CM	Norfolk	Advanced Traffic Management System (ATMS) Phase 5	$ 5,406,600	$ 5,406,600	$ 163,800
17	NO2CM	Norfolk	Citywide Signal Retiming Phase VI	$ 1,413,620	$ 1,413,620	$ 1,060,300
18	NO3CM	Norfolk	Citywide Signal System Upgrades	$ 7,424,060	$ 7,424,060	$ 374,400
19	NO4CM	Norfolk	Traffic Signal Detection Upgrades	$ 3,430,900	$ 3,430,900	$ 99,000
20	NO5CM	Norfolk	Elizabeth River Trail - Eastern Extension Comprehensive Study	$ 1,000,000	$ 1,000,000	$ 500,000
21	NO6CM / UPC 113201	Norfolk	East Little Creek Road/Shore Drive Intersection Improvements	$ 3,320,450	$ 3,320,450	$ 255,680
22	NO7CM	Norfolk	Norview Avenue/Azalea Garden Road Intersection Improvements	$ 3,018,450	$ 3,018,450	$ 174,400
23	NO8CM	Norfolk	Traffic Management Center (TMC) Upgrade	$ 642,090	$ 642,090	$ 44,900
24	SU1CM	Suffolk	South Quay Road at O'Kelly Drive Turn Lane	$ 2,815,000	$ 2,815,000	$ 400,000
25	SU2CM	Suffolk	Plummer Boulevard Extension	$ 8,550,000	$ 8,550,000	$ 850,000
26	VB1CM	Virginia Beach	Citywide Traffic Signal Retiming	$ 1,232,000	$ 1,232,000	$ 616,000
27	VB2CM	Virginia Beach	Pacific Avenue Turn Lane Improvements at 17th Street and 22nd Street	$ 32,864,643	$ 29,864,643	$ 7,900,338
28	VP1CM / UPC 103928	Virginia Port Authority	Green Operator Program	$ 12,000,000	$ 12,000,000	$ 3,000,000
29	WA1CM	WATA	Bus Vehicle Replacement	$ 13,909,079	$ 13,909,079	$ 2,962,820
TOTAL				**$ 187,695,033**	**$ 162,883,533**	**$ 38,585,075**

Table 3 | 2024 New CMAQ Project Applications Scoring and Ranking Summary

Jurisdiction	Project Description	Rank	Cost-Effectiveness		Score		
Previously Approved Projects			VOC	NOx	VOC	NOx	Composite[1]
Chesapeake	**Citywide Traffic Signal System Upgrade**						
Portsmouth	**Citywide Traffic Signal System Upgrades**						
Virginia Port Authority	**Green Operator Program**						
Norfolk	**26th Street/Lafayette Blvd Lane Repurposing**						
Total							
New Candidate Projects							
Norfolk	**Traffic Management Center (TMC) Upgrade**	**1**	$10,764	$11,483	1	1	2
Norfolk	**Citywide Signal Retiming Phase VI**	**2**	$54,624	$58,272	2	4	6
Hampton Roads Transit	**Bus Vehicle Replacement**	**3**	$95,149	$46,181	5	2	7
Virginia Beach	**Citywide Traffic Signal Retiming**	**4**	$59,743	$63,733	3	5	8
Chesapeake	**Citywide Signal Retiming -- Phases 1-5**	**5**	$326,830	$56,123	7	3	10
Norfolk	**Advanced Traffic Management System (ATMS) Phase 5**	**6**	$90,640	$96,693	4	8	12
Newport News	**Citywide ITS Upgrades**	**7**	$554,607	$95,236	8	6	14
Newport News	**Citywide Signal Retiming**	**T8**	$554,607	$95,236	9	7	16
Norfolk	**Citywide Signal System Upgrades**	**T8**	$293,194	$312,774	6	10	16
Hampton	**Traffic Signal Systems Retiming**	**10**	$792,539	$136,093	11	9	20
Norfolk	**Traffic Signal Detection Upgrades**	**11**	$568,650	$606,625	10	12	22
WATA	**Bus Vehicle Replacement**	**12**	$943,026	$457,703	12	11	23
Newport News	**Warwick Boulevard/Main Street Intersection Improvements**	**13**	$4,325,473	$742,761	13	13	26
James City County	**Richmond Road Sidewalk Infill Segment 1**	**14**	$6,729,496	$4,953,737	14	14	28
Chesapeake	**Cedar Road Sidewalk -- Cedar Lakes to Bartell E**	**15**	$8,100,941	$5,963,290	15	15	30
Virginia Port Authority	**Green Operator Program**	**16**	$8,214,609	$8,763,187	16	16	32
James City County	**Matoaka Elementary School Sidewalk Improvements**	**17**	$16,886,491	$12,430,536	17	18	35
Chesapeake	**Cedar Rd/S Battlefield Blvd Turn Lane**	**18**	$53,231,425	$9,140,784	20	17	37
Isle of Wight County	**Red Oaks Shared Use Path**	**18**	$19,094,167	$14,055,657	18	19	37
Norfolk	**Norview Avenue/Azalea Garden Road Intersection Improvements**	**T20**	$131,160,502	$22,522,596	21	20	41
Gloucester County	**Greate Road Siedwalk**	**T20**	$43,207,353	$31,805,930	19	22	41
Norfolk	**East Little Creek Road/Shore Drive Intersection Improvements**	**22**	$132,491,820	$22,751,207	22	21	43
Gloucester County	**Providence Road and Route 17 Turn Lane**	**23**	$300,159,971	$51,542,817	23	23	46
Suffolk	**South Quay Road at O'Kelly Drive Turn Lane**	**24**	$940,006,749	$161,415,913	25	24	49
James City County	**Transit Stop Improvements**	**25**	$554,416,758	$298,605,979	24	26	50
Virginia Beach	**Pacific Avenue Turn Lane Improvements at 17th Street and 22nd Street**	**26**	$1,541,508,359	$264,704,461	26	25	51
Norfolk	**Elizabeth River Trail - Eastern Extension Comprehensive Study**	**T27**	*No Ranking*	*No Ranking*	27	27	54
James City County	**Ironbound Road Sidewalk**	**T27**	*No Reduction*	*No Reduction*	27	27	54
Suffolk	**Plummer Boulevard Extension**	**29**	*Ineligible*	*Ineligible*	29	29	58

[1]The Composite Score is computed as follows:
First, projects are evaluated for their estimated impacts on the reduction of VOC's and NOx.
Second, projects are sorted in ascending order based on the Cost/Benefit for VOC reduction and numbered sequentially. Lower numbers are better.
Third, projects are sorted in ascending order based on the Cost/Benefit for NOx reduction and numbered sequentially. Lower numbers are better.
Finally, the sequential numbers for VOC reduction and NOx reduction are added together to produce the Composite Score. Lower numbers are better.
The Cost-Effectiveness figures represent $/ton of pollutants (NOx, VOC) removed based on the annualized cost of the project.

*prepared by HRTPO Staff November 11, 2024
(1) Listed Previously Approved Projects need additional FY 2031 funding (2) T designates Tied Scores

The TPS subsequently met on November 22, 2024 and, using the project scores as a guide, decided funding allocation recommendations for both existing and new CMAQ projects in FY 2031. The Transportation Technical Advisory Committee (TTAC) endorsed these recommended allocations before being advanced to the HRTPO Board for final approval.

APPROVED CMAQ PROJECT SELECTION AND FUNDING ALLOCATIONS

During the January 16, 2025 meeting, the HRTPO Board approved the following actions regarding CMAQ funding for FY 2031:

- Four current CMAQ projects were selected to receive a total of $2.4 million in FY 2031 funding.
- Fifteen new CMAQ projects were selected to receive a total of $12.3 million in FY 2031 funding.
- A reserve balance of $642,142 in FY 2031 funding was retained.

The approved CMAQ projects are listed in Table 4 on the following page and summarized individually below. Map 1 on Page 21 displays the geographic location of the FY 2031 CMAQ allocations where feasible.

Table 4 | FY-2031 Allocations to Previously Approved and New CMAQ Projects

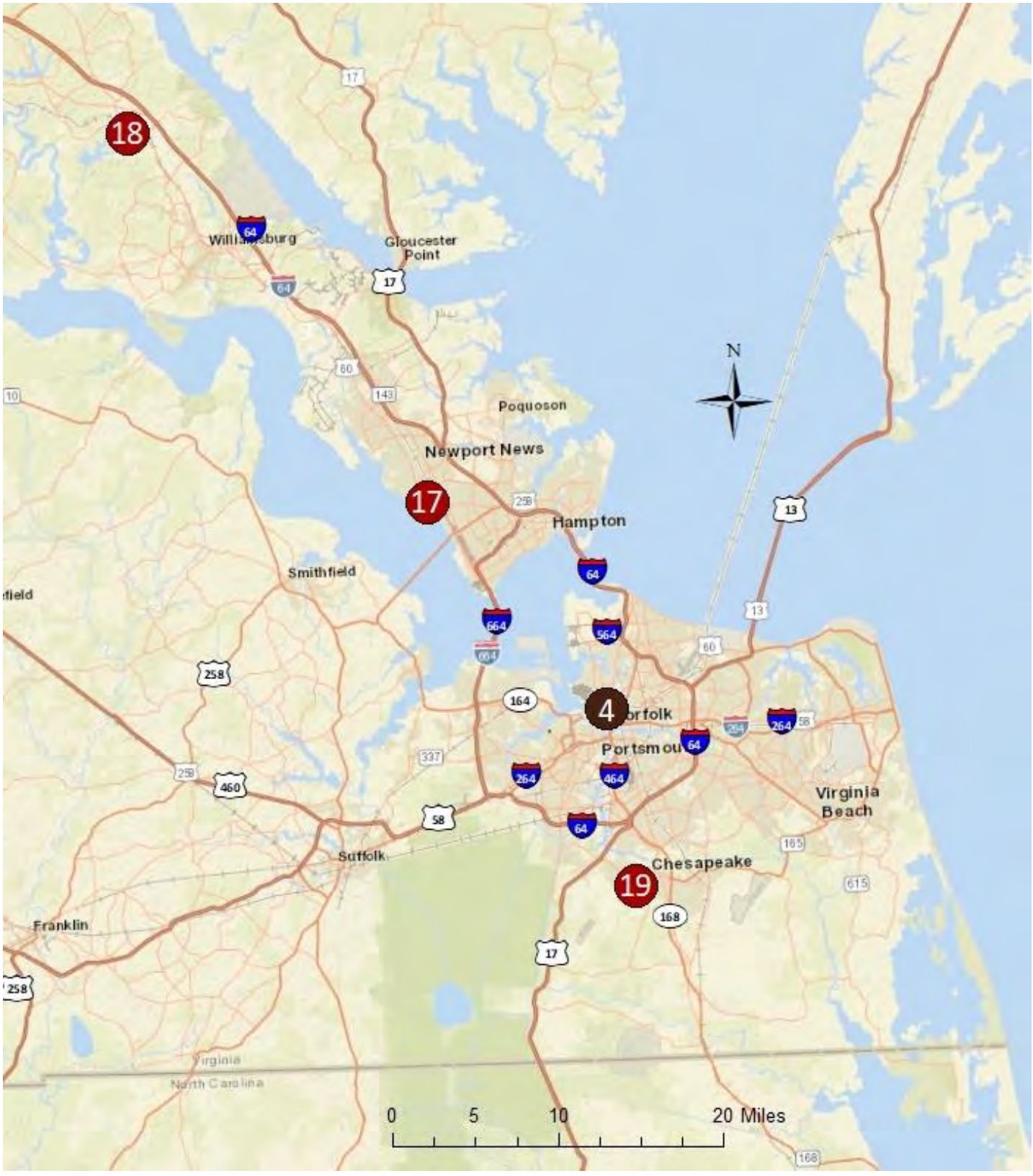
#	UPC/ ID#	Jurisdiction	Project Description	Proposed Allocations FY - 31	Additional Funding Required
Previously Approved Projects					
1	110801	*Chesapeake*	Chesapeake Signal System Upgrade with Feasibility Study - Developing enhancements to the Citywide traffic signal system in Chesapeake to maintain internal City operations as well as regional data sharing opportunities.	* $250,000	
2	119268	*Portsmouth*	Citywide Traffic Signal System Upgrades - Constructing of central traffic signal control system upgrades, Intelligent Transportation System (ITS) elements, and local intersection operations/equipment upgrades.	* $225,000	
3	103928	*Virginia Port Authority*	Green Operator Program - Supporting the Port's dray truck replacement program and also Transportation Demand Management efforts to incentivize the modal shift to move cargo from a single truck to a barge or train.	* $1,000,000	
4	123639	*Norfolk*	26th Street/Lafayette Blvd Lane Repurposing - Repurposing the existing outside lanes along the corridors to create a safe cycling option along a heavily traveled routes connecting Lafayette neighborhoods to Tidewater Drive, thereby creating shorter pedestrian crossing distances and improve safety for the residents in this area, increasing bike and pedestrian safety by eliminating left-turns shared within a thru-lane.	* $895,854	
New Projects					
5	NO8CM	*Norfolk*	Traffic Management Center (TMC) Upgrade - Upgrading the existing TMC video management equipment used to remotely monitor and respond to events on Norfolk's roadway network and across the Hampton Roads Region.	$44,900	$597,190
6	NO2CM	*Norfolk*	Citywide Signal Retiming Phase VI - Updating and creating new coordinated timing plans and other timing parameters for traffic signals operating across ten major travel corridors in the City of Norfolk.	$1,060,300	$353,320
7	HR1CM	*Hampton Roads Transit*	Bus Vehicle Replacement - Supporting the purchase of new vehicles meeting updated emissions standards for use across all six cities in the HRT service area, replacing less efficient equipment at the end of its service life.	$6,000,000	$30,654,500
8	VB1CM	*Virginia Beach*	Citywide Traffic Signal Retiming - Updating timing operations 88 signalized intersections throughout the City of Virginia Beach along six major road corridors.	$616,000	$616,000
9	CH1CM	*Chesapeake*	Citywide Signal Retiming -- Phases 1-5 - Employing a systematic approach to developing new signal timings for strategic corridors and isolated intersections in the over a five-year period.	$150,000	$600,000
10	NO1CM	*Norfolk*	Advanced Traffic Management System (ATMS) Phase 5 - Upgrading the existing ethernet equipment being used for the Norfolk's traffic signal communications system including the evaluation of the existing ethernet equipment, development of minimum or no-plans packages, removal of existing equipment, installation of the new equipment, and completion of network integration and troubleshooting.	$163,800	$5,242,800

