COMMONWEALTH *of* VIRGINIA

Office of the

SECRETARY *of* TRANSPORTATION

EVALUATION OF SMART SCALE PROJECT PERFORMANCE

Pilot Study

Margie Ray

December 7, 2021

Agenda

- Purpose and Goals of Study
- Measures Under Evaluation
- Challenges and Observations/Conclusions
- Status of Project Evaluations – Sample Results
- Next Steps

Purpose and Goals of Study

- Purpose: develop and implement ongoing systems for evaluating and monitoring benefits of SMART SCALE investments and refining application criteria and the prioritization process.

- Current phase: Pilot test proposed methods and measures to evaluate performance before and after construction of individual projects.
  - Test alternative measures to evaluate project performance
  - Discern sensitivity of evaluation measures across project types and scales
  - Develop / refine analysis methodologies
  - Evaluate data sources
  - Evaluate potential for automation
  - Consider implications for SMART SCALE application criteria / evaluation process.
    - Provides a feedback loop and continuous process improvement

Study Background

Conducted peer review of before/after analysis practices

- Evaluated project “types” and performance measures similar to SMART SCALE factors and measures

Identified SMART SCALE factor areas for pilot study application

- Safety - reduce the number and rate of fatalities and serious injuries
- Congestion - reduce person hours of delay and increase person throughput
- Accessibility - increase access to jobs and travel options
- Economic Development - support economic development and improve the movement of goods
  - Reliability Only

Measures Under Evaluation

Measure	Key Question
Person/ Vehicle Miles of Travel (PMT/VMT)	Has traffic demand been impacted significantly?
Person/ Vehicle Hours of Delay (PHD/VHD)	Has traffic congestion been reduced?
Transit Index/Transit Ridership	Has transit ridership activity increased?
Auto and Transit Seat Utilization	Has the share of occupied seats increased?
Freight Destination Accessibility	Has the movement of goods improved?
Bicycle/Pedestrian Activity Index	Has bicycle and pedestrian activity increased?

Measure	Key Question
Average Trip Distance / Time	Has the characteristics of trips changed?
Travel Time Index	Has the level of peak period congestion improved?
Buffer Time Index/Planning Time Index	Has the reliability of travel times improved?
Average Delay	Has average traffic congestion been reduced?
Fatal and Serious Injuries/year Equivalent Property Damage Only/year	Has there been a reduction in reported severe (fatal and serious) or all injury crashes, weighted by economic value?
Access to Jobs and Jobs for dis-advantaged population	Has access to jobs and for disadvantaged populations improved?

Pilot Project Selection

- 30 projects available for pilot testing
  - Construction (CN) complete before January 1, 2019
  - Avoids using 2020 data for post-CN analysis
- 10 projects identified to provide a mix of
  - Project Types
  - Roadway systems
  - Geographic distribution
  - Includes 7 Smart Scale Round 1 (R1) projects, 3 Round 2 (R2) projects
- Additional projects evaluated for some measures if:
  - Measure not relevant to project type, limiting testing opportunities
    - highway project without transit or TDM features
  - Data sources inadequate due to data range availability

Initial Ten Pilot Projects

APP ID	UPC	District	Description	Construction Period
495	108900	Salem	N Main Intersection Improvements at Rte 460 Bypass	2/27/18 - 10/26/18
609	107044	Hampton Roads	I64/Northampton Boulevard Interchange Modification	3/14/17 - 4/17/18
616	109302	Hampton Roads	General Thomas Highway Signalization Project	12/13/16 - 11/17/17
622	98213	Culpeper	Rural Roundabout at US 15/53	6/14/16 - 9/16/17
652	98815	Hampton Roads	Godwin Blvd/Route 58 Park & Ride Lot	6/2/17 - 8/17/18
724	100702	NOVA	I-95SB / SR 784 Off Ramp and Signal	12/30/16 - 8/15/17
735	94847	Staunton	I-81 to Rt 37 Through Lane and Left Turn Lanes	11/8/16 - 11/29/17
1087	110765	Lynchburg	RT 460 / Rt 626 Dynamic Flashers	11/2/2017 - 6/15/18
1394	11881	Salem	Blacksburg Transit Expansion Bus Purchase	2/1/18 - 6/20/18
1448	111304	Lynchburg	Rt 29/Rt 151 Dynamic Flashers	11/2/17 - 6/15/18

