VDOT

Virginia's SMART SCALE and VDOT's Accessibility Tool

2022
Conference on Performance-Based
Management, Planning, and Data
AASHTO

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The Virginia Context and SMART SCALE

The Virginia Context and SMART SCALE

- High-density urban areas and low-density rural areas
- SMART SCALE evaluates projects of all modes, statewide
- Office of Intermodal Planning and Investment (OIPI) oversees SMART SCALE
- VDOT handles scoring for the Accessibility factor

APPLICANTS
MPOs/PDCs, Transit Agencies, Cities, Towns, Counties, and CTB (up to two per CTB Policy)
Applicants can bring $0 or leverage any amount (impacts SMART SCALE score)

MULTI-MODAL PROJECTS
Highway, Bike & Ped, Transit, Rail, TDM (examples Park and Ride and Vanpooling) are scored together
Capital Improvement Program – Not a Maintenance Program

FULLY FUND PROJECTS
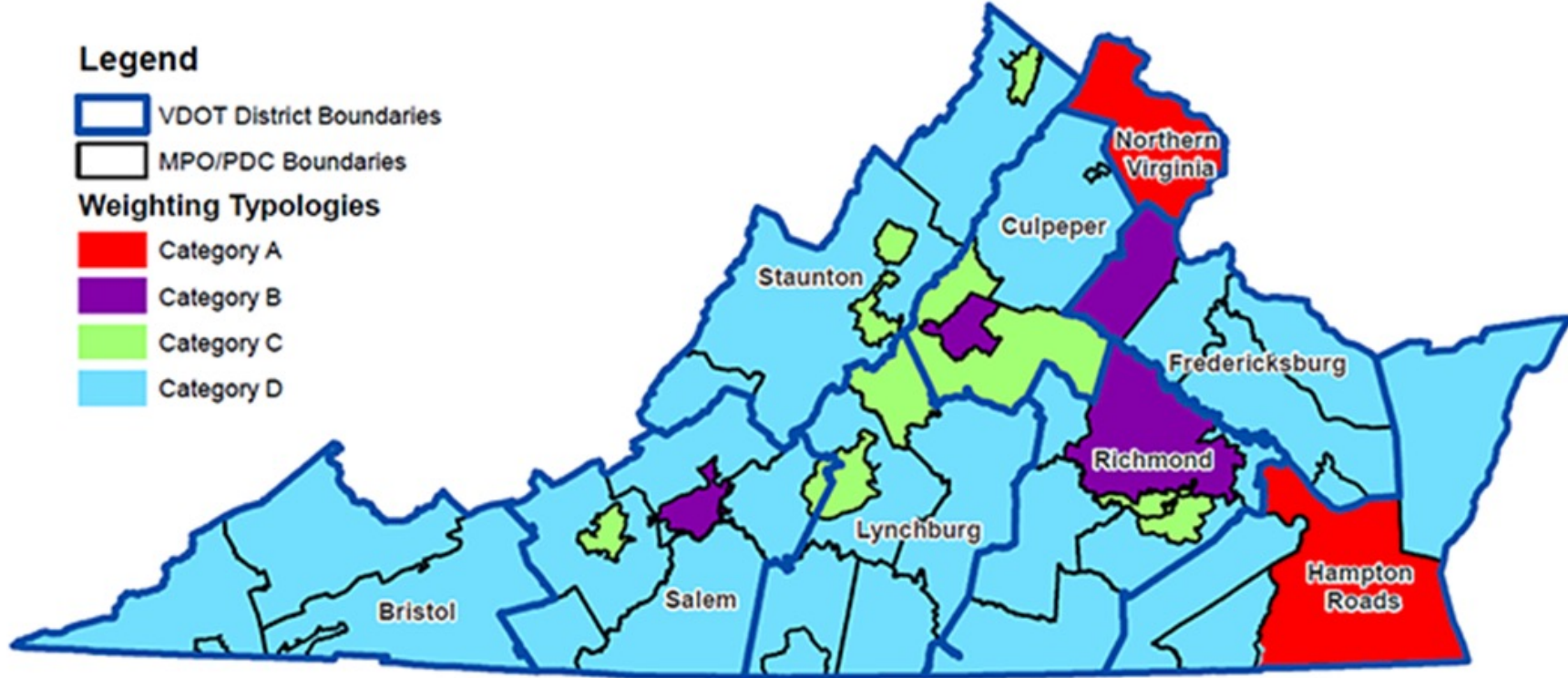Two-Year Cycle, first funds are available in the fifth year of SYIP

APPLICANT SUPPORT
OIPI, VDOT, and DRPT support the applicants through the process
Planning programs like Project Pipeline and STARS target need and readiness

SMART SCALE: Multi-modal Evaluation Factors

- **Safety** – reduce the number and rate of fatalities and severe 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 goods movement

- **Environmental Quality** – improve air quality and avoid impacts to the natural environment

- **Land Use** – support transportation-efficient land development patterns

SMART SCALE: Multi-modal Evaluation Factors

Factor	Congestion Mitigation	Economic Development	Accessibility	Safety	Environmental Quality	Land Use
Category A	45%[b]	5%	15%	5%	10%	20%[a]
Category B	15%	20%	20%	20%	10%	15%[a]
Category C	15%	25%	15%	25%	10%	10%
Category D	10%	30%	10%	30%	10%	10%

SMART SCALE: Cost Effectiveness

- State law requires that benefits produced by a project be analyzed **on a basis of relative costs**

- Results are provided to Commonwealth Transportation Board based on:
  - Benefits relative to funding requested
  - Benefits relative to total costs

$$\text{Overall SMART SCALE Score} = \frac{\text{Benefits}}{\text{Requested \$}}$$

SMART SCALE: Accessibility Measures

The Accessibility measures evaluate how the project addresses household **access to jobs** and to **multiple mode choices**.

- A1 (60%): Change in **average job accessibility** within 45 minutes (within 60 minutes for transit projects).
    - Assesses the average change in access to employment opportunities

- A2 (20%): Change in average jobs accessibility for **disadvantaged populations** within 45 minutes (within 60 minutes for transit projects).
    - Uses the same accessibility tool as A1

- A3 (20%): Assessment of the project support for connections between modes and promotion of **multiple transportation choices.**
    - Assigns more points for projects that increase connections between modes, provide accessible and reliable transportation for all users, and support emergency mobility.