Table 4 (Continued)| FY-2031 Allocations to Previously Approved and New CMAQ Projects

#	UPC/ ID#	Jurisdiction	Project Description	Proposed Allocations FY - 31	Additional Funding Required
New Projects					
11	NN1CM	*Newport News*	Citywide ITS Upgrades - upgrading various traffic signal system components throughout the 280 locations within the Newport News' traffic signal system, including signal system servers, system software, network switches, individual controllers, vehicle and bicycle/pedestrian detection systems, signal communication hardware, advanced video components, and uninterruptible power supply.	$500,000	$1,000,000
12	NN2CM	*Newport News*	Citywide Signal Retiming - Implementing the optimization of traffic signals throughout the City of Newport News with the intent on reducing travel times, delays, stops and fuel use.	$500,000	$1,000,000
13	NO3CM	*Norfolk*	Citywide Signal System Upgrades - Evaluating the existing fiber communications Norfolk's traffic signal system network performance and susceptibility to network connectivity failure, identifying high risk locations and strategies for mitigating risk of network failure, and implementing measures that maximize performance and build redundancy.	$374,400	$7,049,660
14	HA1CM	*Hampton*	Traffic Signal Systems Retiming - Collecting vehicular data and optimizing all 186 traffic signals citywide.	* $1,500,000	
15	NO4CM	*Norfolk*	Traffic Signal Detection Upgrades - Upgrading vehicle detection infrastructure at 36 intersections to improve detection and system performance.	$99,000	$3,331,900
16	WA1CM	*WATA*	Bus Vehicle Replacement - Replacing heavy duty transit vehicles that we be at the end of useful life.	$800,000	$13,109,079
17	NN3CM	*Newport News*	Warwick Boulevard/Main Street Intersection Improvements - upgrading traffic signals to support protected-permissive left turns along all approaches of the Warwick Boulevard / Main street intersection, together with installation of high visibility crosswalks and enhanced pedestrian safety features.	$190,000	$910,000
18	JC2CM	*James City County*	Richmond Road Sidewalk Infill Segment 1 -Installing five foot sidewalks along Richmond Road within the existing gap between Bush Springs Road and 7607 Richmond Road, a distance of approximately 1,453 feet.	$240,509	$1,115,856
19	CH3CM	*Chesapeake*	Cedar Road Sidewalk -- Cedar Lakes to Bartell East - constructing a sidewalk along the south side of Cedar Road between Cedar Lakes Drive and Bartell Drive East.	$110,000	$1,090,000
			FY-31 Mark	$15,361,905	
			Total FY-31 Allocations	$14,719,763	
			Total Left in Reserve/Balance Entry	$642,142	

*** Project is fully funded with the proposed FY 2031 allocation.**

Map 1 | Projects Selected for FY 2031 CMAQ Allocations (See next page for legend)



Projects Selected for CMAQ Allocations

Mapped Projects

- 4 26th Street/Lafayette Boulevard Lane Repurposing - Norfolk
- 17 Warwick Boulevard/Main Street Intersection Improvements - Newport News
- 18 Richmond Road Sidewalk Infill Segment 1 - James City County
- 19 Cedar Road Sidewalk - Cedar Lakes to Bartell East - Chesapeake

Unmapped Projects

- 1 Citywide Traffic Signal System Upgrade - Chesapeake
- 2 Citywide Traffic Signal System Upgrades - Portsmouth
- 3 Green Operator Program - Virginia Port Authority
- 5 Traffic Management Center (TMC) - Norfolk
- 6 Citywide Signal Retiming Phase VI - Norfolk
- 7 Bus Vehicle Replacement - HRT
- 8 Citywide Traffic Signal Retiming - Virginia Beach
- 9 Citywide Signal Retiming Phases 1-5 - Chesapeake
- 10 Advanced Traffic Management System (ATMS) Phase 5 - Norfolk
- 11 Citywide ITS Upgrades - Newport News
- 12 Citywide Signal Retiming - Newport News
- 13 Citywide Signal Systems Upgrades - Norfolk
- 14 Traffic Signal Systems Retiming - Hampton
- 15 Traffic Signal Detection Upgrades - Norfolk
- 16 Bus Vehicle Replacement - WATA

Project Selection Status

- Previously Approved CMAQ Projects
- New CMAQ Projects

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Section IV
RSTP Project Selection

RSTP PROJECT SELECTION

Details on the policies, procedures, and analysis methodologies used for RSTP project selection are included in the ***Guide to the HRTPO CMAQ and RSTP Project Selection Process***, which may be accessed on the HRTPO website at https://www.hrtpo.org/DocumentCenter/View/685/Guide-to-the-HRTPO-CMAQ--RSTP-Project-Selection-Process-PDF?bidId=.

To ensure that all of the necessary information is included with each project proposal, and to provide uniformity to the way that project information is submitted, HRTPO staff developed application forms to be utilized for the submission of RSTP project proposals. The ***RSTP Candidate Project Application Forms*** may be accessed on the HRTPO website at https://www.hrtpo.org/264/Congestion-Mitigation-Air-Quality-Improv.

In an effort to continually improve the quantitative nature of the HRTPO CMAQ and RSTP Project Selection Process, the Transportation Technical Advisory Committee (TTAC) recommended during the meeting of March 2, 2016 that the HRTPO Project Prioritization Tool (https://www.hrtpo.org/260/Project-Prioritization) be used to evaluate highway-type RSTP projects. Since the HRTPO Prioritization Tool at that time was not capable of evaluating most non-highway type projects, TTAC recommended that the HRTPO staff continue to use the previous RSTP methodologies to evaluate these projects. The HRTPO Board approved this change to the Project Selection Process on March 17, 2016. Subsequently, the HRTPO Project Prioritization Tool has been further enhanced to evaluate all types of RSTP project applications.

The total RSTP funding expected to be available for FY 2031, including the 20 percent state match, is approximately $37.1 million. Consistent with the CMAQ project selection process, prior to considering new projects to receive RSTP allocations, the status of current projects is reviewed to determine whether additional funding is needed for the completion of a project or project phase. The review of previously approved projects also includes determining whether those projects are progressing on schedule or whether funds should be:

1. Reallocated to correspond with updated phase schedules, or
2. Reallocated to other projects.

“Penciled-in” requests are funding requests included in the original RSTP project application for years beyond the first year for which funds were requested. The HRTPO staff review of previously approved RSTP projects showed that the “penciled-in” requests for these projects exceeded the expected RSTP funding available in FY 2031. Therefore, the Hampton Roads Transportation Planning Organization (HRTPO) Board recommended at its July 18, 2024, meeting not to accept new projects for the 2024 RSTP Project Selection Process and allocate all available FY 2031 RSTP funding to previously approved projects.

The TPS met on November 22, 2024 and made funding allocation recommendations for previously approved RSTP projects in FY 2031. Subsequently, the Transportation Technical Advisory Committee (TTAC) endorsed these funding allocation recommendations before being advanced to the HRTPO Board for final approval.

RSTP Project Selection and Funding Allocations

During the January 16, 2025 meeting, the HRTPO Board approved the following actions regarding RSTP funding for FY 2031:

- Twelve previously approved RSTP projects were selected to receive a total of $35 million in FY 2031 funding.
- A reserve balance of $2,054,581 in FY 2031 funding was retained.

The approved RSTP projects are listed and summarized in Table 5 below. Map 2 on Page 30 displays the geographic location of the FY 2031 RSTP allocations where feasible.

Table 5 | FY 2031 Allocations to Previously Approved RSTP Projects

#	UPC #	Jurisdiction/ Agency	Project Name and Description	Proposed Allocations FY - 31	Additional Funding Required
Previously Approved Projects					
1	T14104	*HRT*	goCommute Program - Annual funding for the regional Transportation Demand Management (TDM) program.	$1,000,000	$1,000,000 (1)
2	119275	*Virginia Beach*	Laskin Rd Phase III - Widening between Phillip Avenue to Republic Road from 4 lanes to 6 lanes, removal of service/ feeder roads, addition of pedestrian signals and crossings at all signalized intersections, addition of directional median at Phillip Avenue and Laskin Road intersection, and addition of sidewalks and multi-use path.	* $9,675,125	
3	123588	*Norfolk*	Citywide Fiber Upgrades - Evaluating the existing fiber communications network performance and susceptibility to network connectivity failure, identifying high risk locations and strategies for mitigating risk of network failure, and implementing measures that maximize performance and build redundancy into the existing communications network.	$1,707,100	$2,276,030
4	123765	*Suffolk*	Citywide Traffic Signal System Timing - Developing and implementing signal timing plans for coordinated traffic signal systems throughout the City of Suffolk.	* $95,000	
5	123636	*Chesapeake*	Military Hwy Near Bainbridge Blvd Safety Improvement - Implementing a system of strategies targeted to improve vehicle safety to reduce the number and severity of crashes at this interchange, including construction of a Restricted Crossing U-Turn (RCUT) at a median opening east of interchange, adding a new left turn lane, and installation of improved advance street name/guidance signs, railroad crossing activated flashing beacon warnings, and Intelligent Transportation System Dynamic Message Signage.	$117,000	$1,651,188