Additional Pilot Projects

APP ID	UPC	District	Description	Construction Period
474	103320	Bristol	Add merging lane on I77N in Ft. Chiswell	6/13/17 - 8/31/18
585	105495	Bristol	Conn. Road - 2 Lanes With Curb & Gutter - Phase Ii	11/8/16 - 11/14/18
734	109326	Staunton	Fox Drive Turn Lanes	3/13/18 - 6/29/18
519	110542	Lynchburg	Lynchburg Central Business District Circulator	9/1/2016 - 8/22/2017
602	109578	Fredericksburg	Rappahannock Community College Site Access Improvements	6/12/2018 - 12/14/2018
696	109288	Salem	Transit Accessibility Improvements on Edgewood St. (Roanoke)	7/3/2017 - 7/6/2018
722	109541	NOVA	App 722 – ART Service Restructuring & Expansion	4/18/2017 - 10/29/2019
560	108908	Salem	US220 Communications and Adaptive System Project	3/14/2017 - 6/22/2018
552	103725	Fredericksburg	Turn Lane Extension Dahlgren Naval Base	4/11/2017 - 10/30/2017

Challenges

- **Data Sources**
  - Limited historical availability for multiple sources of data
  - Data gaps
- **Data variability and interpretation**
  - What represents a true change as opposed to “decimal dust” or “noise” in the data?
    - need to establish thresholds - what represents change?
  - Insufficient analysis to test sensitivity of data/measures
- **Methodology Testing and Evaluation**
  - Validity of measures/method for certain project types or projects without identified benefits within the measure category
- **Changes to prioritization methodology, evaluation tools, etc.**

Challenges

- **Defining the project area**
  - Use of SMART SCALE segmentation may not reflect where the project benefits actually occur
  - Defining the project area can have significant impacts on the results of measures
    - ex. used SMART SCALE segmentation for park and ride lot to measure change in access to jobs. Delays (reduction in speeds) within the project area resulted in reduction in access to jobs, noted increased congestion some distance from the project, not likely influenced by the park and ride lot
  - Scale/size and type of project has influence on defining the project area
- **Attributing project benefits**
  - Discerning impacts of project vs. external influences
- **Consider project purpose / context / tradeoffs**
  - A roundabout that improves safety may result in reduced travel times/travel speeds on some or all of the affected segments, which could be considered a decline in accessibility or an increase in delay

Observations and Conclusions

- **SMART SCALE is working!**
- **Post Construction Project Benefits**
  - Measured benefits are consistent with estimated benefits
    - in the factor areas where a project received most points (and the basis for funding selection), and
    - in magnitude of estimated benefits
  - For some projects, additional benefits were observed
- **Measure Selection and Testing**
  - Not all measures worked due to limited data or data gaps
  - Similar to SMART SCALE, need to develop methodology and assumptions that can be applied to many projects
    - May not capture all of the benefits
  - For certain project types (i.e. park and ride lot), direct observation data may need to be obtained

N Main Intersection Improvements at Rt 460 Bypass

Salem District

Information from SMART SCALE APPLICATION

- Project Purpose: Improve safety at the intersection of Rte. 460 Bypass and N. Main St. by lengthening and adding turn lanes and limiting dangerous left turning movements
- Pre-Construction: Two-way stop-controlled intersection

• Area Type	C
• Total Project Cost	$3,316,565
• Total SMART SCALE Request	$3,316,565

http://smartscale.org/documents/scorecards/salem.pdf

N Main Intersection Improvements at Rt 460 Bypass

Salem District

Information from Scorecard

- Project Benefit Score: 3.1
- Statewide Rank*: 67/287
- District Rank*: 10/37

- **Primary Benefit - Improve Safety**

Congestion Mitigation		Safety		Accessibility			Environment		Economic Development			Land Use
15% of score		25% of score		25% of score			10% of score		25% of score			N/A
50%	50%	50%	50%	60%	20%	20%	50%	50%	60%	20%	20%	N/A
Increase in Daily Person Throughput	Decrease in Person Hours Delay	Reduction in Fatal and Severe Injury	Reduction in Fatal and Severe Injury Rate	Increase in Access to Jobs	Increase in Access to Jobs for Disadvantaged Populations	Improved Access to Multimodal Choices (Users Benefit Value)	Air Quality (Total Benefit Value)	Acres of Natural/Cultural Resources Potentially Impacted	Economic Development Support (Sq. ft.)	Intermodal Access Improvements (Tons Benefit Value)	Travel Time Reliability Improvement	Transportation Efficient Land Use
0	0	9.1	12.6	0	0	0	0	0.3		3.1	4.4	

*Rank based on SMART SCALE requested amount

N Main Intersection Improvements at Rt 460 Bypass Before and After Performance Results