VDOT's Accessibility Tool

Accessibility Tool Development

- Goal: Evaluate and score accessibility with and without implementation of a particular project

- After proof of concept tests, VDOT commissioned Caliper to develop accessibility tool for Round 4 of SMART SCALE analysis

- One common dataset is used for all modes

http://smartscale.org/documents/2020documents/technical-guide-2022.pdf

Accessibility Tool Development: Data

- **HERE datasets**
  - Streets (~ 2.5 million links) with congested speed estimates by hour, functional class, lanes, speed limits
  - Transit facilities
  - Walking and biking trails
  - Points of Interest (143,000): recreation, healthcare, schools, institutions

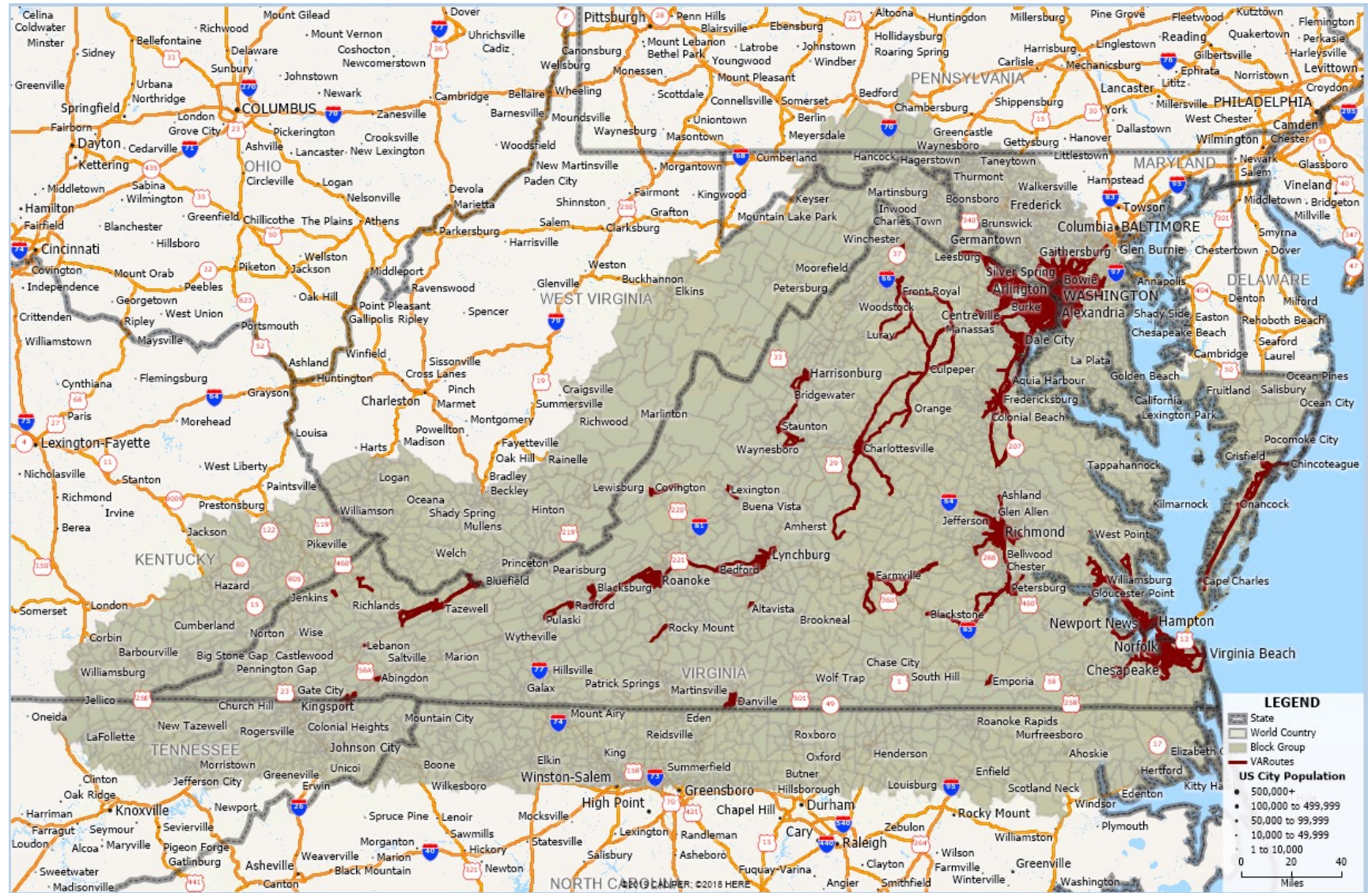- **Sidewalk and bike data (VDOT)**

- **Demographics**
  - Blocks (263,000)
  - Block Groups (10,602)
  - Population, Employment, Disadvantaged Population, Resident Workers (2025, 2030, 2035, other years) (from VDOT)

- **GTFS Datasets (DRPT)**
  - 15 fixed route transit operators
  - GTFS Routes conflated onto HERE streets
  - Schedules used to estimate headways and stop-to-stop and overall runtimes

Accessibility Tool Development: Data

Modeling Area with Transit Routes

Accessibility Tool Development: Modeling

- Program was developed using GISDK within TransCAD Version 9
  - Accessibility Models
  - Accessibility Visualizer

- Base and Project skimming (block-to-block; block group-to-block group)

- Base and Project accessibility calculation
  - Total employment accessibility to block/block group
  - Auto, Transit, Walk modes
  - Work (employment) and non-work (POI) accessibilities