Table 5 (Continued) | FY 2031 Allocations to Previously Approved RSTP Projects

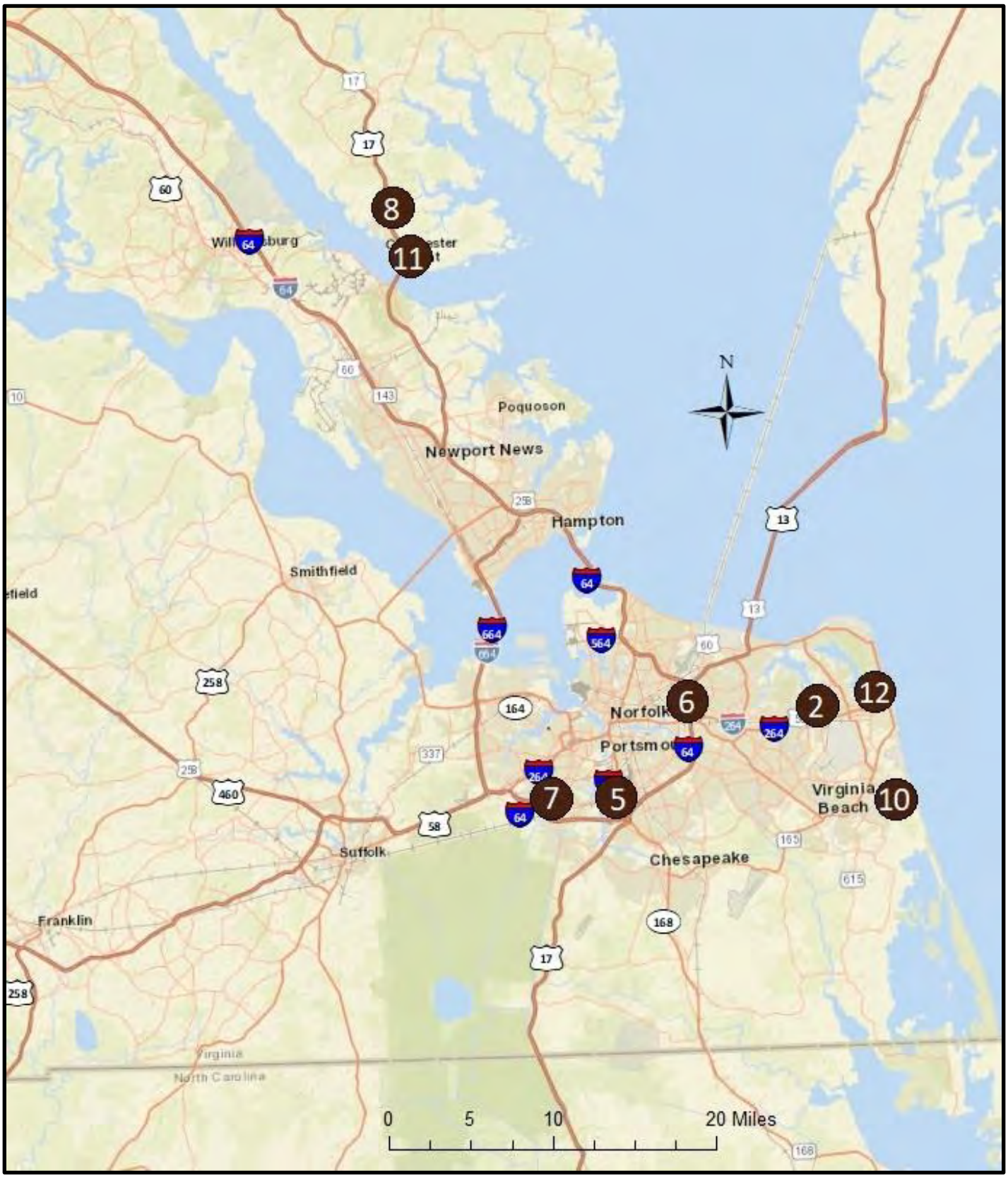
#	UPC #	Jurisdiction/ Agency	Project Name and Description	Proposed Allocations FY - 31	Additional Funding Required
Previously Approved Projects					
6	123635	*Norfolk*	Military Highway at Poplar Hall Shared Use Path - Constructing a 12-foot wide asphalt shared use path along the west side of Military Highway from the existing sidewalk terminus of the Curlew Drive overpass over I-264 to Poplar Hall Drive, constructing a 8-foot wide concrete sidewalk along the south side of Poplar Hall drive from the new shared use path to the existing shared use path terminus in the median of Poplar Hall Drive, and other related safety enhancements in the area.	$2,066,975	$4,770,123
7	123587	*Chesapeake*	Rt 17/460 Intersection Improvement - Addressing the safety issues at the signalized intersection of Military Highway and George Washington Highway by partially displacing the left turns from east bound and west bound Military Highway to reduce left-turning crossing distances.	$1,380,686	$9,814,153
8	110627	*Gloucester County*	George Washington Memorial Highway (Route 17) Widening Phase 1 - Widening from a 4-lane principal arterial to a 6-lane principle arterial and to provide safe passage for pedestrians. The phase will begin at the intersection of Farmwood Road, where a previous widening project ended, and continue to approximately 1000 feet north of the intersection with Hook Road/Guinea Road. The total length of this phase is 1.4 miles of the overall 10.4 miles for the entire project.	* $4,122,551	
9	T19477	*HRT*	Pennisula BRT - Identifying and comparing the benefits, costs, and impacts of potential new fixed guideway transit alternatives. The intent of the analysis is to identify potential impacts to the social, economic and natural environment for each alternative and the relative cost to mitigate these impacts. The conceptual engineering effort will define key connection points, right of way requirements, and station locations.	$4,000,000	$4,000,000
10	115543	*Virginia Beach*	Nimmo Parkway -- Phase VIIB - Constructing a new two lane undivided roadway with shoulders, on road bike lanes, and a single shared use path on the north side from Albuquerque Drive to Sandbridge Road, a distance of approximately 1.7 miles. This project will include a bridge spanning Hell's Point Creek and the adjacent flood plain and wetlands area.	* $2,759,495	
11	110627	*Gloucester County*	Rt. 17 Gloucester Point Shared Use Path - Constructing a buffered 10 foot wide shared use path along the eastside of Route 17 from Farmwood Road to Guinea Road.	$4,050,000	$6,967,546
12	123585	*Virginia Beach*	Laskin Road Phase I-B - Eliminating the unsafe and confusing bi-directional frontage roads on both sides of Laskin Road from Red Robin Road to Oriole Drive by widening the 4-lane plus frontage road facility to a traditional 6-lane divided facility with a raised median and accommodations for bicycles, sidewalks, and a shared-use path.	$4,050,000	$28,626,075
			FY-31 Mark	**$37,078,513**	
			Total FY-31 Allocations	**$35,023,932**	
			Total Left in Reserve/Balance Entry	**$2,054,581**	

*** Project is fully funded with the proposed FY 2031 allocation.**

(1) Annual requirement

All of the projects identified for CMAQ and RSTP funding will be reflected in all official State and regional programming documents including the Six Year Improvement Program (SYIP) and Transportation Improvement Program (TIP). Any changes in project schedules, costs, or other aspects of the selected projects will be monitored and managed according to HRTPO procedures.

Map 2 | Projects Selected for FY 2031 RSTP Allocations (See next page for legend)



Projects Selected for RSTP Allocations

Mapped Projects

2. Laskin Road Phase III - Virginia Beach
5. Military Hwy Near Bainbridge Blvd Safety Improvement - Chesapeake
6. Military Highway at Poplar Hall Drive Shared Use Path - Norfolk
7. Rt 17/460 Intersection Improvement - Chesapeake
8. George Washington Memorial Highway (Route 17) Widening Phase 1 - Gloucester County
10. Nimmo Parkway Phase VIIB - Virginia Beach
11. Rt 17 Gloucester Point Shared Use Path - Gloucester County
12. Laskin Road Phase I-B - Virginia Beach

Unmapped Projects

1. goCommute Transportation Demand Management Program - HRT
3. Citywide Fiber Upgrades - Norfolk
4. Citywide Traffic Signal System Timing - Suffolk
9. Peninsula BRT - HRT

Project Selection Status

- Previously Approved RSTP Projects
- New RSTP Projects

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Section V
Appendix

CONGESTION MITIGATION AND AIR QUALITY

SIGNAL RETIMING

DATE: 7/26/2024
APPLICANT: Chesapeake
PROJECT NAME: Chesapeake Citywide Signal Retiming: Phases 1-5
LOCATION: Citywide
DESCRIPTION: Citywide optimization of signal timings through 5 phases

Key: cell with formula (method of calculation)

1 - COST: $750,000

2 - EMISSIONS REDUCTION

		Low Volume Intersections	Medium Volume Intersections	High Volume Intersections	Total # of Intersections	
	pm peak hr range:	Less than 3,000 vph	3,000 to 6,000 vph	More than 6,000 vph		
Number of Intersections:		125	63	6	194	
multiplied by	pm peak hour volume:	2,000	4,500	10,000		vph [1]
multiplied by	delay savings:	14	14	14		sec/veh [2]
divided by	conversion factor:	3,600	3,600	3,600		sec/hr
divided by	delay K factor:	0.17	0.17	0.17		delay K factor [3]
multiplied by	weekday equivalents:	300	300	300		days/year (say)
multiplied by	useful life:	5	5	5		years [5]
Change in Vehicle Delay:		8,578,431	9,727,941	2,058,824		hours

Total Change in Vehicle Delay (sum of the columns above): 20,365,196 hours

Type of Emissions	Delay Reduction, hr (above)	Emissions Factor, Heavy Duty Vehs, g/hr[4]	Heavy Duty (HD), % [6]	Emissions Reduction, Heavy Duty Vehs, kg (product/ 1,000)	Light Duty, % (1-HD%)	Emissions Factor, Light Duty Vehs, g/hr[4]	Emissions Reduction, Light Duty Vehs, kg (product/ 1,000)	Emissions Reduction, All Vehs, kg (sum)
VOC	20,365,196	2.042	3.2%	1,331	97%	0.038072	751	2,081
NOx	20,365,196	16.204	3.2%	10,560	97%	0.079186	1,561	12,121

3 - COST EFFECTIVENESS

Type	Cost, $ (above)	Emissions Reduction, kg (above)	Cost Effectiveness, $/kg (quotient)	Conversion Factor, kg/ton	Cost Effectiveness, $/ton (product)
VOC	$750,000	2,081	$360	907	**$326,830**
NOx	$750,000	12,121	$62	907	**$56,123**

Notes:

[1] Based on range

[2] Pre-project delay 55 seconds * 25% full delay savings = 14 seconds.
(55 seconds: average control delay for LOS D/E, HCM 2000, Table 5)
(25% savings: avg. of 6 studies in *The benefits of retiming traffic signals* [Srinivasa Sunkari, ITE journal, Apr. 2004, p. 26];
article documented 7 studies, but one study's results were outlying)

[3] Portion of daily delay represented by peak hour; assumed not to change significantly over the decades.
Assume pm peak hour is the peak hour of the day.
Source: "Cost Benefit Model for Intersection Level of Service Improvements" (HRPDC, June 1997), pg. 8.

[4] CMAQ Emission Reduction Toolkit (NCHRP, 25-25, Task 108) "IntImproveData" sheet filtered:
year 2030 (estimated project year factor used throughout useful life)
speed 0 mph (idling)
road type: 5 (urban street)

[5] Based on recommendation of retiming signals every three to five years (*Traffic Signal Timing Manual*, FHWA, June 2008, section 7.1.2), assume useful life of 5 years.

[6] Trucks, Non-freeways in Hampton Roads, CMP 2017-2019 network (3.2%)

CONGESTION MITIGATION AND AIR QUALITY
ISOLATED INTERSECTON IMPROVEMENT

APPLICANT: Chesapeake (e.g. locality)
PROJECT NAME: **Cedar Road/ S Battlefield Boulevard Turn Lane**
LOCATION: Intersection of S. Battlefield Boulevard and Cedar Road
DATE: 7/26/2024 (application date)
DESCRIPTION: Provide for an exlusive southbound right turn lane from S. Battlefield Boulevard onto Cedar Road

Key: cell with formula (method of calculation)

1 - COST $3,600,000 (1)

2 - EMISSIONS REDUCTION

Weekday Peak Hour

Intersection Delay Before Project	46.9	sec/veh (1)
Intersection Delay After Project	34.4	sec/veh (1)
Reduction in Intersection Delay (diff.)	12.50	sec/veh, pk hr
multiplied by	3,265	veh/pkhr (1)
divided by	3,600	sec/hr
divided by	17%	pk hr delay factor (2)
multiplied by	300	wkday equivalents / year (say)
multiplied by	30	useful life, years (4)
Reduction in Intersection Delay	600,184	hours

Type of Emissions	Delay Reduction, hr (above)	Emissions Factor, Heavy Duty Vehs, g/hr(3)	Trucks, % (5)	Emissions Reduction, Heavy Duty Vehs, kg (product/ 1,000)	Autos, % (1-truck%)	Emissions Factor, Light Duty Vehs, g/hr(3)	Emissions Reduction, Light Duty Vehs, kg (product/ 1,000)	Emissions Reduction, All Vehs, kg (sum)
VOC	600,184	2.042	3.2%	39	96.8%	0.03807	22	61
NOx	600,184	16.204	3.2%	311	96.8%	0.07919	46	357

3 - COST EFFECTIVENESS

Type of Emissions	Cost, $ (above)	Emissions Reduction, kg (above)	Cost Effective-ness, $/kg (quotient)	Conversion Factor, kg/ton (fixed)	Cost Effective-ness, $/ton (product)
VOC	$3,600,000	61	$58,690	907	**$53,231,425**
NOx	$3,600,000	357	$10,078	907	**$9,140,784**

Notes:
(1) From application
(2) pk hr delay factor = pk hr delay / daily delay; assumed not to change signficantly over the decades
Source: "Cost Benefit Model for Intersection Level of Service Improvements", HRPDC, Page 8, June 1997.
(3) CMAQ Emission Reduction Toolkit (NCHRP, 25-25, Task 108)- assumptions:
year 2030 (estimated project year factor used throughout useful life)
speed 0 mph (idling)
road type: urban (5)
(4) standard for civil projects
(5) Non-freeways in Hampton Roads, CMP 2017-2019 network (3.2%)

CONGESTION MITIGATION AND AIR QUALITY

PEDESTRIAN IMPROVEMENTS

APPLICANT: Chesapeake (locality/agency)

PROJECT NAME: **Cedar Road Sidewalk - Cedar Lakes to Bartell East**

LOCATION: Along south side of Cedar Road between Cedar Lakes Drive and Bartell Dr East

DESCRIPTION: Provide new sidewalk facility with directional curb ramps and high visibility crosswalks

DATE: 8/9/2024 (application date)

Key: cell w/formula (method of calculation is shown in parentheses)

1- PROJECT DATA [5] Cost: $1,200,000

2- VMT REDUCTION ESTIMATE

ID, adjacent [9] blockgroups	Existing walk commuters [2]
CT 210.05, BG 1	16
CT 210.10, BG 2	0
CT 210.10, BG 3	45
total	61

Walk commuters "without" pedestrian improvement (above)	61	
Increase due to pedestrian improvement [3]	**40%**	
New active transportation commuters (product)	24	
Factor for roundtrips	2	
Auto trip reduction [4] (product)	49	per day
Average length of auto trip replaced (one-way)	5	mi.[7]
VMT reduction (product)	244	mi./day

3- EMISSIONS CALCULATION Emissions year [8] 2030

	Auto Starts			Auto Running			Total
Type	Auto Starts Reduction, /day (above)	Emissions Factor, g/start [6]	Emissions Reduction-Starts, g/day (product)	VMT Reduction, mi/day (above)	Emissions Factor, g/mi [6]	Emissions Reduction-Running, g/day (product)	Emissions Reduction-Running, g/day (sum)
VOC	49	0.325933	15.9	244	0.008267	2.0	17.9
NOx	49	0.255832	12.5	244	0.048618	11.9	24.3

4- COST PER TON Analysis years: 30 [1]

Type	Emissions Reduction-Running, g/day (above)	Conversion Factor, kg/g	Workdays per year (say)	Analysis Years (above)	Conversion Factor, ton/kg	Emissions Reduction (ER), ton (product)	Cost per Ton ($ [above] / ER [left])
VOC	17.9	0.001	250	30	0.001102	0.148	**$8,100,941**
NOx	24.3	0.001	250	30	0.001102	0.201	**$5,963,290**

Notes:

[1] Standard for civil projects.