Before-After Analysis Periods

- Before Period: 11/2016 - 11/2017
- After Period: 01/2019 - 01/2020
- Safety Period: 11/2018 - 02/2020 (16 months)

Primary Benefit

- No fatalities or serious injury crashes since construction complete
- Reduction in EPDO exceeded projections - actual reduction of 91% compared to projected reduction of 35%

Additional Benefits

- Average delay (AM peak period) was reduced by 50%, no delay benefits projected

Construction Period: 2/27/18 - 10/26/18

I-64/Northampton Blvd Interchange Modification

Hampton Roads District

Information from SMART SCALE APPLICATION

- Project Purpose: Modify off-ramp terminal interfaces with Northampton Boulevard. Project includes ramp widening and ramp re-alignment as well as traffic signal modifications for I-64 approaches to Northampton Blvd to improve traffic merges.

- Area Type A
- Total Project Cost $9,300,000
- Total SMART SCALE Request $9,300,000

http://smartscale.org/documents/scorecards/Hampton_roads.pdf

I-64/Northampton Blvd Interchange Modification

Hampton Roads District

Information from Scorecard

- Project Benefit Score: 0.9
- Statewide Rank*: 186/287
- District Rank*: 18/40

- **Primary Benefit: Improve safety and traffic flow**

Congestion Mitigation		Safety		Accessibility			Environment		Economic Development			Land Use
45% of score		5% of score		15% of score			10% of score		5% of score			20% of score
50%	50%	50%	50%	60%	20%	20%	50%	50%	60%	20%	20%	100%
Increase in Daily Person Throughput	Decrease in Person Hours Delay	Reduction in Fatal and Severe Injury	Reduction in Fatal and Severe Injury Rate	Increase in Access to Jobs	Increase in Access to Jobs for Disadvantaged Populations	Improved Access to Multimodal Choices (Users Benefit Value)	Air Quality (Total Benefit Value)	Acres of Natural/Cultural Resources Potentially Impacted	Economic Development Support (Sq. ft.)	Intermodal Access Improvements (Tons Benefit Value)	Travel Time Reliability Improvement	Transportation Efficient Land Use
1.1	0.8	6.0	6.3	0	0	0	0	1.0	0.3	8.3	4.3	0

*Rank based on SMART SCALE requested amount

I-64/Northampton Blvd Interchange Modification Before and After Performance Results

Before-After Analysis Periods

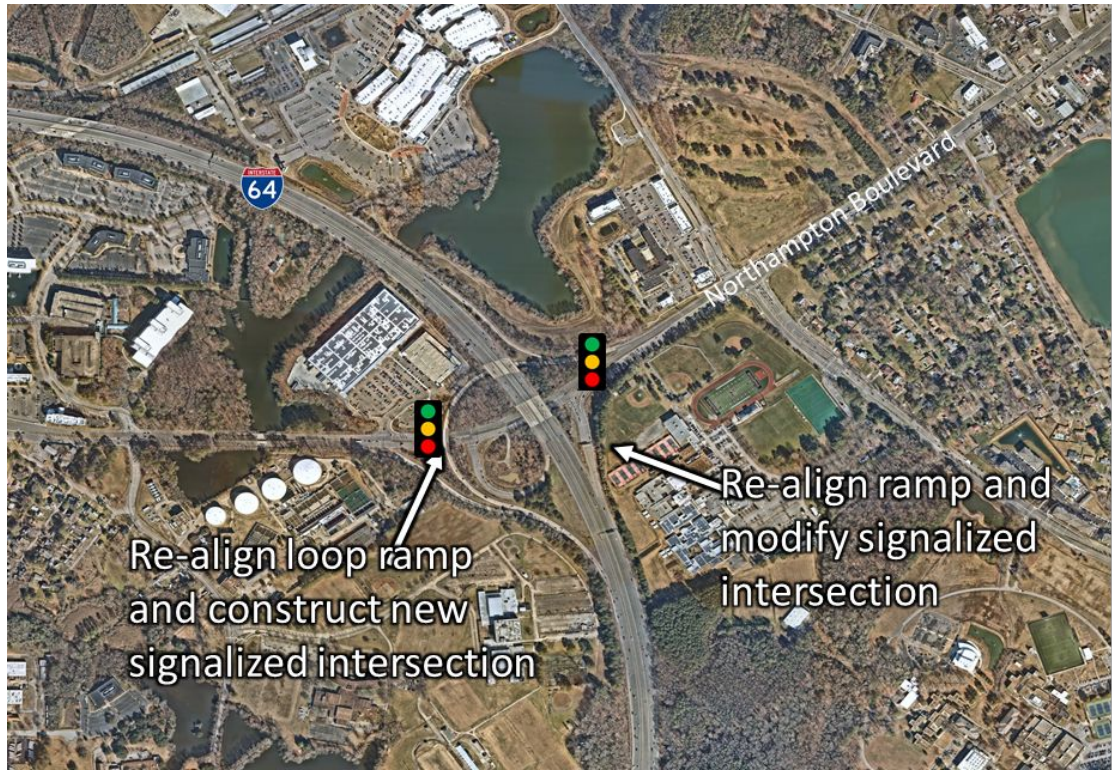
- Before Period: 12/2015 – 12/2016
- After Period: 07/2018 – 07/2019
- Safety Period: 05/2018 - 02/2020 (22 Months)