- Project vs. Base accessibility differences
  - Different population and employment weights
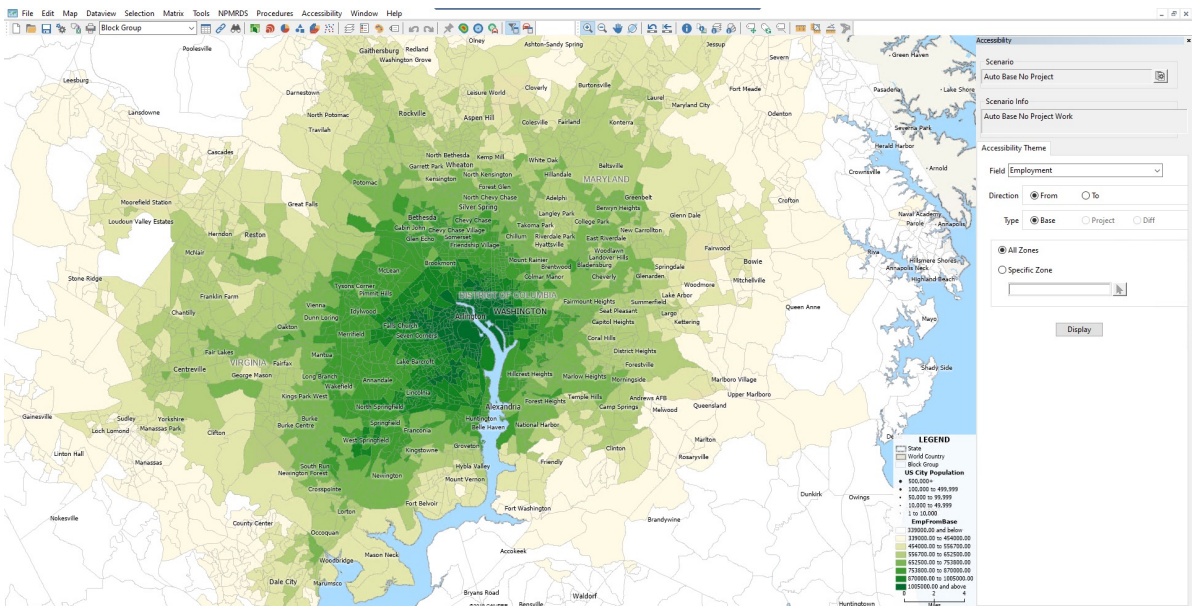 - Result is project's Accessibility score input to SMART SCALE

Accessibility Tool Visualizer

- Visualize accessibilities by block/block group and project
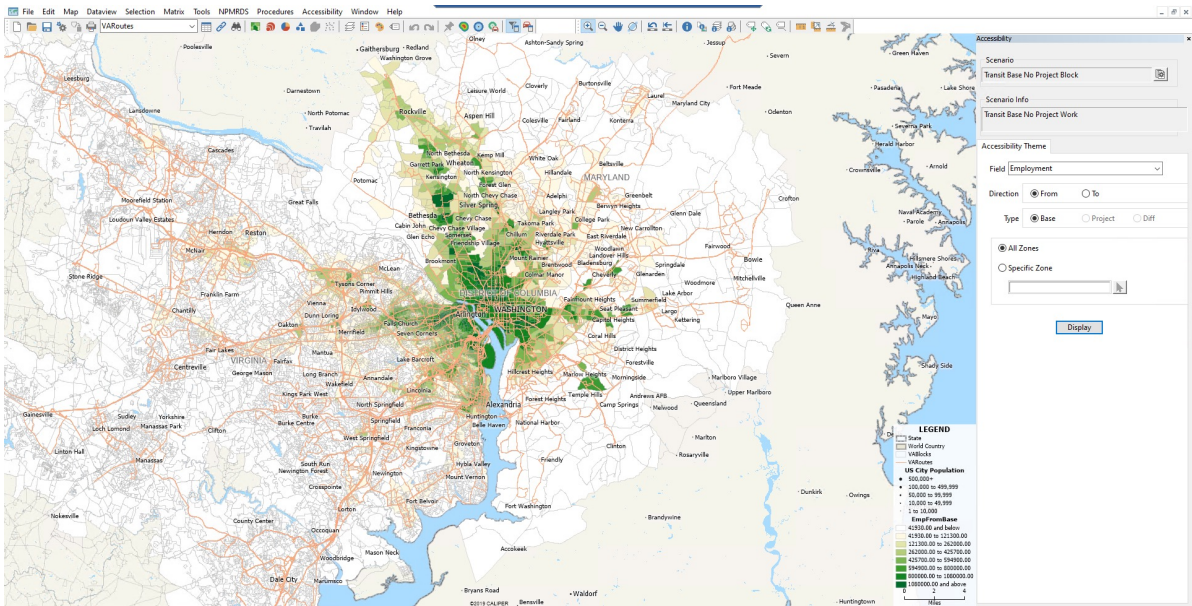
- Employment, Resident Workers, and POI accessibilities from, to zone