[2] Table: B08301 File: CMAQ scoring tech update- post-6-17-22 TPS work area.pptx

[3] Source: TPS (see "alt commute % increase" tab in this workbook)

[4] Assume that these simplifications offset each other: a) only examining commuting (e.g. ignoring shopping), and b) using a one-to-one relationship between new alt mode trips and eliminated auto trips.

[5] From application

[6] Source: NCHRP project 2525 task 108 toolkit (Excel) "BikePedData" tab

[7] Source: 6-17-22 TPS meeting (note: avg. alt mode trips are shorter than 5 mi; avg. auto trips are longer than 5 mi)

[8] Approximate project implementation year. Given the difficulty of forecasting vehicle regulations and mix, use implementation-year emissions factors throughout the useful life of the project (as recommended by 2019 NCHRP CMAQ emission reduction toolkit).

[9] "adjacent": ie beside (not at the end of)

CONGESTION MITIGATION AND AIR QUALITY
ISOLATED INTERSECTON IMPROVEMENT

APPLICANT: Gloucester (e.g. locality)
PROJECT NAME: **Providence Road and Rte. 17 (Turn Lane)**
LOCATION: Intersection of Rte. 17 and Providence Road
DATE: 8/15/2024 (application date)
DESCRIPTION: Provide for a left turn lane on Providence Road to Route 17 North

Key: cell with formula (method of calculation)

1 - COST $5,775,254 (1)

2 - EMISSIONS REDUCTION

Weekday Peak Hour		
Intersection Delay Before Project	22.3	sec/veh (1)
Intersection Delay After Project	18.2	sec/veh (1)
Reduction in Intersection Delay (diff.)	4.10	sec/veh, pk hr
multiplied by	2,832	veh/pkhr (1)
divided by	3,600	sec/hr
divided by	17%	pk hr delay factor (2)
multiplied by	300	wkday equivalents / year (say)
multiplied by	30	useful life, years (4)
Reduction in Intersection Delay	170,753	hours

Type of Emissions	Delay Reduction, hr (above)	Emissions Factor, Heavy Duty Vehs, g/hr(3)	Trucks, % (5)	Emissions Reduction, Heavy Duty Vehs, kg (product/ 1,000)	Autos, % (1-truck%)	Emissions Factor, Light Duty Vehs, g/hr(3)	Emissions Reduction, Light Duty Vehs, kg (product/ 1,000)	Emissions Reduction, All Vehs, kg (sum)
VOC	170,753	2.042	3.2%	11	96.8%	0.03807	6	17
NOx	170,753	16.204	3.2%	89	96.8%	0.07919	13	102

3 - COST EFFECTIVENESS

Type of Emissions	Cost, $ (above)	Emissions Reduction, kg (above)	Cost Effective-ness, $/kg (quotient)	Conversion Factor, kg/ton (fixed)	Cost Effective-ness, $/ton (product)
VOC	$5,775,254	17	$330,937	907	**$300,159,971**
NOx	$5,775,254	102	$56,828	907	**$51,542,817**

Notes:
(1) From application
(2) pk hr delay factor = pk hr delay / daily delay; assumed not to change signficantly over the decades
Source: "Cost Benefit Model for Intersection Level of Service Improvements", HRPDC, Page 8, June 1997.
(3) CMAQ Emission Reduction Toolkit (NCHRP, 25-25, Task 108)- assumptions:
year 2030 (estimated project year factor used throughout useful life)
speed 0 mph (idling)
road type: urban (5)
(4) standard for civil projects
(5) Non-freeways in Hampton Roads, CMP 2017-2019 network (3.2%)

CONGESTION MITIGATION AND AIR QUALITY

PEDESTRIAN IMPROVEMENTS

APPLICANT: Gloucester (locality/agency)

PROJECT NAME: **Greate Road Sidewalk**

LOCATION: Along east side of Greate Raod from Lafayette Heights to the end of Greate Road

DESCRIPTION: A buffered 6' wide sidewalk

DATE: 8/15/2024 (application date)

Key: cell w/formula (method of calculation is shown in parentheses)

1- PROJECT DATA [5] Cost: $5,246,185

2- VMT REDUCTION ESTIMATE

ID, adjacent [9] blockgroups	Existing walk commuters [2]
CT 1003.01, BG 1	0
CT 1003.01, BG 2	50
total	50

Walk commuters "without" pedestrian improvement (above)	50	
Increase due to pedestrian improvement [3]	**40%**	
New active transportation commuters (product)	20	
Factor for roundtrips	2	
Auto trip reduction [4] (product)	40	per day
Average length of auto trip replaced (one-way)	5	mi.[7]
VMT reduction (product)	200	mi./day

3- EMISSIONS CALCULATION Emissions year [8] 2030

	Auto Starts			Auto Running			Total
Type	Auto Starts Reduction, /day (above)	Emissions Factor, g/start [6]	Emissions Reduction-Starts, g/day (product)	VMT Reduction, mi/day (above)	Emissions Factor, g/mi [6]	Emissions Reduction-Running, g/day (product)	Emissions Reduction-Running, g/day (sum)
VOC	40	0.325933	13.0	200	0.008267	1.7	14.7
NOx	40	0.255832	10.2	200	0.048618	9.7	20.0

4- COST PER TON Analysis years: 30 [1]

Type	Emissions Reduction-Running, g/day (above)	Conversion Factor, kg/g	Workdays per year (say)	Analysis Years (above)	Conversion Factor, ton/kg	Emissions Reduction (ER), ton (product)	Cost per Ton ($ [above] / ER [left])
VOC	14.7	0.001	250	30	0.001102	0.121	**$43,207,353**
NOx	20.0	0.001	250	30	0.001102	0.165	**$31,805,930**

Notes:

[1] Standard for civil projects.

[2] Table: B08301 File: CMAQ scoring tech update- post-6-17-22 TPS work area.pptx

[3] Source: TPS (see "alt commute % increase" tab in this workbook)

[4] Assume that these simplifications offset each other: a) only examining commuting (e.g. ignoring shopping), and b) using a one-to-one relationship between new alt mode trips and eliminated auto trips.

[5] From application

[6] Source: NCHRP project 2525 task 108 toolkit (Excel) "BikePedData" tab

[7] Source: 6-17-22 TPS meeting (note: avg. alt mode trips are shorter than 5 mi; avg. auto trips are longer than 5 mi)

[8] Approximate project implementation year. Given the difficulty of forecasting vehicle regulations and mix, use implementation-year emissions factors throughout the useful life of the project (as recommended by 2019 NCHRP CMAQ emission reduction toolkit).

[9] "adjacent": ie beside (not at the end of)

CONGESTION MITIGATION AND AIR QUALITY

SIGNAL RETIMING

DATE: 8/15/2024 (application date)
APPLICANT: Hampton (e.g. locality)
PROJECT NAME: **Traffic Signal Systems Retiming**
LOCATION: Citywide
DESCRIPTION: Optimize all traffic signals citywide and collect vehicular data.

Key: cell with formula (method of calculation)

1 - COST: $1,500,000

2 - EMISSIONS REDUCTION

		Low Volume Intersections	Medium Volume Intersections	High Volume Intersections	Total # of Intersections	
	pm peak hr range:	Less than 3,000 vph	3,000 to 6,000 vph	More than 6,000 vph		
	Number of Intersections:	150	31	5	186	
multiplied by	pm peak hour volume:	2,000	4,500	10,000		vph [1]
multiplied by	delay savings:	14	14	14		sec/veh [2]
divided by	conversion factor:	3,600	3,600	3,600		sec/hr
divided by	delay K factor:	0.17	0.17	0.17		delay K factor [3]
multiplied by	weekday equivalents:	300	300	300		days/year (say)
multiplied by	useful life:	5	5	5		years [5]
	Change in Vehicle Delay:	10,294,118	4,786,765	1,715,686		hours

Total Change in Vehicle Delay (sum of the columns above): 16,796,569 hours

Type of Emissions	Delay Reduction, hr (above)	Emissions Factor, Heavy Duty Vehs, g/hr[4]	Heavy Duty (HD), % [6]	Emissions Reduction, Heavy Duty Vehs, kg (product/ 1,000)	Light Duty, % (1-HD%)	Emissions Factor, Light Duty Vehs, g/hr[4]	Emissions Reduction, Light Duty Vehs, kg (product/ 1,000)	Emissions Reduction, All Vehs, kg (sum)
VOC	16,796,569	2.042	3.2%	1,098	97%	0.038072	619	1,717
NOx	16,796,569	16.204	3.2%	8,709	97%	0.079186	1,287	9,997

3 - COST EFFECTIVENESS

Type	Cost, $ (above)	Emissions Reduction, kg (above)	Cost Effectiveness, $/kg (quotient)	Conversion Factor, kg/ton	Cost Effectiveness, $/ton (product)
VOC	$1,500,000	1,717	$874	907	**$792,539**
NOx	$1,500,000	9,997	$150	907	**$136,093**

Notes:

[1] Based on range

[2] Pre-project delay 55 seconds * 25% full delay savings = 14 seconds.
(55 seconds: average control delay for LOS D/E, HCM 2000, Table 5)
(25% savings: avg. of 6 studies in *The benefits of retiming traffic signals* [Srinivasa Sunkari, ITE journal, Apr. 2004, p. 26]; article documented 7 studies, but one study's results were outlying)

[3] Portion of daily delay represented by peak hour; assumed not to change significantly over the decades.
Assume pm peak hour is the peak hour of the day.
Source: "Cost Benefit Model for Intersection Level of Service Improvements" (HRPDC, June 1997), pg. 8.

[4] CMAQ Emission Reduction Toolkit (NCHRP, 25-25, Task 108) "IntImproveData" sheet filtered:
year 2030 (estimated project year factor used throughout useful life)
speed 0 mph (idling)
road type: 5 (urban street)

[5] Based on recommendation of retiming signals every three to five years (*Traffic Signal Timing Manual* , FHWA, June 2008, section 7.1.2), assume useful life of 5 years.

[6] Trucks, Non-freeways in Hampton Roads, CMP 2017-2019 network (3.2%)

CONGESTION MITIGATION AND AIR QUALITY

BUS[4] REPLACEMENT

APPLICANT: HRT (locality/agency)
PROJECT NAME: **Bus Vehicle Replacement**
DESCRIPTION: 29, 35, and 40 foot buses
DATE: 8/28/2024 (application date)

Key: cell with formula (method of calculation)

	Existing Buses	Proposed Buses	
Model Year [1]	Varies	2031-2035	
Fuel Type [1]	Diesel	Diesel	
Number of Buses (# to be purchased = # to be retired)		103	buses[1]
Annual Vehicle-Miles per bus (old&new buses)		41,667	VMT/year[1]
Expected Years of Service per new bus		15	years[3]

1 - COST $36,654,500 [1]

2 - EMISSIONS REDUCTION

Type	Emissions Factor for Existing Buses, g/mi [2]	Emissions Factor for Proposed Buses, g/mi [2]	Emissions Factor Reduction, g/mi (difference)	Buses (above)	Annual VMT per bus (above)	Expected Years of Service per new bus (above)	Emissions Reduction, kg (product/ 1,000)
VOC	6.08270	0.65506	5.42764	103	41,667	15	349,407
NOx	12.11861	0.93580	11.18281	103	41,667	15	719,899

3 - COST EFFECTIVENESS

Type	Cost (above)	Emissions Reduction, kg (above)	Cost Effectiveness, $/kg (quotient)	Conversion Factor, kg/ton (fixed)	Cost Effectiveness, $/ton (product)
VOC	$36,654,500	349,407	$104.90	907	**$95,149**
NOx	$36,654,500	719,899	$50.92	907	**$46,181**

[1] From application

[2] NCHRP project 2525 task 108 toolkit (Excel, "NewTransitBusData" tab), based on these inputs:
model year (modelyearid) and fuel type (fueltypeid: gas[1], diesel[2], CNG[3], EV[9]) based on application;
analysis year (yearID=2030); road type (roadtypeid=5 [urban unrestricted access])
[The emissions factors on the prototype sheet (6.08, 0.655, 12.11, 0.93) came from the old (2020) calculation sheet.]