Primary Benefit

- No fatalities or serious injury crashes since construction complete
- Reduction in EPDO exceeded projections - actual reduction of 55% compared to projected reduction of 35%
- Reliability improved

Additional Benefits

- Average delay for Rt 13 was reduced by 10-20% during the peak period



Construction Period: 03/14/2017 - 04/17/2018

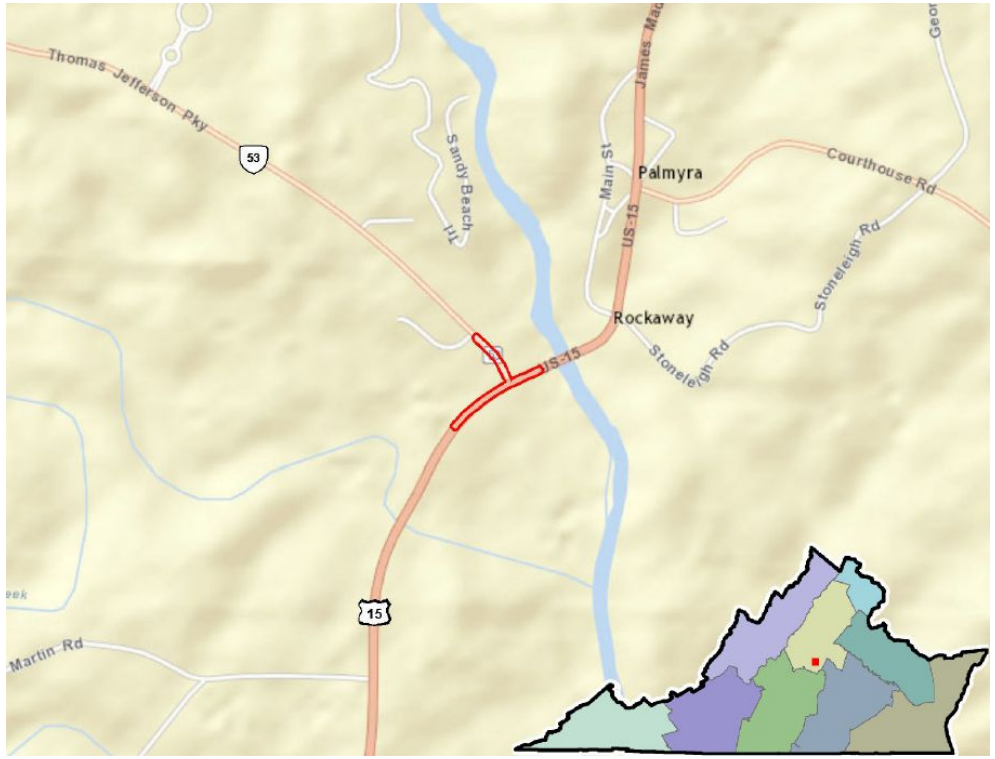
Rural Roundabout at US 15/53

Culpeper District

Information from SMART SCALE APPLICATION

- Project Purpose: The project currently under development will improve safety by replacing the existing unsignalized “T” intersection at US Route 15 and Route 53 in Fluvanna County with a single lane roundabout and includes sidewalks, bike lanes, and a multi-use trail
- Additional Information: Project is located on the Route 76 Bicycle Route and includes improvement for this route as well as a construction of a new sidewalk