- Walk scores

- Project vs. Base differences

- Auto, Transit, Walk accessibilities

- Toolbox control

Accessibility Tool Visualizer

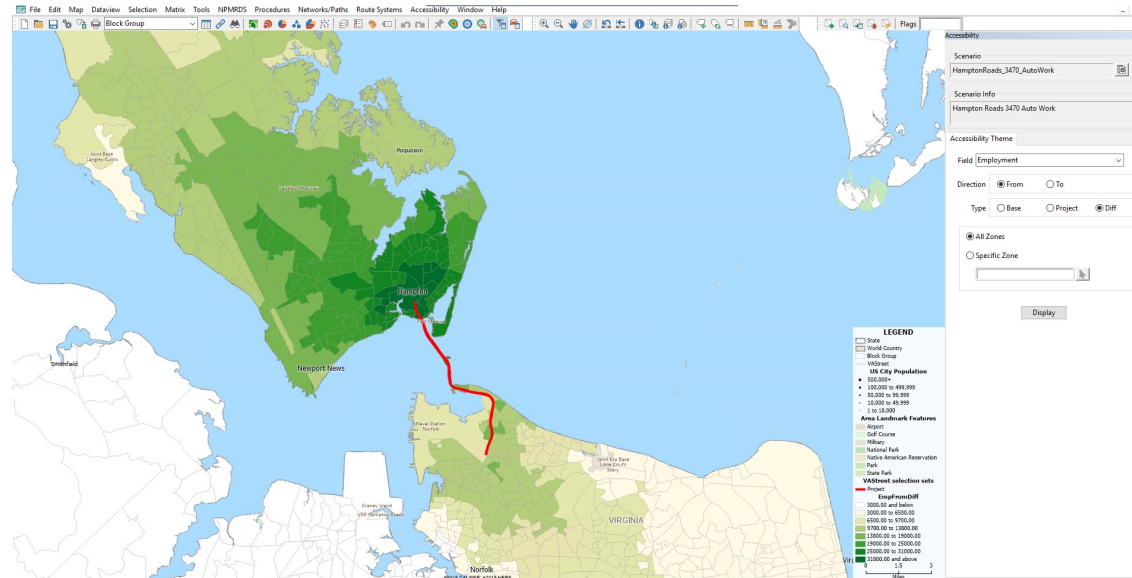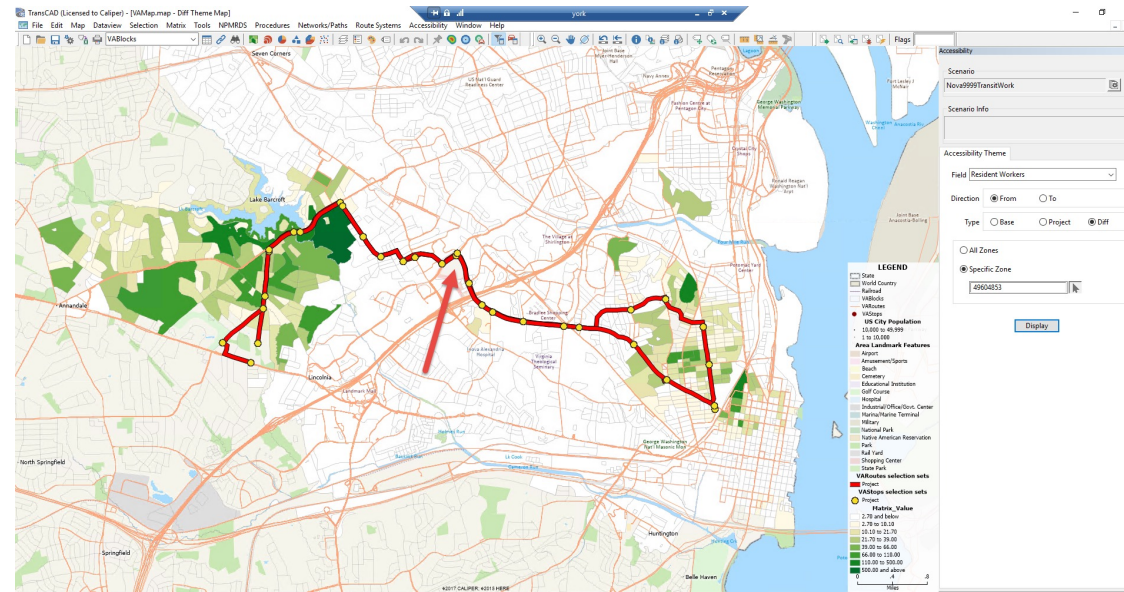**Auto accessibilities**

Transit Accessibilities

Accessibility Tool Visualizer
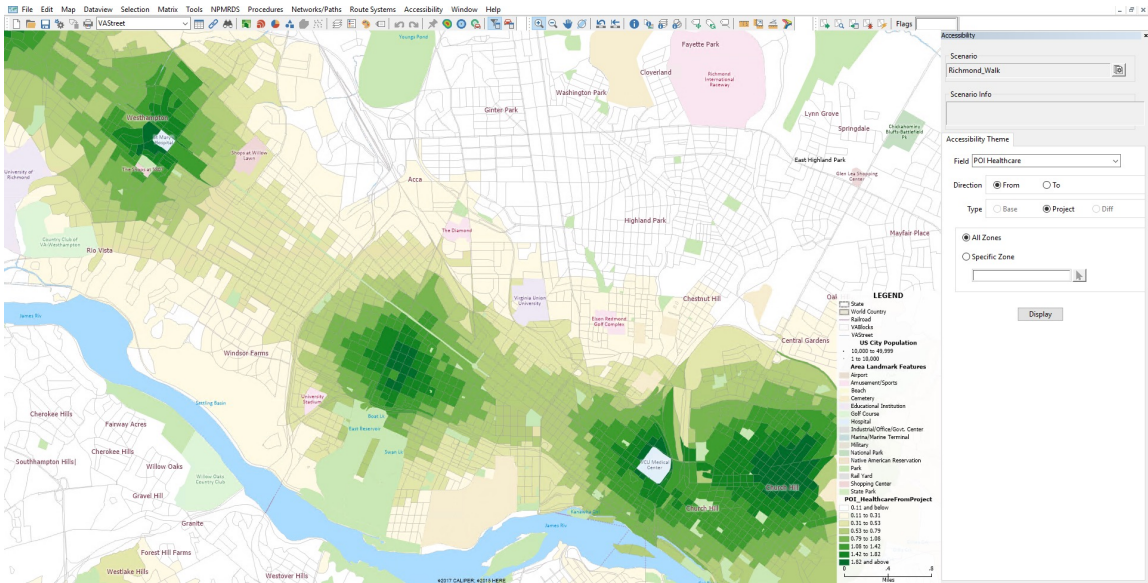
Project minus base accessibility differences

Zonal accessibilities

Accessibility Tool Visualizer

Accessibilities to Health Care

Walk Scores

Applying the Accessibility Tool

- Project-level analysis: pre- vs. post-construction accessibility

- Inputs

Project Input	Description	Sources
Project Limit	The area that would receive an accessibility benefit from the project improvement	Project description and sketch
Auto	Congested speed for base/project scenarios	SMART SCALE Congestion Analysis
Walk & Bike	Ped/Bike LOS value of walk/bike facilities for base/project scenarios	Project description, Google Maps and pre-defined look-up table
Transit	Transit improvement (change in headway, route run time, relocating bus stop, new route etc.)	Project description and sketch

- Output: Number of additional jobs accessible during the AM peak after project implementation