[3] Average retirement age of a 12-year bus is 15.1 years (Laver, et al. Useful Life of Transit Buses and Vans. FTA, 2007)

CONGESTION MITIGATION AND AIR QUALITY

MULTI-USE PATH

APPLICANT: Isle of Wight (locality/agency)
PROJECT NAME: **Red Oaks Shared Use Path**
LOCATION: Along Route 10 between the intersections of Tuner Drive and Red Oaks Drive

DESCRIPTION: ten-foot wide shared use path with two-foot wide shoulders
DATE: 8/15/2024 (application date)

Key: cell w/formula (method of calculation is shown in parentheses)

1- PROJECT DATA [5] Cost: $2,017,000

2- VMT REDUCTION ESTIMATE

Blockgroups *adjacent to* [9] project	Existing bicycle commuters [2]	Existing walk commuters [2]	Total existing alternative mode commuters (sum)
BG 1 CT 2801.05	0	0	0
BG 2 CT 2801.05	0	0	0
BG 3 CT 2801.05	0	0	0
BG 1 CT 2801.06	0	26	26
BG 2 CT 2801.06	0	3	3
BG 1 CT 2801.07	0	0	0
BG 2 CT 2801.07	0	0	0
total	0	29	29

Alternative mode commuters "without" proposed improvement (above) 29
Increase due to proposed improvement [3] **60%**
New alternative mode commuters (product) 17

Factor for roundtrips 2
Auto trip reduction [4] (product) 35 per day

Average length of auto trip replaced (one-way) 5 mi.[7]
VMT reduction (product) 174 mi./day

3- EMISSIONS CALCULATION Emissions year [8] 2030

	Auto Starts			Auto Running			Total
Type	Auto Starts Reduction, /day (above)	Emissions Factor, g/start [6]	Emissions Reduction-Starts, g/day (product)	VMT Reduction, mi/day (above)	Emissions Factor, g/mi [6]	Emissions Reduction-Running, g/day (product)	Emissions Reduction-Running, g/day (sum)
VOC	35	0.325933	11	174	0.008267	1	13
NOx	35	0.255832	9	174	0.048618	8	17

4- COST PER TON Analysis years: 30 [1]

Type	Emissions Reduction-Running, g/day (above)	Conversion Factor, kg/g	Workdays per year (say)	Analysis Years (above)	Conversion Factor, ton/kg	Emissions Reduction (ER), ton (product)	Cost per Ton ($ [above] / ER [left])
VOC	13	0.001	250	30	0.001102	0.106	**$19,094,167**
NOx	17	0.001	250	30	0.001102	0.144	**$14,055,657**

Notes:
[1] Standard for civil projects.
[2] Table: B08301 File: ACSDT5Y2015.B08301_data_with_overlays_2022-07-13T153102.xlsx
[3] Source: TPS (see "alt commute % increase" tab in this workbook)
[4] Assume that these simplifications offset each other: a) only examining commuting (e.g. ignoring shopping), and b) using a one-to-one relationship between new alt mode trips and eliminated auto trips.
[5] From application
[6] Source: NCHRP project 2525 task 108 toolkit (Excel) "BikePedData" tab, for given emissions year
[7] Source: 6-17-22 TPS meeting (note: avg. alt mode trips are shorter than 5 mi; avg. auto trips are longer than 5 mi)
[8] Approximate project implementation year. Given the difficulty of forecasting vehicle regulations and mix, use implementation-year emissions factors throughout the useful life of the project (as recommended by 2019 NCHRP CMAQ emission reduction toolkit).
[9] "adjacent to": ie beside (not at the end of)

CONGESTION MITIGATION AND AIR QUALITY

PEDESTRIAN IMPROVEMENTS

APPLICANT: James City (locality/agency)
PROJECT NAME: **Ironbound Road Sidewalk**
LOCATION: along Ironbound Road from John Tyler Highway to 3686 Ironbound Road

DESCRIPTION: project will connect existing sidewalk to to John Tyler Highway intersection with 5' sidewalk
DATE: 8/5/2024 (application date)

Key: cell w/formula (method of calculation is shown in parentheses)

1- PROJECT DATA [5] Cost: $2,788,459

2- VMT REDUCTION ESTIMATE

ID, adjacent [9] blockgroups	Existing walk commuters [2]
CT 802.02, BG 1	0
CT 802.02, BG 2	0
CT 802.02, BG 3	0
CT 803.07, BG 1	0
CT 803.07, BG 2	0
CT 803.07, BG 3	0
total	0

Walk commuters "without" pedestrian improvement (above) 0
Increase due to pedestrian improvement [3] **40%**
New active transportation commuters (product) 0

Factor for roundtrips 2
Auto trip reduction [4] (product) 0 per day

Average length of auto trip replaced (one-way) 5 mi.[7]
VMT reduction (product) 0 mi./day

3- EMISSIONS CALCULATION Emissions year [8] 2030

	Auto Starts			Auto Running			Total
Type	Auto Starts Reduction, /day (above)	Emissions Factor, g/start [6]	Emissions Reduction-Starts, g/day (product)	VMT Reduction, mi/day (above)	Emissions Factor, g/mi [6]	Emissions Reduction-Running, g/day (product)	Emissions Reduction-Running, g/day (sum)
VOC	0	0.325933	0.0	0	0.008267	0.0	0.0
NOx	0	0.255832	0.0	0	0.048618	0.0	0.0

4- COST PER TON Analysis years: 30 [1]

Type	Emissions Reduction-Running, g/day (above)	Conversion Factor, kg/g	Workdays per year (say)	Analysis Years (above)	Conversion Factor, ton/kg	Emissions Reduction (ER), ton (product)	Cost per Ton ($ [above] / ER [left])
VOC	0.0	0.001	250	30	0.001102	0.000	**#DIV/0!**
NOx	0.0	0.001	250	30	0.001102	0.000	**#DIV/0!**

Notes:
[1] Standard for civil projects.
[2] Table: B08301 File: CMAQ scoring tech update- post-6-17-22 TPS work area.pptx
[3] Source: TPS (see "alt commute % increase" tab in this workbook)
[4] Assume that these simplifications offset each other: a) only examining commuting (e.g. ignoring shopping), and b) using a one-to-one relationship between new alt mode trips and eliminated auto trips.
[5] From application
[6] Source: NCHRP project 2525 task 108 toolkit (Excel) "BikePedData" tab
[7] Source: 6-17-22 TPS meeting (note: avg. alt mode trips are shorter than 5 mi; avg. auto trips are longer than 5 mi)
[8] Approximate project implementation year. Given the difficulty of forecasting vehicle regulations and mix, use implementation-year emissions factors throughout the useful life of the project (as recommended by 2019 NCHRP CMAQ emission reduction toolkit).
[9] "adjacent": ie beside (not at the end of)

CONGESTION MITIGATION AND AIR QUALITY

PEDESTRIAN IMPROVEMENTS

APPLICANT: James City (locality/agency)

PROJECT NAME: **Richmond Road Sidewalk Infill Segment 1**

LOCATION: Along richmond Road from Bush Springs Road to 7691 Richmond Road

DESCRIPTION: Provide a 5' sidewalk to filll existing gap

DATE: 8/5/2024 (application date)

Key: cell w/formula (method of calculation is shown in parentheses)

1- PROJECT DATA [5] Cost: $1,356,365

2- VMT REDUCTION ESTIMATE

ID, adjacent [9] blockgroups	Existing walk commuters [2]
CT 802.04, BG 1	0
CT 802.04, BG 2	0
CT 802.04, BG 3	68
CT 802.04, BG 4	15
total	83

Walk commuters "without" pedestrian improvement (above)	83	
Increase due to pedestrian improvement [3]	**40%**	
New active transportation commuters (product)	33	
Factor for roundtrips	2	
Auto trip reduction [4] (product)	66	per day
Average length of auto trip replaced (one-way)	5	mi.[7]
VMT reduction (product)	332	mi./day

3- EMISSIONS CALCULATION Emissions year [8] 2030

	Auto Starts			Auto Running			Total
Type	Auto Starts Reduction, /day (above)	Emissions Factor, g/start [6]	Emissions Reduction-Starts, g/day (product)	VMT Reduction, mi/day (above)	Emissions Factor, g/mi [6]	Emissions Reduction-Running, g/day (product)	Emissions Reduction-Running, g/day (sum)
VOC	66	0.325933	21.6	332	0.008267	2.7	24.4
NOx	66	0.255832	17.0	332	0.048618	16.1	33.1

4- COST PER TON Analysis years: 30 [1]

Type	Emissions Reduction-Running, g/day (above)	Conversion Factor, kg/g	Workdays per year (say)	Analysis Years (above)	Conversion Factor, ton/kg	Emissions Reduction (ER), ton (product)	Cost per Ton ($ [above] / ER [left])
VOC	24.4	0.001	250	30	0.001102	0.202	**$6,729,496**
NOx	33.1	0.001	250	30	0.001102	0.274	**$4,953,737**

Notes:

[1] Standard for civil projects.

[2] Table: B08301 File: CMAQ scoring tech update- post-6-17-22 TPS work area.pptx

[3] Source: TPS (see "alt commute % increase" tab in this workbook)

[4] Assume that these simplifications offset each other: a) only examining commuting (e.g. ignoring shopping), and b) using a one-to-one relationship between new alt mode trips and eliminated auto trips.

[5] From application

[6] Source: NCHRP project 2525 task 108 toolkit (Excel) "BikePedData" tab

[7] Source: 6-17-22 TPS meeting (note: avg. alt mode trips are shorter than 5 mi; avg. auto trips are longer than 5 mi)

[8] Approximate project implementation year. Given the difficulty of forecasting vehicle regulations and mix, use implementation-year emissions factors throughout the useful life of the project (as recommended by 2019 NCHRP CMAQ emission reduction toolkit).

[9] "adjacent": ie beside (not at the end of)

CONGESTION MITIGATION AND AIR QUALITY

PEDESTRIAN IMPROVEMENTS

APPLICANT: James City (locality/agency)
PROJECT NAME: **Matoaka Elementary School Sidewalk Improvements**
LOCATION: From Matoaka Elementary School to Centerville Road

DESCRIPTION: Provide a 5' sidewalk to connect Elementary School to Centerville Road
DATE: 8/5/2024 (application date)

Key: cell w/formula (method of calculation is shown in parentheses)

1- PROJECT DATA [5] Cost: $2,788,459

2- VMT REDUCTION ESTIMATE

ID, adjacent [9] blockgroups	Existing walk commuters [2]
CT 803.04, BG 1	68
CT 803.04, BG 2	0
CT 803.04, BG 3	0
total	68

Walk commuters "without" pedestrian improvement (above)	68	
Increase due to pedestrian improvement [3]	**40%**	
New active transportation commuters (product)	27	
Factor for roundtrips	2	
Auto trip reduction [4] (product)	54	per day
Average length of auto trip replaced (one-way)	5	mi.[7]
VMT reduction (product)	272	mi./day

3- EMISSIONS CALCULATION Emissions year [8] 2030

	Auto Starts			Auto Running			Total
Type	Auto Starts Reduction, /day (above)	Emissions Factor, g/start [6]	Emissions Reduction-Starts, g/day (product)	VMT Reduction, mi/day (above)	Emissions Factor, g/mi [6]	Emissions Reduction-Running, g/day (product)	Emissions Reduction-Running, g/day (sum)
VOC	54	0.325933	17.7	272	0.008267	2.2	20.0
NOx	54	0.255832	13.9	272	0.048618	13.2	27.1

4- COST PER TON Analysis years: 30 [1]

Type	Emissions Reduction-Running, g/day (above)	Conversion Factor, kg/g	Workdays per year (say)	Analysis Years (above)	Conversion Factor, ton/kg	Emissions Reduction (ER), ton (product)	Cost per Ton ($ [above] / ER [left])
VOC	20.0	0.001	250	30	0.001102	0.165	**$16,886,491**
NOx	27.1	0.001	250	30	0.001102	0.224	**$12,430,536**

Notes:

[1] Standard for civil projects.

[2] Table: B08301 File: CMAQ scoring tech update- post-6-17-22 TPS work area.pptx

[3] Source: TPS (see "alt commute % increase" tab in this workbook)

[4] Assume that these simplifications offset each other: a) only examining commuting (e.g. ignoring shopping), and b) using a one-to-one relationship between new alt mode trips and eliminated auto trips.

[5] From application

[6] Source: NCHRP project 2525 task 108 toolkit (Excel) "BikePedData" tab

[7] Source: 6-17-22 TPS meeting (note: avg. alt mode trips are shorter than 5 mi; avg. auto trips are longer than 5 mi)

[8] Approximate project implementation year. Given the difficulty of forecasting vehicle regulations and mix, use implementation-year emissions factors throughout the useful life of the project (as recommended by 2019 NCHRP CMAQ emission reduction toolkit).

[9] "adjacent": ie beside (not at the end of)

CONGESTION MITIGATION AND AIR QUALITY

BUS SHELTERS

APPLICANT: James City (locality/agency)
PROJECT NAME: **Transit Stop Improvements**
LOCATION: Various locations
DESCRIPTION: Improvements may include ADA sidewalks, shelters, benches, and lighting
DATE: 8/8/2024 (application date)

Key: cell w/ formula (method of calculation is shown in parentheses)

1 - PROJECT DATA: [1]

Cost	$234,000	
Number of new shelters	86	shelters
Total boardings at subject stops [7]	7	boardings per day
Service days of subject routes	250	days per year

2 - ANALYSIS YEARS [2]: 20 years

3 - REDUCED AUTO EMISSIONS:

Current boardings at subject stops	7	above
Increase in boardings due to shelters	5% [6]	
Portion of bus trips that would have been made in auto	53% [4]	
Reduction in Auto Trips	0.2	trips
Average auto trip length	10.5 [5]	
Reduction in Auto VMT	2	miles/day

Auto Starts

Type	Emissions Factor, g/start [3]	kg/g	Starts Reduction, per day (above)	Analysis days per year (above)	Analysis Years (above)	Emissions Reduction, kg (product)
VOC	0.325933	0.001	0	250	20	0
NOx	0.255832	0.001	0	250	20	0

Auto Running

Type	Emissions Factor, g/mi [3]	kg/g	VMT Reduction, mi/day (above)	Analysis days per year (above)	Analysis Years (above)	Emissions Reduction, kg (product)
VOC	0.008267	0.001	2	250	20	0
NOx	0.048618	0.001	2	250	20	0

4 - COST EFFECTIVENESS:

Type	Auto Starts Emissions, kg (above)	Auto Running Emissions, kg (above)	Total Change in Emissions, kg (sum)	Cost (above)	Cost Effectiveness, $/kg (quotient)	Conversion Factor, kg/ton	Cost Effectiveness, $/ton (product)
VOC	0	0	0	$234,000	$611,264	907	**$554,416,758**
NOx	0	0	-1	$234,000	$329,224	907	**$298,605,979**

[1] From application

[2] "a useful life of about 20 years seems to be typical" (http://lgam.wikidot.com/bus-shelter)

[3] NCHRP project 2525 task 108 toolkit (Excel), "New Bus Services" tab:
Project Year: 2030; Car Trips: 1; Trip Distance: 1. Get EFs from col. D on "NewBusServiceCalcs" tab.