- Area Type C
- Total Project Cost $2,500,600
- Total SMART SCALE Request $1,400,600



http://smartscale.org/documents/scorecards/culpeper.pdf

Rural Roundabout at US 15/53

Culpeper District

Information from Scorecard

- Project Benefit Score: 2.1
- Statewide Rank*: 39/287
- District Rank*: 3/17

Primary Benefit: Improve safety

Congestion Mitigation		Safety		Accessibility			Environment		Economic Development			Land Use
15% of score		25% of score		25% of score			10% of score		25% of score			N/A
50%	50%	50%	50%	60%	20%	20%	50%	50%	60%	20%	20%	N/A
Increase in Daily Person Throughput	Decrease in Person Hours Delay	Reduction in Fatal and Severe Injury	Reduction in Fatal and Severe Injury Rate	Increase in Access to Jobs	Increase in Access to Jobs for Disadvantaged Populations	Improved Access to Multimodal Choices (Users Benefit Value)	Air Quality (Total Benefit Value)	Acres of Natural/Cultural Resources Potentially Impacted	Economic Development Support (Sq. ft.)	Intermodal Access Improvements (Tons Benefit Value)	Travel Time Reliability Improvement	Transportation Efficient Land Use
0.6	0.3	3.4	12.3	0	0	0.1	0.1	0	0.1	0	1.2	

*Rank based on SMART SCALE requested amount

Rural Roundabout at US 15/53
Before and After Performance Results

Before-After Analysis Periods

- Before Period: 03/2015 – 03/2016
- After Period: 12/2017 – 12/2018
- After Period: Safety 10/2017 – 02/2020 (29 months)

Primary Benefit

- Through February 2020, only PDO crashes have occurred post-construction, a 100% reduction compared to a projected reduction of 80%

Additional Benefits

- Reliability improved
- Average delay was significantly reduced for NB US-15 and somewhat reduced for SB US-15. Projected a 78% reduction in delay and realized a 40-50% delay. Average speed decreased

Construction Period: 06/14/2016 – 09/16/2017

Construct Auxiliary Lane I77 North Exit 32 onto I81 South

Bristol District

Information from SMART SCALE APPLICATION

- Project Purpose: Construct additional merge lane on ramp from I-77 North to I-81 South. The merge lane designed to become a drop lane at Exit 80 for exiting vehicles. The additional lane reduces congestion at junction of two Interstates 81 & 77

- Area Type D
- Total Project Cost $9,100,000
- Total SMART SCALE Request $9,000,000

http://smartscale.org/documents/scorecards/bristol.pdf

Construct Auxiliary Lane I77 North Exit 32 onto I81 South

Bristol District

Information from Scorecard

- Project Benefit Score: 1.4
- Statewide Rank*: 156/287
- District Rank*: 14/22

Primary Benefit: Improve congestion and intermodal access

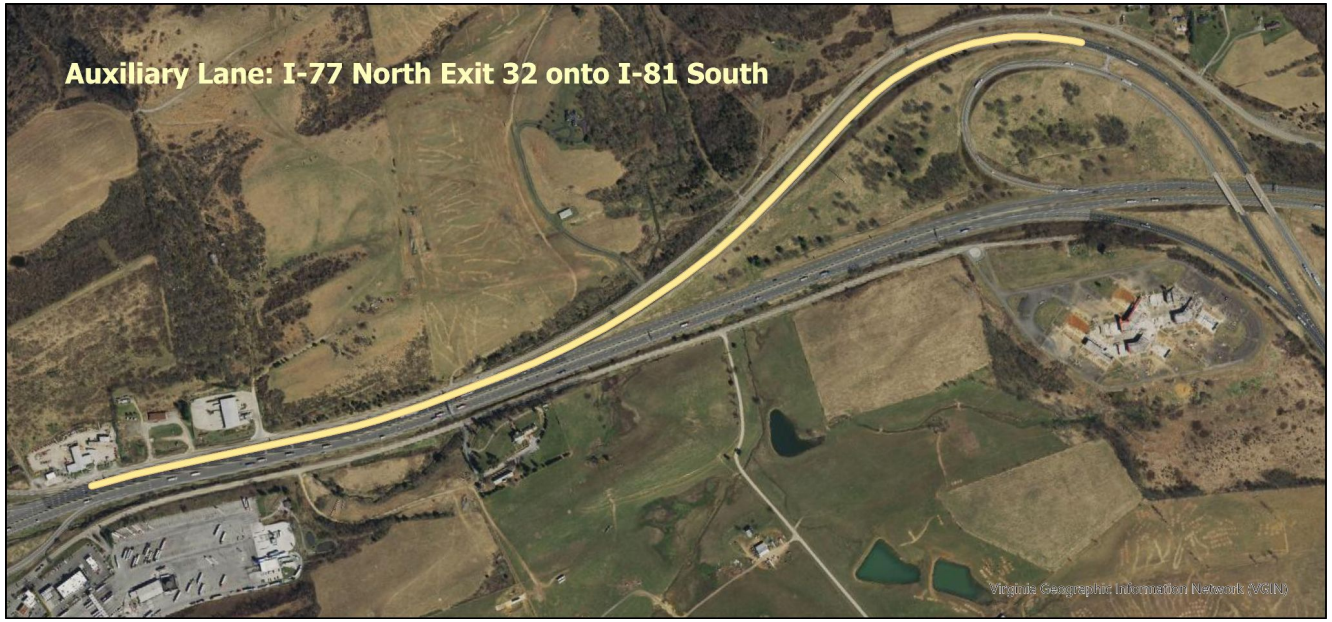
Congestion Mitigation		Safety		Accessibility			Environment		Economic Development			Land Use
10% of score		30% of score		15% of score			10% of score		35% of score			N/A
50%	50%	50%	50%	60%	20%	20%	50%	50%	60%	20%	20%	N/A
Increase in Daily Person Throughput	Decrease in Person Hours Delay	Reduction in Fatal and Severe Injury	Reduction in Fatal and Severe Injury Rate	Increase in Access to Jobs	Increase in Access to Jobs for Disadvantaged Populations	Improved Access to Multimodal Choices (Users Benefit Value)	Air Quality (Total Benefit Value)	Acres of Natural/Cultural Resources Potentially Impacted	Economic Development Support (Sq. ft.)	Intermodal Access Improvements (Tons Benefit Value)	Travel Time Reliability Improvement	Transportation Efficient Land Use
4.0	1.3	0	0	0.2	0.4	0	0.5	0.2	0	15.3	0	