  - A1 Score: Access to Jobs

  - A2 Score: Access to Jobs for disadvantaged populations

Applying the Accessibility Tool: Walk mode (Proj. 6655)

Project ID	Description	Street	From Location	To Location
6655	The Hey Road corridor improvements will include sidewalks on both sides of the roadway.	Hey Rd	Hull Street Road	Walmsley Blvd

- Step 1. Determine the project location, project limit and the type of improvement based on project sketch
- Step 2. Check the type of the adjacent roadway facility in terms of functional class, number of lanes, and travel speed via Google Maps
- Step 3. Check the Pedestrian Level of Service (LOS) value via the lookup table
- Step 4. Code the LOS value for base/project conditions on selected project links in the scoring tool
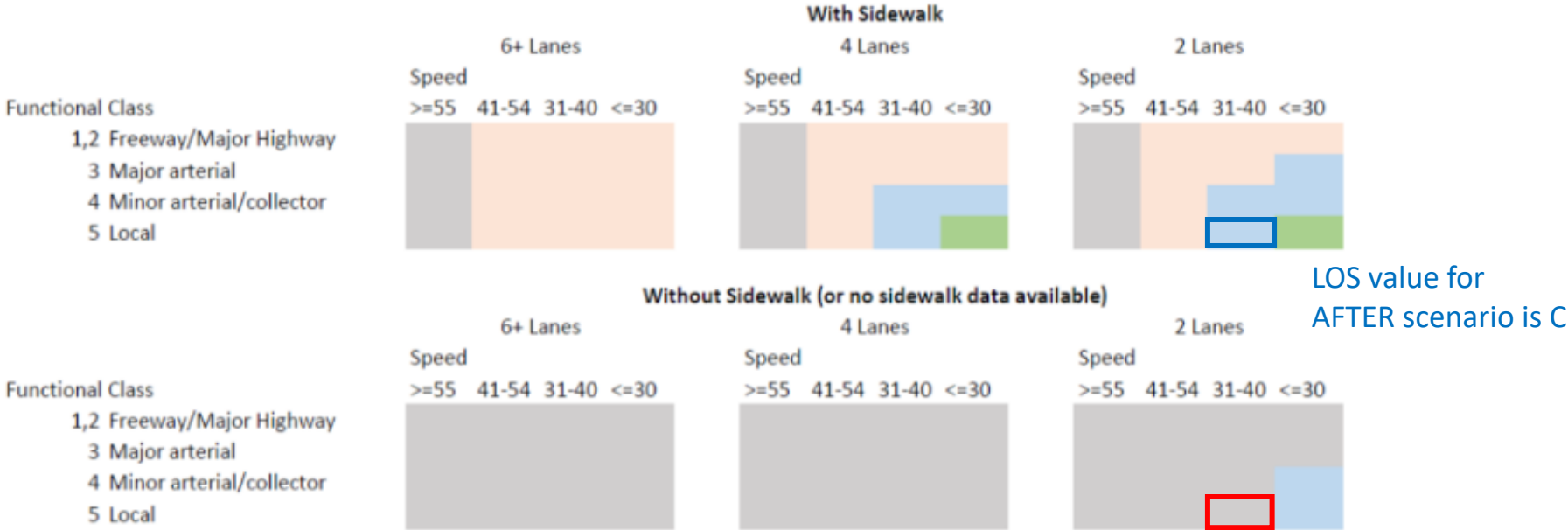- Step 5. Run the tool to obtain Accessibility scores

- Functional Class: 5 (local)
- Number of Lanes: 2
- Speed Limit: 35 mph

18

Applying the Accessibility Tool: Walk mode (Proj. 6655)

Bike and Pedestrian Notes:
Zone type: Blocks

With Sidewalk

Functional Class	6+ Lanes Speed				4 Lanes Speed				2 Lanes Speed			
	>=55	41-54	31-40	<=30	>=55	41-54	31-40	<=30	>=55	41-54	31-40	<=30
1,2 Freeway/Major Highway												
3 Major arterial												
4 Minor arterial/collector												
5 Local												

LOS value for AFTER scenario is C

Without Sidewalk (or no sidewalk data available)

Functional Class	6+ Lanes Speed				4 Lanes Speed				2 Lanes Speed			
	>=55	41-54	31-40	<=30	>=55	41-54	31-40	<=30	>=55	41-54	31-40	<=30
1,2 Freeway/Major Highway												
3 Major arterial												
4 Minor arterial/collector												
5 Local												

LOS value for BEFORE scenario is E

Key	Speed	LOS
Prohibited	0.0 MPH	
Available	1.5 MPH	E
Low	2.4 MPH	D
Medium	2.7 MPH	C
High	3.0 MPH	B
		A

Results:
A1: 0.43
A2: 0.51

Applying the Accessibility Tool: Walk mode (Proj. 6655)

Zonal Accessibility Improvement for Project 6655

LEGEND

State
World Country
Railroad
VABlocks
VAStreets

US City Population
· 10,000 to 49,999
· 1 to 10,000

VAStreets selection sets
━━ Project

EmpFromDiff
0.36 and below
0.36 to 1.30
1.30 to 4.00
4.00 to 10.00
10.00 to 20.00
20.00 to 30.00
30.00 to 40.00
40.00 and above

0   .2   .4
Miles

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SMART SCALE Website - https://smartscale.org
SMART Portal - https://smartportal.virginiahb2.org
Project Pipeline - https://vaprojectpipeline.org
VTrans Statewide Multimodal Plan - www.vtrans.org

Compliments or technical questions about accessibility scoring: **Ying (Winnie) Xiong, Transportation and Mobility Planning Division, ying.xiong@vdot.virginia.gov**