[4] 53%, from GRTC 2019 on-board survey ("how would you have made this trip?") - sum of new auto trips ("driven alone", "gotten someone to drive me", and "used a taxi, Uber, or Lyft"), factored up to include a portion of "not sure"

[5] Source: "Summary of Travel Trends, 2017 National Household Travel Survey" (FHWA, July 2018), p. 20

[6] Source: WATA, HRT, Suffolk, DRPT- 2022 emails (see "boardings % increase" tab)

[7] Source: "boardings at stops in WATA 2016 shelter application.xlsx"

CONGESTION MITIGATION AND AIR QUALITY

SIGNAL RETIMING

DATE: 8/15/2024 (application date)
APPLICANT: Newport News (e.g. locality)
PROJECT NAME: Citywide ITS Upgrades
LOCATION: Citywide ITS Upgrades
DESCRIPTION: Upgrade various

Key: cell with formula (method of calculation)

1 - COST: $1,500,000

2 - EMISSIONS REDUCTION

		Low Volume Intersections	Medium Volume Intersections	High Volume Intersections	Total # of Intersections	
	pm peak hr range:	Less than 3,000 vph	3,000 to 6,000 vph	More than 6,000 vph		
Number of Intersections:		137	79	7	223	
multiplied by	pm peak hour volume:	2,000	4,500	10,000		vph [1]
multiplied by	delay savings:	14	14	14		sec/veh [2]
divided by	conversion factor:	3,600	3,600	3,600		sec/hr
divided by	delay K factor:	0.17	0.17	0.17		delay K factor [3]
multiplied by	weekday equivalents:	300	300	300		days/year (say)
multiplied by	useful life:	5	5	5		years [5]
Change in Vehicle Delay:		9,401,961	12,198,529	2,401,961		hours

Total Change in Vehicle Delay (sum of the columns above): 24,002,451 hours

Type of Emissions	Delay Reduction, hr (above)	Emissions Factor, Heavy Duty Vehs, g/hr[4]	Heavy Duty (HD), % [6]	Emissions Reduction, Heavy Duty Vehs, kg (product/ 1,000)	Light Duty, % (1-HD%)	Emissions Factor, Light Duty Vehs, g/hr[4]	Emissions Reduction, Light Duty Vehs, kg (product/ 1,000)	Emissions Reduction, All Vehs, kg (sum)
VOC	24,002,451	2.042	3.2%	1,569	97%	0.038072	885	2,453
NOx	24,002,451	16.204	3.2%	12,446	97%	0.079186	1,840	14,286

3 - COST EFFECTIVENESS

Type	Cost, $ (above)	Emissions Reduction, kg (above)	Cost Effectiveness, $/kg (quotient)	Conversion Factor, kg/ton	Cost Effectiveness, $/ton (product)
VOC	$1,500,000	2,453	$611	907	**$554,607**
NOx	$1,500,000	14,286	$105	907	**$95,236**

Notes:

[1] Based on range

[2] Pre-project delay 55 seconds * 25% full delay savings = 14 seconds.
(55 seconds: average control delay for LOS D/E, HCM 2000, Table 5)
(25% savings: avg. of 6 studies in *The benefits of retiming traffic signals* [Srinivasa Sunkari, ITE journal, Apr. 2004, p. 26];
article documented 7 studies, but one study's results were outlying)

[3] Portion of daily delay represented by peak hour; assumed not to change significantly over the decades.
Assume pm peak hour is the peak hour of the day.
Source: "Cost Benefit Model for Intersection Level of Service Improvements" (HRPDC, June 1997), pg. 8.

[4] CMAQ Emission Reduction Toolkit (NCHRP, 25-25, Task 108) "IntImproveData" sheet filtered:
year 2030 (estimated project year factor used throughout useful life)
speed 0 mph (idling)
road type: 5 (urban street)

[5] Based on recommendation of retiming signals every three to five years (*Traffic Signal Timing Manual* , FHWA, June 2008, section 7.1.2), assume useful life of 5 years.

[6] Trucks, Non-freeways in Hampton Roads, CMP 2017-2019 network (3.2%)

CONGESTION MITIGATION AND AIR QUALITY

SIGNAL RETIMING

DATE: 8/8/2024 (application date)
APPLICANT: Newport News (e.g. locality)
PROJECT NAME: **Citywide Signal Retiming**
LOCATION: Citywide
DESCRIPTION: optimization of traffic signals throughout the City of Newport News.

Key: cell with formula (method of calculation)

1 - COST: $1,500,000

2 - EMISSIONS REDUCTION

		Low Volume Intersections	Medium Volume Intersections	High Volume Intersections	Total # of Intersections	
	pm peak hr range:	Less than 3,000 vph	3,000 to 6,000 vph	More than 6,000 vph		
Number of Intersections:		137	79	7	223	
multiplied by	pm peak hour volume:	2,000	4,500	10,000		vph [1]
multiplied by	delay savings:	14	14	14		sec/veh [2]
divided by	conversion factor:	3,600	3,600	3,600		sec/hr
divided by	delay K factor:	0.17	0.17	0.17		delay K factor [3]
multiplied by	weekday equivalents:	300	300	300		days/year (say)
multiplied by	useful life:	5	5	5		years [5]
Change in Vehicle Delay:		9,401,961	12,198,529	2,401,961		hours

Total Change in Vehicle Delay (sum of the columns above): 24,002,451 hours

Type of Emissions	Delay Reduction, hr (above)	Emissions Factor, Heavy Duty Vehs, g/hr[4]	Heavy Duty (HD), % [6]	Emissions Reduction, Heavy Duty Vehs, kg (product/ 1,000)	Light Duty, % (1-HD%)	Emissions Factor, Light Duty Vehs, g/hr[4]	Emissions Reduction, Light Duty Vehs, kg (product/ 1,000)	Emissions Reduction, All Vehs, kg (sum)
VOC	24,002,451	2.042	3.2%	1,569	97%	0.038072	885	2,453
NOx	24,002,451	16.204	3.2%	12,446	97%	0.079186	1,840	14,286

3 - COST EFFECTIVENESS

Type	Cost, $ (above)	Emissions Reduction, kg (above)	Cost Effectiveness, $/kg (quotient)	Conversion Factor, kg/ton	Cost Effectiveness, $/ton (product)
VOC	$1,500,000	2,453	$611	907	**$554,607**
NOx	$1,500,000	14,286	$105	907	**$95,236**

Notes:

[1] Based on range

[2] Pre-project delay 55 seconds * 25% full delay savings = 14 seconds.
(55 seconds: average control delay for LOS D/E, HCM 2000, Table 5)
(25% savings: avg. of 6 studies in *The benefits of retiming traffic signals* [Srinivasa Sunkari, ITE journal, Apr. 2004, p. 26]; article documented 7 studies, but one study's results were outlying)

[3] Portion of daily delay represented by peak hour; assumed not to change significantly over the decades.
Assume pm peak hour is the peak hour of the day.
Source: "Cost Benefit Model for Intersection Level of Service Improvements" (HRPDC, June 1997), pg. 8.

[4] CMAQ Emission Reduction Toolkit (NCHRP, 25-25, Task 108) "IntImproveData" sheet filtered:
year 2030 (estimated project year factor used throughout useful life)
speed 0 mph (idling)
road type: 5 (urban street)

[5] Based on recommendation of retiming signals every three to five years (*Traffic Signal Timing Manual* , FHWA, June 2008, section 7.1.2), assume useful life of 5 years.

[6] Trucks, Non-freeways in Hampton Roads, CMP 2017-2019 network (3.2%)

CONGESTION MITIGATION AND AIR QUALITY
ISOLATED INTERSECTON IMPROVEMENT

APPLICANT: Newport News (e.g. locality)
PROJECT NAME: **Warwick Blvd and Main St Intersection Improvements**
LOCATION: Intersection of Warwick Blvd and Main St
DATE: 8/14/2024 (application date)
DESCRIPTION: Left turn signal upgrades, crosswalks and enhanced pedestrian facilities

Key: cell with formula (method of calculation)

1 - COST $1,100,000 (1)

2 - EMISSIONS REDUCTION

Weekday Peak Hour		
Intersection Delay Before Project	64.7	sec/veh (1)
Intersection Delay After Project	12.5	sec/veh (1)
Reduction in Intersection Delay (diff.)	52.20	sec/veh, pk hr
multiplied by	2,940	veh/pkhr (1)
divided by	3,600	sec/hr
divided by	17%	pk hr delay factor (2)
multiplied by	300	wkday equivalents / year (say)
multiplied by	30	useful life, years (4)
Reduction in Intersection Delay	2,256,882	hours

Type of Emissions	Delay Reduction, hr (above)	Emissions Factor, Heavy Duty Vehs, g/hr(3)	Trucks, % (5)	Emissions Reduction, Heavy Duty Vehs, kg (product/ 1,000)	Autos, % (1-truck%)	Emissions Factor, Light Duty Vehs, g/hr(3)	Emissions Reduction, Light Duty Vehs, kg (product/ 1,000)	Emissions Reduction, All Vehs, kg (sum)
VOC	2,256,882	2.042	3.2%	147	96.8%	0.03807	83	231
NOx	2,256,882	16.204	3.2%	1,170	96.8%	0.07919	173	1,343

3 - COST EFFECTIVENESS

Type of Emissions	Cost, $ (above)	Emissions Reduction, kg (above)	Cost Effective-ness, $/kg (quotient)	Conversion Factor, kg/ton (fixed)	Cost Effective-ness, $/ton (product)
VOC	$1,100,000	231	$4,769	907	**$4,325,473**
NOx	$1,100,000	1,343	$819	907	**$742,761**

Notes:
(1) From application
(2) pk hr delay factor = pk hr delay / daily delay; assumed not to change signficantly over the decades
Source: "Cost Benefit Model for Intersection Level of Service Improvements", HRPDC, Page 8, June 1997.
(3) CMAQ Emission Reduction Toolkit (NCHRP, 25-25, Task 108)- assumptions:
year 2030 (estimated project year factor used throughout useful life)
speed 0 mph (idling)
road type: urban (5)
(4) standard for civil projects
(5) Non-freeways in Hampton Roads, CMP 2017-2019 network (3.2%)

CONGESTION MITIGATION AND AIR QUALITY

CITYWIDE SIGNAL SYSTEM

JURISDICTION: Norfolk
PROJECT NAME: **Advanced Traffic Management System (ATMS) Phase 5**
LOCATION: Citywide
DESCRIPTION: Enhancements to the citywide traffic signal system in the City of Norfolk
DATE: 8/15/2024 (1)
PROJECT COST: $5,406,600

1 - EMISSIONS REDUCTION

		Low Volume Intersections	Medium Volume Intersections	High Volume Intersections	Total Intersections
	veh / pm pk hr:	Less than 2,690	2,690 to 5,900	More than 5,900	
Number of Intersections (1):		221	66	1	288
	multiplied by:	2,690	5,900	9,500	veh / pm pk hr (2)
	multiplied by:	10.7	10.7	10.7	sec/veh (2)
	divided by:	3,600	3,600	3,600	sec/hr
	divided by:	0.17	0.17	0.17	delay factor (3)
Change in Vehicle Delay:		10,394	6,808	166	hrs/day

Total Change in Vehicle Delay (sum of 3 col's above): 17,368 hrs/day

Type	Emissions Factor, g/hr (4)	Change in Veh Delay, hr/day (above)	Emissions Reduction, g/day (5)	Emissions Reduction, kg/day	Conversion Factor, wkdays/yr	Emissions Reduction, kg/yr
VOC	1.246	17,368	21,641	21.6	250	5,410
NOx	1.168	17,368	20,286	20.3	250	5,071

2 - COST EFFECTIVENESS

Total Cost: $5,406,600 (from above)
Useful Life, years: 10 (2)
Annual Cost: $540,660

Type	Cost, $/yr (above)	Emissions Reduction, kg/yr (above)	Cost Effectiveness, $/kg	Conversion Factor, kg/ton	Cost Effectiveness, $/ton
VOC	$540,660	5,410	$99.93	907	**$90,640**
NOx	$540,660	5,071	$106.61	907	**$96,693**

Notes:
(1) From application
(2) As previously assumed
(3) Portion of daily delay represented by peak hour
Source: "Cost Benefit Model for Intersection Level of Service Improvements", HRPDC, June 1997.
(4) Source: VDOT, Fleet Avg. Emission Factors for Hampton Roads (Based on US EPA Model MOVES2010b), 2021, idle.
(5) Emission Factor * Change in Vehicle Delay

CONGESTION MITIGATION AND AIR QUALITY

CITYWIDE SIGNAL SYSTEM

JURISDICTION: Norfolk
PROJECT NAME: **Citywide Signal Retiming Phase VI**
LOCATION: Citywide
DESCRIPTION: Upgrade of signal timing plans
DATE: 8/15/2024 (1)
PROJECT COST: $1,413,620