*Rank based on SMART SCALE requested amount

Construct Auxiliary Lane I77 North Exit 32 onto I81 South Before and After Performance Results

Before-After Analysis Periods

- Before Period: 03/2016 – 03/2017
- After Period: 12/2018 – 12/2019
- After Period: Safety 09/2017 – 02/2020 (18 months)



Primary Benefits

- Average delay was reduced by 54% in the AM peak period*, compared to a projection of 99%
- Truck travel speeds have increased despite increases in truck volumes

*peak period changed to 6am-8am

Construction Period: 06/13/2017 – 08/31/2018

Route 11 North Improvements between Exit 317 and Rt 37

Staunton District

Information from SMART SCALE APPLICATION

- Project Purpose: Project increases capacity on US 11 with the addition of a third southbound through lane between Highway 37 and I-81, Exit 317. The additional lane will also improve the operation and safety of the existing intersection with Welltown Road

- Area Type C
- Total Project Cost $2,500,755
- Total SMART SCALE Request $1,078,947

http://smartscale.org/documents/scorecards/staunton.pdf

Route 11 North Improvements between Exit 317 and Rt 37

Staunton District

Information from Scorecard

- Project Benefit Score: 4.2
- Statewide Rank*: 11/287
- District Rank*: 1/29

Primary Benefit: Increase capacity, improve safety and operations

Congestion Mitigation		Safety		Accessibility			Environment		Economic Development			Land Use
15% of score		25% of score		25% of score			10% of score		25% of score			N/A
50%	50%	50%	50%	60%	20%	20%	50%	50%	60%	20%	20%	N/A
Increase in Daily Person Throughput	Decrease in Person Hours Delay	Reduction in Fatal and Severe Injury	Reduction in Fatal and Severe Injury Rate	Increase in Access to Jobs	Increase in Access to Jobs for Disadvantaged Populations	Improved Access to Multimodal Choices (Users Benefit Value)	Air Quality (Total Benefit Value)	Acres of Natural/Cultural Resources Potentially Impacted	Economic Development Support (Sq. ft.)	Intermodal Access Improvements (Tons Benefit Value)	Travel Time Reliability Improvement	Transportation Efficient Land Use
0	0.3	6.0	9.2	0.1	0	0	0	0	3.2	11.6	23.8	

*Rank based on SMART SCALE requested amount

Route 11 North Improvements between Exit 317 and Rt 37 Before and After Performance Summary

Before-After Analysis Periods

- Before Period: 08/2015 - 08/2016
- After Period: 02/2018 - 02/2019
- After Period: Safety 01/18 - 02/2020 (26 months)

<u>Primary Benefits:</u>

- Average delay was reduced by 25% in the AM peak period, projected a 56% reduction
- Improved travel time, speed, and reliability
- No fatalities or serious injury crashes since construction complete
- Reduction in EPDO exceeded projections - actual reduction of 63% compared to projected reduction of 20%