Heckling, rants, and complaints: **Peter Ohlms, AICP, Virginia Transportation Research Council, peter.ohlms@vdot.virginia.gov**
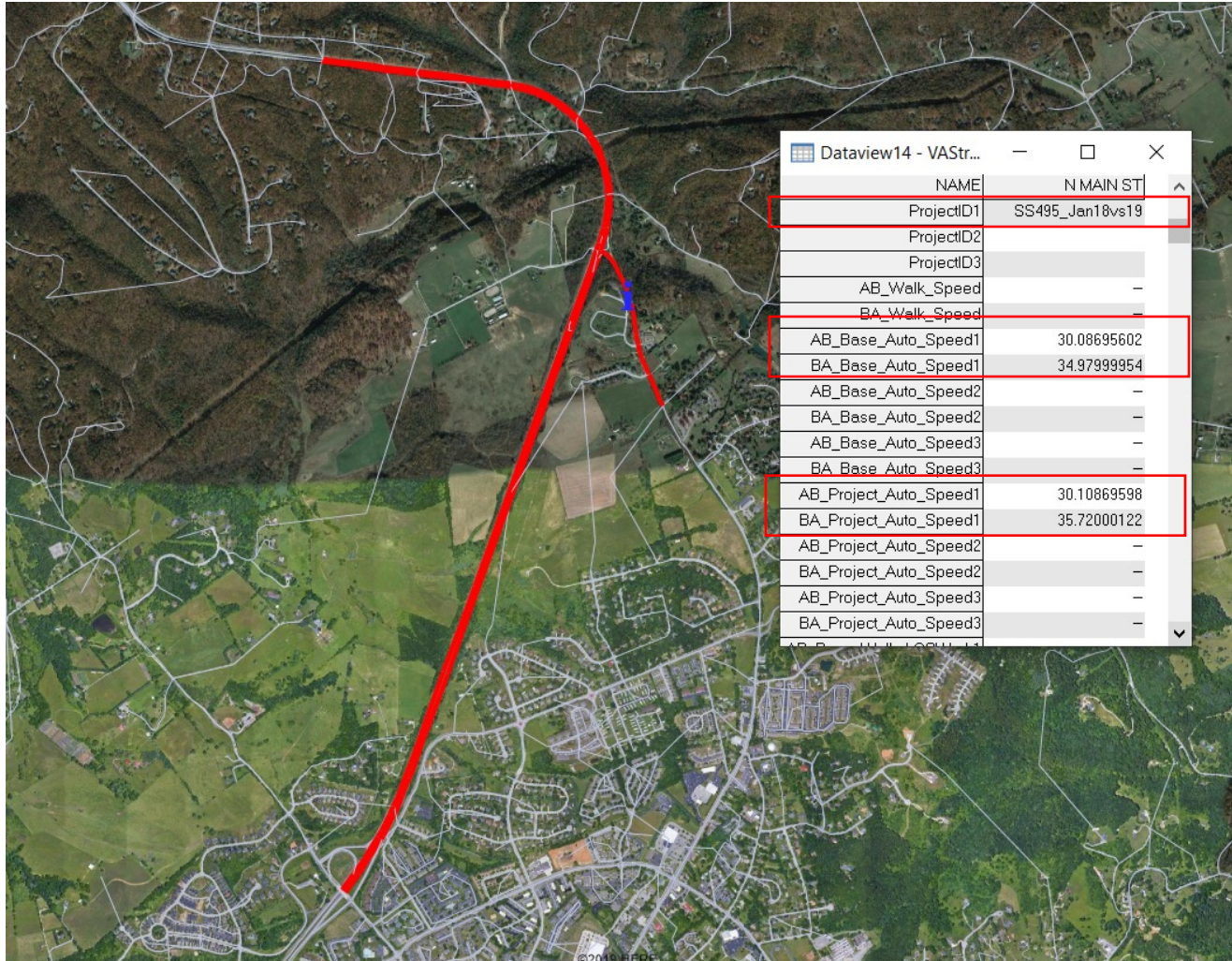
Extra Demo Slides

Demo 1. Auto mode – Project 495

Project ID	CN Period	Description	Speed Data Source	Data Period	Day of the week	Time of the day
495	02/27/2018 - 10/26/2018	North Main Intersection Improvements at 460 Bypass	Inrix	Before: Jan 2018 After: Jan 2019	Weekday (Mon – Fri)	AM peak (7-9am)

- Step 1. Select the Project Limit based on the project sketch

- Step 2. Get the hourly speed information for segments within the Project Limit for both BEFORE and AFTER scenarios from INRIX

- Step 3. Calculate average speed for the required time slot

- Step 4. Code the speed information as base/project speed in the accessibility scoring tool