1 - EMISSIONS REDUCTION

		Low Volume Intersections	Medium Volume Intersections	High Volume Intersections	Total Intersections
	veh / pm pk hr:	Less than 2,690	2,690 to 5,900	More than 5,900	
Number of Intersections (1):		101	27	0	128
	multiplied by:	2,690	5,900	9,500	veh / pm pk hr (2)
	multiplied by:	10.7	10.7	10.7	sec/veh (2)
	divided by:	3,600	3,600	3,600	sec/hr
	divided by:	0.17	0.17	0.17	delay factor (3)
Change in Vehicle Delay:		4,750	2,785	0	hrs/day

Total Change in Vehicle Delay (sum of 3 col's above): 7,535 hrs/day

Type	Emissions Factor, g/hr (4)	Change in Veh Delay, hr/day (above)	Emissions Reduction, g/day (5)	Emissions Reduction, kg/day	Conversion Factor, wkdays/yr	Emissions Reduction, kg/yr
VOC	1.246	7,535	9,389	9.4	250	2,347
NOx	1.168	7,535	8,801	8.8	250	2,200

2 - COST EFFECTIVENESS

Total Cost: $1,413,620 (from above)
Useful Life, years: 10 (2)
Annual Cost: $141,362

Type	Cost, $/yr (above)	Emissions Reduction, kg/yr (above)	Cost Effectiveness, $/kg	Conversion Factor, kg/ton	Cost Effectiveness, $/ton
VOC	$141,362	2,347	$60.22	907	**$54,624**
NOx	$141,362	2,200	$64.25	907	**$58,272**

Notes:
(1) From application
(2) As previously assumed
(3) Portion of daily delay represented by peak hour
Source: "Cost Benefit Model for Intersection Level of Service Improvements", HRPDC, June 1997.
(4) Source: VDOT, Fleet Avg. Emission Factors for Hampton Roads (Based on US EPA Model MOVES2010b), 2021, idle.
(5) Emission Factor * Change in Vehicle Delay

CONGESTION MITIGATION AND AIR QUALITY

CITYWIDE SIGNAL SYSTEM

JURISDICTION: Norfolk
PROJECT NAME: **Citywide Signal System Upgrades**
LOCATION: Citywide
DESCRIPTION: Improved fiber communications
DATE: 8/15/2024 (1)
PROJECT COST: $7,424,060

1 - EMISSIONS REDUCTION

		Low Volume Intersections	Medium Volume Intersections	High Volume Intersections	Total Intersections
	veh / pm pk hr:	Less than 2,690	2,690 to 5,900	More than 5,900	
Number of Intersections (1):		80	35	0	115
	multiplied by:	2,690	5,900	9,500	veh / pm pk hr (2)
	multiplied by:	10.7	10.7	10.7	sec/veh (2)
	divided by:	3,600	3,600	3,600	sec/hr
	divided by:	0.17	0.17	0.17	delay factor (3)
Change in Vehicle Delay:		3,762	3,610	0	hrs/day

Total Change in Vehicle Delay (sum of 3 col's above): 7,373 hrs/day

Type	Emissions Factor, g/hr (4)	Change in Veh Delay, hr/day (above)	Emissions Reduction, g/day (5)	Emissions Reduction, kg/day	Conversion Factor, wkdays/yr	Emissions Reduction, kg/yr
VOC	1.246	7,373	9,187	9.2	250	2,297
NOx	1.168	7,373	8,611	8.6	250	2,153

2 - COST EFFECTIVENESS

Total Cost: $7,424,060 (from above)
Useful Life, years: 10 (2)
Annual Cost: $742,406

Type	Cost, $/yr (above)	Emissions Reduction, kg/yr (above)	Cost Effectiveness, $/kg	Conversion Factor, kg/ton	Cost Effectiveness, $/ton
VOC	$742,406	2,297	$323.26	907	**$293,194**
NOx	$742,406	2,153	$344.84	907	**$312,774**

Notes:
(1) From application
(2) As previously assumed
(3) Portion of daily delay represented by peak hour
Source: "Cost Benefit Model for Intersection Level of Service Improvements", HRPDC, June 1997.
(4) Source: VDOT, Fleet Avg. Emission Factors for Hampton Roads (Based on US EPA Model MOVES2010b), 2021, idle.
(5) Emission Factor * Change in Vehicle Delay

CONGESTION MITIGATION AND AIR QUALITY

CITYWIDE SIGNAL SYSTEM

JURISDICTION: Norfolk
PROJECT NAME: **Traffic Signal Detection Upgrades**
LOCATION: Citywide
DESCRIPTION: Upgrade detection infrastructure at multiple locations
DATE: 8/15/2024 (1)
PROJECT COST: $3,430,900

1 - EMISSIONS REDUCTION

		Low Volume Intersections	Medium Volume Intersections	High Volume Intersections	Total Intersections
	veh / pm pk hr:	Less than 2,690	2,690 to 5,900	More than 5,900	
Number of Intersections (1):		22	7	0	29
	multiplied by:	2,690	5,900	9,500	veh / pm pk hr (2)
	multiplied by:	10.7	10.7	10.7	sec/veh (2)
	divided by:	3,600	3,600	3,600	sec/hr
	divided by:	0.17	0.17	0.17	delay factor (3)
Change in Vehicle Delay:		1,035	722	0	hrs/day

Total Change in Vehicle Delay (sum of 3 col's above): 1,757 hrs/day

Type	Emissions Factor, g/hr (4)	Change in Veh Delay, hr/day (above)	Emissions Reduction, g/day (5)	Emissions Reduction, kg/day	Conversion Factor, wkdays/yr	Emissions Reduction, kg/yr
VOC	1.246	1,757	2,189	2.2	250	547
NOx	1.168	1,757	2,052	2.1	250	513

2 - COST EFFECTIVENESS

Total Cost: $3,430,900 (from above)
Useful Life, years: 10 (2)
Annual Cost: $343,090

Type	Cost, $/yr (above)	Emissions Reduction, kg/yr (above)	Cost Effectiveness, $/kg	Conversion Factor, kg/ton	Cost Effectiveness, $/ton
VOC	$343,090	547	$626.96	907	**$568,650**
NOx	$343,090	513	$668.83	907	**$606,625**

Notes:
(1) From application
(2) As previously assumed
(3) Portion of daily delay represented by peak hour
Source: "Cost Benefit Model for Intersection Level of Service Improvements", HRPDC, June 1997.
(4) Source: VDOT, Fleet Avg. Emission Factors for Hampton Roads (Based on US EPA Model MOVES2010b), 2021, idle.
(5) Emission Factor * Change in Vehicle Delay

NORFOLK - ERT EXTENSION STUDY

NO SCORE OR EMISSIONS REDUCTION

STUDY PROJECT REQUEST

CONGESTION MITIGATION AND AIR QUALITY

ISOLATED INTERSECTON IMPROVEMENT

APPLICANT: Norfolk (e.g. locality)
PROJECT NAME: **E Little Creek Rd/Shore Dr Intersection Improvement**
LOCATION: Intersection E Little Creek Rd and Shore Dr
DATE: 8/15/2024 (application date)
DESCRIPTION: New NB left turn lane, ped crosswalks, traffic signals, ADA ramps and sidewalks

Key: cell with formula (method of calculation)

1 - COST $3,320,450 (1)

2 - EMISSIONS REDUCTION

Weekday Peak Hour		
Intersection Delay Before Project	51.2	sec/veh (1)
Intersection Delay After Project	47.2	sec/veh (1)
Reduction in Intersection Delay (diff.)	4.00	sec/veh, pk hr
multiplied by	3,781	veh/pkhr (1)
divided by	3,600	sec/hr
divided by	17%	pk hr delay factor (2)
multiplied by	300	wkday equivalents / year (say)
multiplied by	30	useful life, years (4)
Reduction in Intersection Delay	222,412	hours

Type of Emissions	Delay Reduction, hr (above)	Emissions Factor, Heavy Duty Vehs, g/hr(3)	Trucks, % (5)	Emissions Reduction, Heavy Duty Vehs, kg (product/ 1,000)	Autos, % (1-truck%)	Emissions Factor, Light Duty Vehs, g/hr(3)	Emissions Reduction, Light Duty Vehs, kg (product/ 1,000)	Emissions Reduction, All Vehs, kg (sum)
VOC	222,412	2.042	3.2%	15	96.8%	0.03807	8	23
NOx	222,412	16.204	3.2%	115	96.8%	0.07919	17	132

3 - COST EFFECTIVENESS

Type of Emissions	Cost, $ (above)	Emissions Reduction, kg (above)	Cost Effective-ness, $/kg (quotient)	Conversion Factor, kg/ton (fixed)	Cost Effective-ness, $/ton (product)
VOC	$3,320,450	23	$146,077	907	**$132,491,820**
NOx	$3,320,450	132	$25,084	907	**$22,751,207**

Notes:

(1) From application

(2) pk hr delay factor = pk hr delay / daily delay; assumed not to change signficantly over the decades
Source: "Cost Benefit Model for Intersection Level of Service Improvements", HRPDC, Page 8, June 1997.

(3) CMAQ Emission Reduction Toolkit (NCHRP, 25-25, Task 108)- assumptions:
year 2030 (estimated project year factor used throughout useful life)
speed 0 mph (idling)
road type: urban (5)

(4) standard for civil projects

(5) Non-freeways in Hampton Roads, CMP 2017-2019 network (3.2%)

CONGESTION MITIGATION AND AIR QUALITY

ISOLATED INTERSECTON IMPROVEMENT

APPLICANT: Norfolk (e.g. locality)
PROJECT NAME: **Norview Av/Azalea Garden Rd Intersection Improvement**
LOCATION: Intersection of Norview Av and Azalea Garden Rd
DATE: 8/15/2024 (application date)
DESCRIPTION: New NB left turn lane, ped crosswalks, traffic signals, ADA ramps and sidewalks

Key: cell with formula (method of calculation)

1 - COST $3,018,450 [1]

2 - EMISSIONS REDUCTION

Weekday Peak Hour

Intersection Delay Before Project	31.3	sec/veh [1]
Intersection Delay After Project	24.9	sec/veh [1]
Reduction in Intersection Delay (diff.)	6.40	sec/veh, pk hr
multiplied by	2,170	veh/pkhr [1]
divided by	3,600	sec/hr
divided by	17%	pk hr delay factor [2]
multiplied by	300	wkday equivalents / year (say)
multiplied by	30	useful life, years [4]
Reduction in Intersection Delay	204,235	hours

Type of Emissions	Delay Reduction, hr (above)	Emissions Factor, Heavy Duty Vehs, g/hr[3]	Trucks, % [5]	Emissions Reduction, Heavy Duty Vehs, kg (product/ 1,000)	Autos, % (1-truck%)	Emissions Factor, Light Duty Vehs, g/hr[3]	Emissions Reduction, Light Duty Vehs, kg (product/ 1,000)	Emissions Reduction, All Vehs, kg (sum)
VOC	204,235	2.042	3.2%	13	96.8%	0.03807	8	21
NOx	204,235	16.204	3.2%	106	96.8%	0.07919	16	122

3 - COST EFFECTIVENESS

Type of Emissions	Cost, $ (above)	Emissions Reduction, kg (above)	Cost Effective-ness, $/kg (quotient)	Conversion Factor, kg/ton (fixed)	Cost Effective-ness, $/ton (product)
VOC	$3,018,450	21	$144,609	907	**$131,160,502**
NOx	$3,018,450	122	$24,832	907	**$22,522,596**

Notes:

[1] From application

[2] pk hr delay factor = pk hr delay / daily delay; assumed not to change signficantly over the decades
Source: "Cost Benefit Model for Intersection Level of Service Improvements", HRPDC, Page 8, June 1997.