Construction Period: 11/8/2016 - 11/29/2017

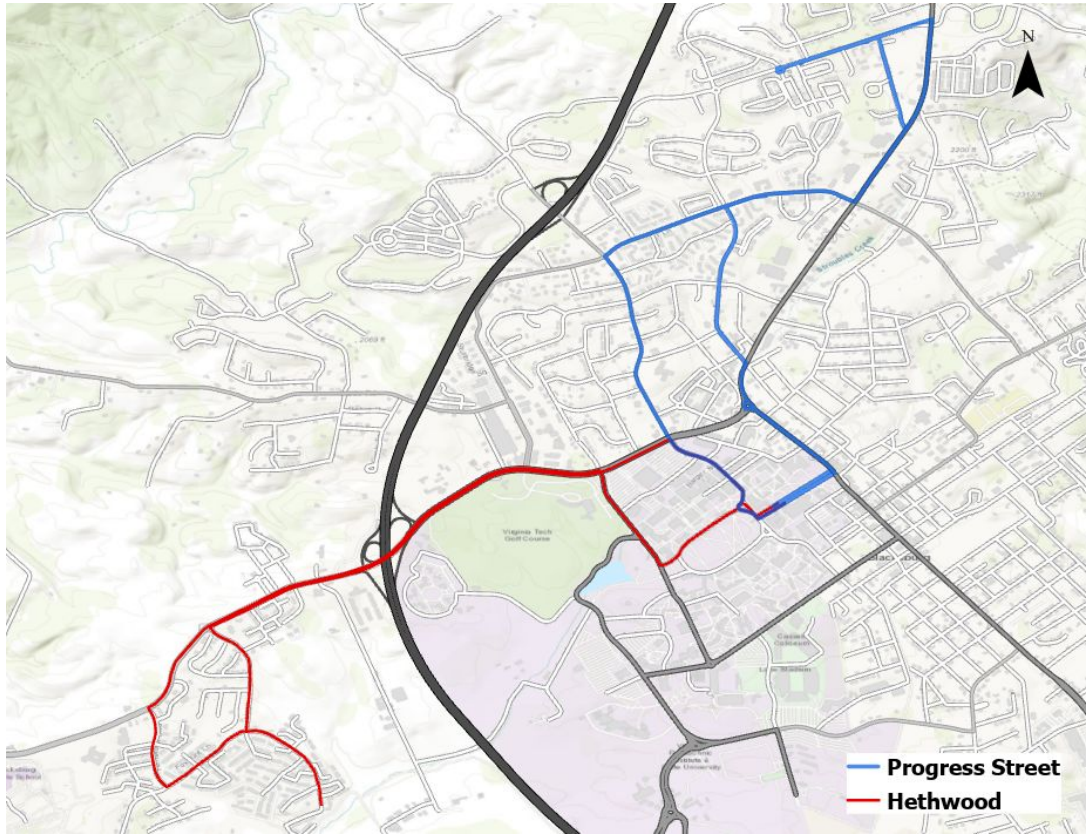
Blacksburg Transit Expansion Bus Purchase

Salem District - Round 2

Information from SMART SCALE APPLICATION

- Purpose: This project added two 60-ft articulated buses to the Blacksburg Transit (BT) fleet. The 60-ft buses are able to carry 54% more passengers than a standard 40-ft bus. Adding more capacity to the vehicle fleet is part of BT's strategy to meet growing needs, along with an aggressive program to hire additional operators.

- Area Type C
- Total Project Cost $1,928,250
- Total SMART SCALE Request $1,928,250



https://paptprd.blob.core.windows.net/scorecards/F2-0000001394-R02.PDF

Blacksburg Transit Expansion Bus Purchase

Salem District

Information from Scorecard

- Project Benefit Score: 2.3
- Statewide Rank*: 64/404
- District Rank*: 12/50

Primary Benefit: Improve congestion by increasing transit ridership, increase accessibility to jobs

Congestion Mitigation		Safety		Accessibility			Economic Development			Environment		Land Use
Increase in Peak Period Person Throughput	Reduction in Peak Period Delay	Reduction in Fatal and Injury Crashes	Reduction in Fatal and Injury Crash Rate	Increase in Access to Jobs	Increase in Access to Jobs for Disadvantaged Populations	Increase in Access to Multimodal Travel Choices	Square Feet of Commercial/Industrial Development Supported	Tons of Goods Impacted	Improvement to Travel Time Reliability	Potential to Improve Air Quality	Other Factor Values Scaled by Potential Acreage Impacted	Support of Transportation-Efficient Land Development
354.0	0.4	14.3	0	0	0	1,770.0	0	19,935.4	0	354.0	2.1	
thousand persons	thousand person hrs.	EPDO	EPDO / 100M VMT	jobs per resident	jobs per resident	adjusted users	thousand adj sq. ft.	thousand adj daily tons	adj. buffer time index	adjusted points	tscaled points	adjusted jobs & pop.