- Step 5. Run the tool to obtain Accessibility scores
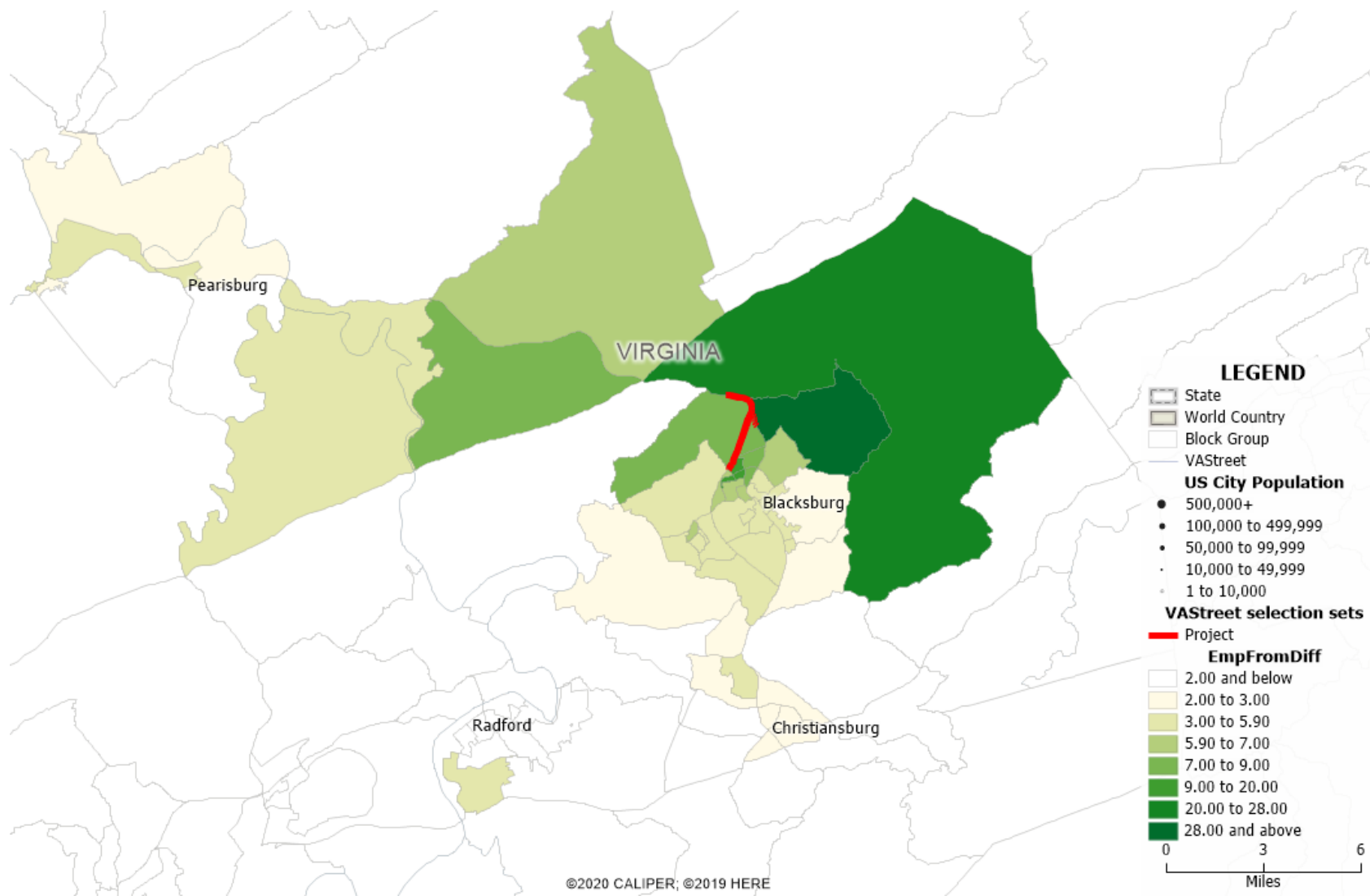
Demo 1. Auto mode – Project 495

Results:

A1: 0.94

A2: 1.30

Demo1. Zonal Accessibility Improvement for project 495

LEGEND

- State
- World Country
- Block Group
- VAStreet

US City Population
- ● 500,000+
- ● 100,000 to 499,999
- • 50,000 to 99,999
- · 10,000 to 49,999
- · 1 to 10,000

VAStreet selection sets
- ▬ Project

EmpFromDiff
- 2.00 and below
- 2.00 to 3.00
- 3.00 to 5.90
- 5.90 to 7.00
- 7.00 to 9.00
- 9.00 to 20.00
- 20.00 to 28.00
- 28.00 and above