[3] CMAQ Emission Reduction Toolkit (NCHRP, 25-25, Task 108)- assumptions:
year 2030 (estimated project year factor used throughout useful life)
speed 0 mph (idling)
road type: urban (5)

[4] standard for civil projects

[5] Non-freeways in Hampton Roads, CMP 2017-2019 network (3.2%)

CONGESTION MITIGATION AND AIR QUALITY

CITYWIDE SIGNAL SYSTEM

JURISDICTION: Norfolk
PROJECT NAME: **Traffic Management Center Upgrades**
LOCATION: Citywide
DESCRIPTION: Improved fiber communications
DATE: 8/15/2024 (1)
PROJECT COST: $642,090

1 - EMISSIONS REDUCTION

		Low Volume Intersections	Medium Volume Intersections	High Volume Intersections	Total Intersections
	veh / pm pk hr:	Less than 2,690	2,690 to 5,900	More than 5,900	
Number of Intersections (1):		221	66	1	288
	multiplied by:	2,690	5,900	9,500	veh / pm pk hr (2)
	multiplied by:	10.7	10.7	10.7	sec/veh (2)
	divided by:	3,600	3,600	3,600	sec/hr
	divided by:	0.17	0.17	0.17	delay factor (3)
Change in Vehicle Delay:		10,394	6,808	166	hrs/day

Total Change in Vehicle Delay (sum of 3 col's above): 17,368 hrs/day

Type	Emissions Factor, g/hr (4)	Change in Veh Delay, hr/day (above)	Emissions Reduction, g/day (5)	Emissions Reduction, kg/day	Conversion Factor, wkdays/yr	Emissions Reduction, kg/yr
VOC	1.246	17,368	21,641	21.6	250	5,410
NOx	1.168	17,368	20,286	20.3	250	5,071

2 - COST EFFECTIVENESS

Total Cost: $642,090 (from above)
Useful Life, years: 10 (2)
Annual Cost: $64,209

Type	Cost, $/yr (above)	Emissions Reduction, kg/yr (above)	Cost Effectiveness, $/kg	Conversion Factor, kg/ton	Cost Effectiveness, $/ton
VOC	$64,209	5,410	$11.87	907	**$10,764**
NOx	$64,209	5,071	$12.66	907	**$11,483**

Notes:
(1) From application
(2) As previously assumed
(3) Portion of daily delay represented by peak hour
Source: "Cost Benefit Model for Intersection Level of Service Improvements", HRPDC, June 1997.
(4) Source: VDOT, Fleet Avg. Emission Factors for Hampton Roads (Based on US EPA Model MOVES2010b), 2021, idle.
(5) Emission Factor * Change in Vehicle Delay

CONGESTION MITIGATION AND AIR QUALITY
ISOLATED INTERSECTON IMPROVEMENT

APPLICANT: Suffolk (e.g. locality)
PROJECT NAME: **S. Quay Road at O'Kelly Drive turn lane**
LOCATION: Intersection of S. Quay Road and O'Kelly Drive
DATE: 8/15/2024 (application date)
DESCRIPTION: Provide for a right turn lane from eastbound S. Quay Road onto southbound O'Kelly Drive

Key: cell with formula (method of calculation)

1 - COST $2,815,000 (1)

2 - EMISSIONS REDUCTION

Weekday Peak Hour		
Intersection Delay Before Project	6.9	sec/veh (1)
Intersection Delay After Project	6.6	sec/veh (1)
Reduction in Intersection Delay (diff.)	0.30	sec/veh, pk hr
multiplied by	6,024	veh/pkhr (1)
divided by	3,600	sec/hr
divided by	17%	pk hr delay factor (2)
multiplied by	300	wkday equivalents / year (say)
multiplied by	30	useful life, years (4)
Reduction in Intersection Delay	26,576	hours

Type of Emissions	Delay Reduction, hr (above)	Emissions Factor, Heavy Duty Vehs, g/hr(3)	Trucks, % (5)	Emissions Reduction, Heavy Duty Vehs, kg (product/ 1,000)	Autos, % (1-truck%)	Emissions Factor, Light Duty Vehs, g/hr(3)	Emissions Reduction, Light Duty Vehs, kg (product/ 1,000)	Emissions Reduction, All Vehs, kg (sum)
VOC	26,576	2.042	3.2%	2	96.8%	0.03807	1	3
NOx	26,576	16.204	3.2%	14	96.8%	0.07919	2	16

3 - COST EFFECTIVENESS

Type of Emissions	Cost, $ (above)	Emissions Reduction, kg (above)	Cost Effective-ness, $/kg (quotient)	Conversion Factor, kg/ton (fixed)	Cost Effective-ness, $/ton (product)
VOC	$2,815,000	3	$1,036,391	907	**$940,006,749**
NOx	$2,815,000	16	$177,967	907	**$161,415,913**

Notes:
(1) From application
(2) pk hr delay factor = pk hr delay / daily delay; assumed not to change signficantly over the decades
Source: "Cost Benefit Model for Intersection Level of Service Improvements", HRPDC, Page 8, June 1997.
(3) CMAQ Emission Reduction Toolkit (NCHRP, 25-25, Task 108)- assumptions:
year 2030 (estimated project year factor used throughout useful life)
speed 0 mph (idling)
road type: urban (5)
(4) standard for civil projects
(5) Non-freeways in Hampton Roads, CMP 2017-2019 network (3.2%)

SUFFOLK - PLUMMER BLVD EXTENSION

PROJECT NOT SCORED

INELIGIBLE ACTIVITY - ADDITIONAL CAPACITY FOR SOV TRAVEL

CONGESTION MITIGATION AND AIR QUALITY

CITYWIDE SIGNAL SYSTEM

JURISDICTION: Virginia Beach
PROJECT NAME: **Citywide Traffic Signal Retiming**
LOCATION: Citywide
DESCRIPTION: Upgrade of signal timing plans for 88 intersections
DATE: 8/15/2024 (1)
PROJECT COST: $1,232,000

1 - EMISSIONS REDUCTION

		Low Volume Intersections	Medium Volume Intersections	High Volume Intersections	Total Intersections
	veh / pm pk hr:	Less than 2,690	2,690 to 5,900	More than 5,900	
Number of Intersections (1):		57	29	2	88
	multiplied by:	2,690	5,900	9,500	veh / pm pk hr (2)
	multiplied by:	10.7	10.7	10.7	sec/veh (2)
	divided by:	3,600	3,600	3,600	sec/hr
	divided by:	0.17	0.17	0.17	delay factor (3)
Change in Vehicle Delay:		2,681	2,991	332	hrs/day

Total Change in Vehicle Delay (sum of 3 col's above): 6,004 hrs/day

Type	Emissions Factor, g/hr (4)	Change in Veh Delay, hr/day (above)	Emissions Reduction, g/day (5)	Emissions Reduction, kg/day	Conversion Factor, wkdays/yr	Emissions Reduction, kg/yr
VOC	1.246	6,004	7,481	7.5	250	1,870
NOx	1.168	6,004	7,013	7.0	250	1,753

2 - COST EFFECTIVENESS

Total Cost: $1,232,000 (from above)
Useful Life, years: 10 (2)
Annual Cost: $123,200

Type	Cost, $/yr (above)	Emissions Reduction, kg/yr (above)	Cost Effectiveness, $/kg	Conversion Factor, kg/ton	Cost Effectiveness, $/ton
VOC	$123,200	1,870	$65.87	907	**$59,743**
NOx	$123,200	1,753	$70.27	907	**$63,733**

Notes:
(1) From application
(2) As previously assumed
(3) Portion of daily delay represented by peak hour
Source: "Cost Benefit Model for Intersection Level of Service Improvements", HRPDC, June 1997.
(4) Source: VDOT, Fleet Avg. Emission Factors for Hampton Roads (Based on US EPA Model MOVES2010b), 2021, idle.
(5) Emission Factor * Change in Vehicle Delay

CONGESTION MITIGATION AND AIR QUALITY
ISOLATED INTERSECTON IMPROVEMENT

APPLICANT: Virginia Beach (e.g. locality)
PROJECT NAME: **Pacific Avenue at 17th and 22nd Streets Turn Lane Improvements**
LOCATION: Intersection of Pacific Ave and 17th and 22nd Streets
DATE: 8/15/2024 (application date)
DESCRIPTION: New left turn lanes along Pacific Av at 17th and 22nd Street

Key: cell with formula (method of calculation)

1 - COST $29,864,643 [1]

2 - EMISSIONS REDUCTION

Weekday Peak Hour

Intersection Delay Before Project	22.4	sec/veh [1]
Intersection Delay After Project	15.7	sec/veh [1]
Reduction in Intersection Delay (diff.)	6.70	sec/veh, pk hr
multiplied by	1,745	veh/pkhr [1]
divided by	3,600	sec/hr
divided by	17%	pk hr delay factor [2]
multiplied by	300	wkday equivalents / year (say)
multiplied by	30	useful life, years [4]
Reduction in Intersection Delay	171,934	hours

Type of Emissions	Delay Reduction, hr (above)	Emissions Factor, Heavy Duty Vehs, g/hr[3]	Trucks, % [5]	Emissions Reduction, Heavy Duty Vehs, kg (product/ 1,000)	Autos, % (1-truck%)	Emissions Factor, Light Duty Vehs, g/hr[3]	Emissions Reduction, Light Duty Vehs, kg (product/ 1,000)	Emissions Reduction, All Vehs, kg (sum)
VOC	171,934	2.042	3.2%	11	96.8%	0.03807	6	18
NOx	171,934	16.204	3.2%	89	96.8%	0.07919	13	102

3 - COST EFFECTIVENESS

Type of Emissions	Cost, $ (above)	Emissions Reduction, kg (above)	Cost Effective-ness, $/kg (quotient)	Conversion Factor, kg/ton (fixed)	Cost Effective-ness, $/ton (product)
VOC	$29,864,643	18	$1,699,568	907	**$1,541,508,359**
NOx	$29,864,643	102	$291,846	907	**$264,704,461**

Notes:
[1] From application
[2] pk hr delay factor = pk hr delay / daily delay; assumed not to change signficantly over the decades
Source: "Cost Benefit Model for Intersection Level of Service Improvements", HRPDC, Page 8, June 1997.
[3] CMAQ Emission Reduction Toolkit (NCHRP, 25-25, Task 108)- assumptions:
year 2030 (estimated project year factor used throughout useful life)
speed 0 mph (idling)
road type: urban (5)
[4] standard for civil projects
[5] Non-freeways in Hampton Roads, CMP 2017-2019 network (3.2%)

CONGESTION MITIGATION AND AIR QUALITY

OTHER

JURISDICTION: The Port of Virginia
PROJECT NAME: **Green Operator Program**
LOCATION: HRTPO Planning Area
DESCRIPTION: Air quality and congestion management program (clean diesel technologies for dray truck replacements, tug repowering, cargo handling equipment, and monitored Transportation Demand Management Program to induce the shift of containers from single truck trips to barge or rail.
DATE: 8/15/2024 (1)
PROJECT COST: $12,000,000

1 - EMISSIONS REDUCTION

Vehicle Volume (ADT)	24,500	/1440	17.01	vehicles per minute
Train Crossings per day	5		340.28	vehicles delayed per train (3)
Average Obstruction per train (min)	20		10	average vehicle delay (mins) (6)

Arterial	Number of Vehicles Delayed (4)	Avg Delay Before (s/veh)	Avg Delay After (s/veh)	Delay Savings (s/veh)	Delay Savings (s/day)	Delay Savings (hr/day)
Freeman Avenue						
North Main Street at CSX Main Line Crossing	1701	600	0	600	1,020,833	284
				Total Delay Savings		284 hr/day

Type	Emissions Factor, g/hr (2)	Change in Veh Delay, hr/day (above)	Emissions Reduction, g/day	Emissions Reduction, kg/day	Conversion Factor, wkdays/yr (3)	Emissions Reduction, kg/yr
VOC	1.246	284	353	0.4	250	88
NOx	1.168	284	331	0.3	250	83

2 - COST EFFECTIVENESS

Total Cost:	$12,000,000
Useful Life, years:	15 (5)
Annual Cost:	$800,000

Type	Cost, $/yr (above)	Emissions Reduction, kg/yr (above)	Cost Effectiveness, $/kg	Cost Effectiveness, $/ton
VOC	$800,000	88	$9,057	**$8,214,609**
NOx	$800,000	83	$9,662	**$8,763,187**

(1) From application
(2) Source: VDOT, Fleet Avg. Emission Factors for Hampton Roads (Based on US EPA Model MOVES2012014a) 2023, idle
(3) Average Obstruction per train (minutes) * Vehicles per minute
(4) Vehicles delayed per train * number of train crossings per day
(5) Assumed useful life in years for railroad crossing early warning system
(6) Avg. of 20 minute maximum delay and 0 minute minimum delay; (AVG 20,0)

CONGESTION MITIGATION AND AIR QUALITY

BUS[4] REPLACEMENT

APPLICANT: WATA (locality/agency)
PROJECT NAME: **Bus Vehicle Replacement**
DESCRIPTION: Purchase of Replacement and New Vehicles
DATE: 8/28/2024 (application date)

Key: cell with formula (method of calculation)

	Existing Buses	Proposed Buses	
Model Year [1]	2015	2033	
Fuel Type [1]	Diesel	Mixed	
Number of Buses (# to be purchased = # to be retired)		4	buses[1]
Annual Vehicle-Miles per bus (old&new buses)		41,079	VMT/year[1]
Expected Years of Service per new bus		15	years[3]

1 - COST $13,909,079 [1]

2 - EMISSIONS REDUCTION

Type	Emissions Factor for Existing Buses, g/mi [2]	Emissions Factor for Proposed Buses, g/mi [2]	Emissions Factor Reduction, g/mi (difference)	Buses (above)	Annual VMT per bus (above)	Expected Years of Service per new bus (above)	Emissions Reduction, kg (product/ 1,000)
VOC	6.08270	0.65506	5.42764	4	41,079	15	13,378
NOx	12.11861	0.93580	11.18281	4	41,079	15	27,563

3 - COST EFFECTIVENESS

Type	Cost (above)	Emissions Reduction, kg (above)	Cost Effectiveness, $/kg (quotient)	Conversion Factor, kg/ton (fixed)	Cost Effectiveness, $/ton (product)
VOC	$13,909,079	13,378	$1,039.72	907	**$943,026**
NOx	$13,909,079	27,563	$504.63	907	**$457,703**

[1] From application

[2] NCHRP project 2525 task 108 toolkit (Excel, "NewTransitBusData" tab), based on these inputs:
model year (modelyearid) and fuel type (fueltypeid: gas[1], diesel[2], CNG[3], EV[9]) based on application;
analysis year (yearID=2030); road type (roadtypeid=5 [urban unrestricted access])
[The emissions factors on the prototype sheet (6.08, 0.655, 12.11, 0.93) came from the old (2020) calculation sheet.]

[3] Average retirement age of a 12-year bus is 15.1 years (Laver, et al. Useful Life of Transit Buses and Vans. FTA, 2007)