Blacksburg Transit Expansion Bus Purchase

Salem District

Before-After Analysis Periods

- Before Period: 01/2016 – 12/2016
- After Period: 01/2019 – 12/2019

Primary Benefits

- Increase in transit ridership exceeded projections on both routes
- Progress Street – actual increase of 17% compared to projected increase of 6%
- Hethwood – actual increase of 114% compared to a projected increase of 6%

Progress Street		
Calendar Year	Avg Weekday Ridership (Projected)	Avg Weekday Ridership (Actual)
2016	N/A	2835
2017	2892	2647
2018	2950	2954
2019	3009	3303

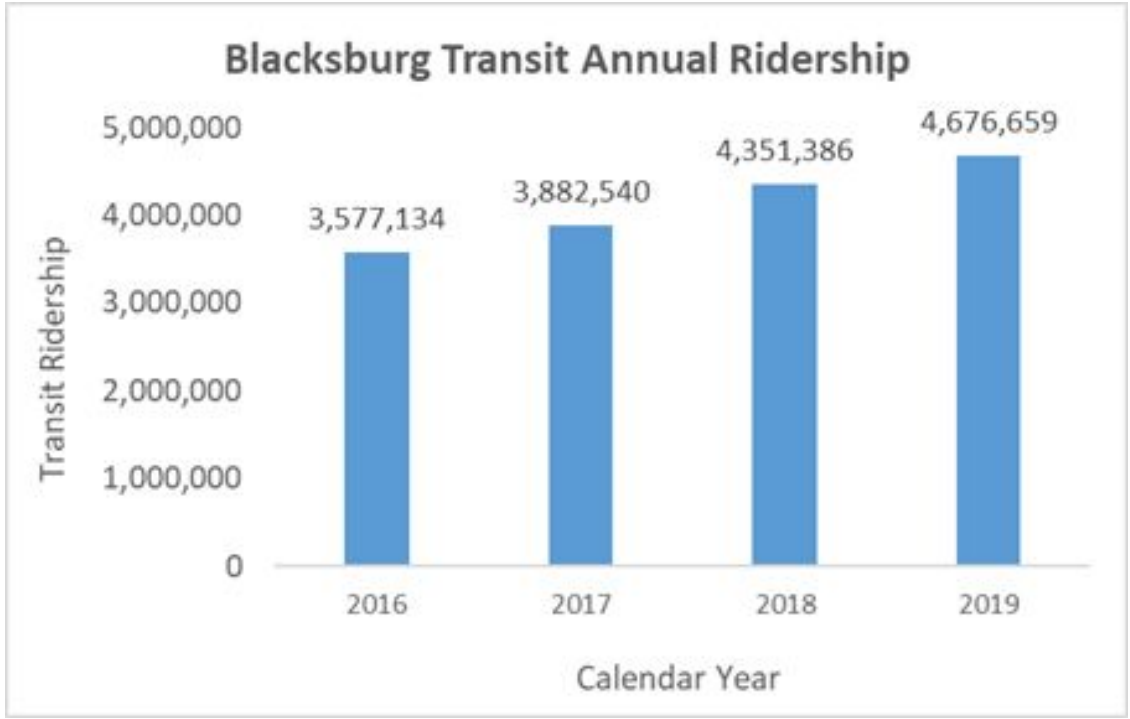
Hethwood		
Calendar Year	Avg Weekday Ridership (Projected)	Avg Weekday Ridership (Actual)
2016	N/A	2279
2017	2325	3937
2018	2371	4368
2019	2418	4869

Blacksburg Transit Expansion Bus Purchase

Salem District

Additional Benefits

- BT has increased the passenger capacity with the addition of 60-ft articulated buses
- Combined average ridership increased by over 3,000 boardings per day from 2016 to 2019 on transit routes that share corridors with Hethwood and Progress Street Routes
- BT system ridership increased 31% over forecasted period
- BT can provide more efficient service with the same (or fewer) bus operators
- Increased access to jobs and jobs for disadvantaged populations



Next Steps - Phase 2

- Develop process recommendations for Board consideration
  - Frequency of analysis
  - Timing, etc.
- Identify additional projects for testing
  - Validate and refine methodology as needed
- Assess project impacts relative to identified VTrans needs
- Consider measures for other Factor areas
- Develop tools for automation where possible

Questions?