0   3   6
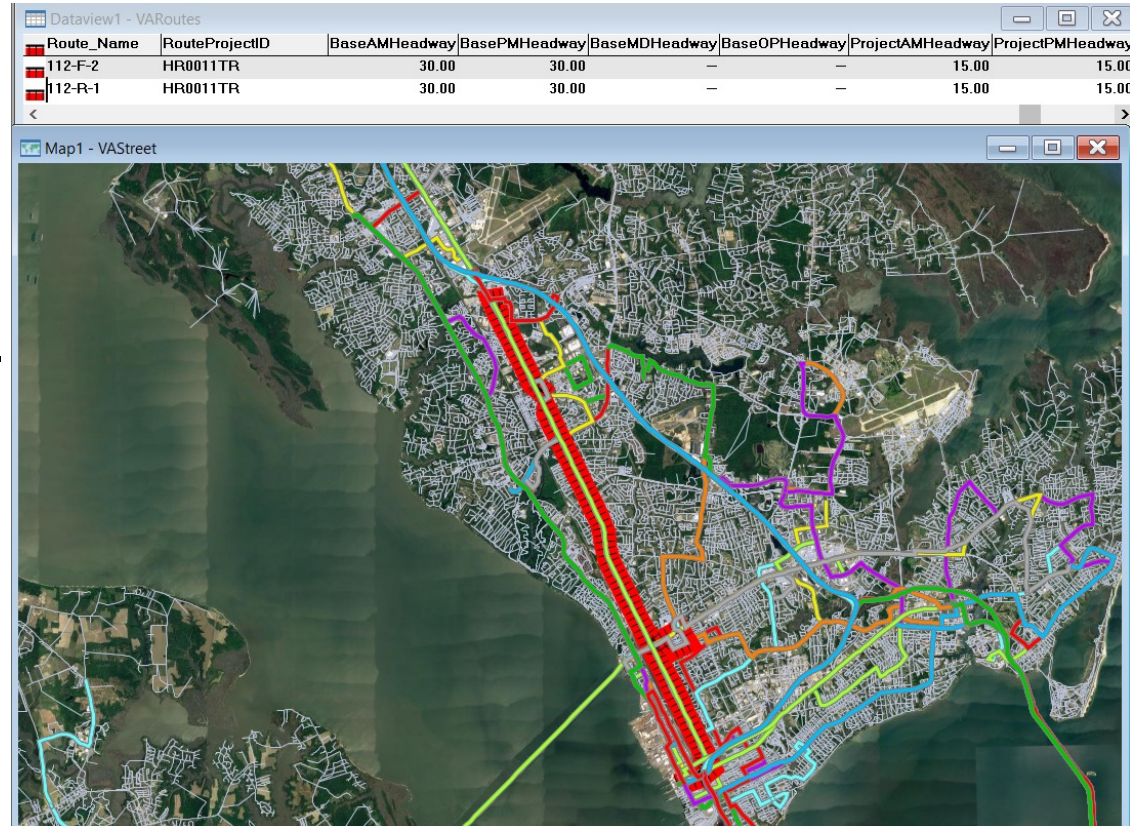Miles

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Demo 2. Transit mode

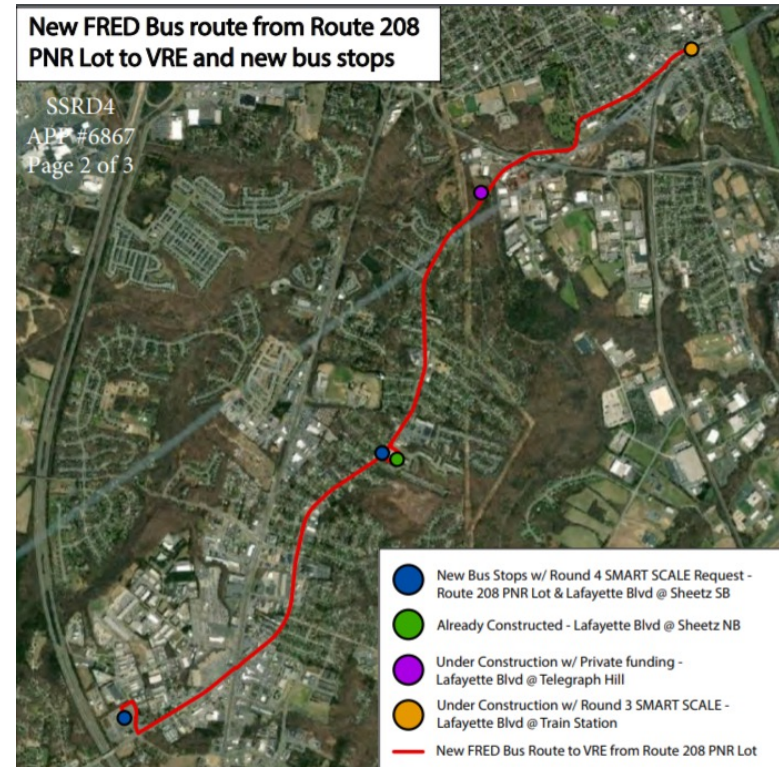| Types of Transit Improvements	Scoring Method
Change in Headway (Increase service frequency)	Code up headway information for base/project conditions
Change in Route Run Time (BRT)	Code up speed or route run time information for base/project conditions
Adding New Route	Adding new route with corresponding GTFS parameters in the Transit Network
Relocating Existing Stops / Adding New Stops	Duplicate the original route as a new route with relocated/new added stops. Only include new route in project condition and include the old route in base condition.

Demo 2A Transit mode – Project 3080 Change in Headway

- Newport News Route 112
- Increase peak frequency from 30-minutes to every 15 minutes
- Results:
- A1: 19.14
- A2: 19.52

Demo 2B Transit mode – Project 6867 Adding New Route

- New VRE Feeder Bus from Rte 208 P&R Lot to Fredericksburg AMTRAK/VRE Station

- Headway: 30 mins

- Stop-to-Stop run time is estimated based on Google travel time at 8:00 am

New FRED Bus route from Route 208 PNR Lot to VRE and new bus stops

SSRD4
APP #6867
Page 2 of 3

- New Bus Stops w/ Round 4 SMART SCALE Request - Route 208 PNR Lot & Lafayette Blvd @ Sheetz SB
- Already Constructed - Lafayette Blvd @ Sheetz NB
- Under Construction w/ Private funding - Lafayette Blvd @ Telegraph Hill
- Under Construction w/ Round 3 SMART SCALE - Lafayette Blvd @ Train Station
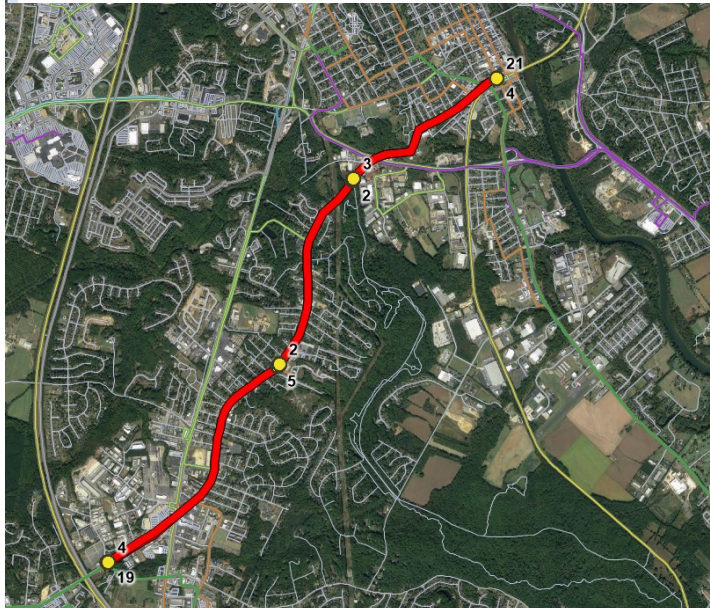- New FRED Bus Route to VRE from Route 208 PNR Lot

Demo 2B Transit mode – Project 6867 Adding New Route

Dataview4 - Routes

Route_Name	RouteProjectID	BaseAMHeadway	ProjectAMHeadway	IncludeRouteInBase	IncludeRouteInProject	BaseRouteRunTime
New FRED Route NB	FredericksburgAreaMPO_6867_Transit	—	30.00	0	1	—
New FRED Route SB	FredericksburgAreaMPO_6867_Transit	—	30.00	0	1	—

Dataview3 - RoutesAndStops

VAStops.Route_ID	Route_Name	Milepost	STOPDIST	BaseStopRunSpeed	ProjectStopRunSpeed	BaseStopRunTime	ProjectStopRunTime
12421	New FRED Route NB	0.01	1.86	—	—	—	4.00
12421	New FRED Route NB	1.87	1.40	—	—	—	2.00
12421	New FRED Route NB	3.27	1.25	—	—	—	3.00
12421	New FRED Route NB	4.53	—	—	—	—	21.00
12422	New FRED Route SB	0.00	1.26	—	—	—	4.00
12422	New FRED Route SB	1.26	1.41	—	—	—	2.00
12422	New FRED Route SB	2.67	1.86	—	—	—	5.00
12422	New FRED Route SB	4.53	—	—	—	—	19.00

Results:
A1: 2.49
A2: 2.85

Demo 2B Zonal Accessibility Improvement for project 6867