Accessibility Tool To Support VDOT's Smart Scale Project Prioritization Process

Ying (Winnie) Xiong, VDOT
Jim Lam, Caliper Corporation

Outline

- Motivation for Tool Development
- Development of Accessibility Tool
- Accessibility Models and Results
- Accessibility Tool Visualization
- Live Demonstration
- Application of the Accessibility Tool

Motivation for Tool Development

- Accessibility scoring one step of VDOT's SMART SCALE process evaluating transportation projects
- Evaluate and score accessibility with and without project implementation
- After proof of concept tests, VDOT advanced to develop accessibility tool for Round 4 of SMART SCALE analysis

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

Development of Accessibility Tool

Jim Lam
Caliper Corporation
1st June, 2021

Development of Accessibility Tool-Data

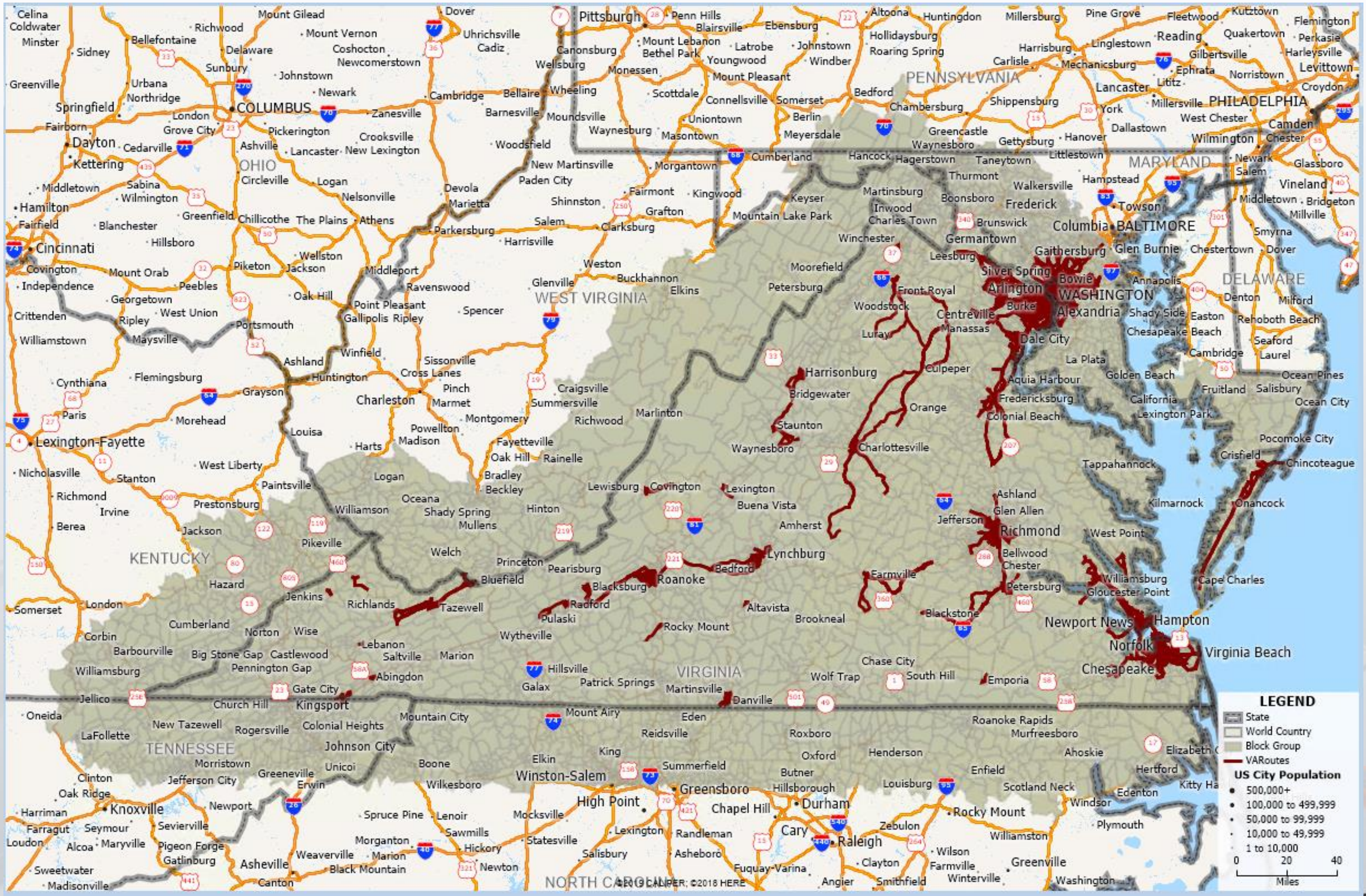
- **Analysis area: State of Virginia and 30 mile surrounding area**
- **Extraction of HERE datasets**
  - **Streets (~ 2.5 million links) with congested speed estimates by hour, functional class, lanes, speed limits**
  - **Transit facilities**
  - **Walking and biking trails**
  - **Sidewalk and bike data**
  - **Points of Interest (143,000)**
- **Demographic Areas**
  - **Blocks (263,000)**
  - **Block Groups (10,602)**
  - **Population, Employment, Disadvantaged Population, Resident Workers (2025, 2030, 2035, other years) provided by VDOT**

Development of Accessibility Tool-Data

- **GTFS Datasets**
  - **WMATA and major and minor transit operators in Virginia**
  - **15 total operators**
  - **GTFS Routes conflated onto HERE streets using import procedure**
  - **Schedules used to estimate route headways and stop-to-stop and overall runtimes**
  - **Special handling for subway, light rail, commuter rail, and ferry routes**
- **One common dataset is used for all modes.**

Development of Accessibility Tool-Data

- **Modeling Area with Transit Routes**



Development of Accessibility Tool-Program

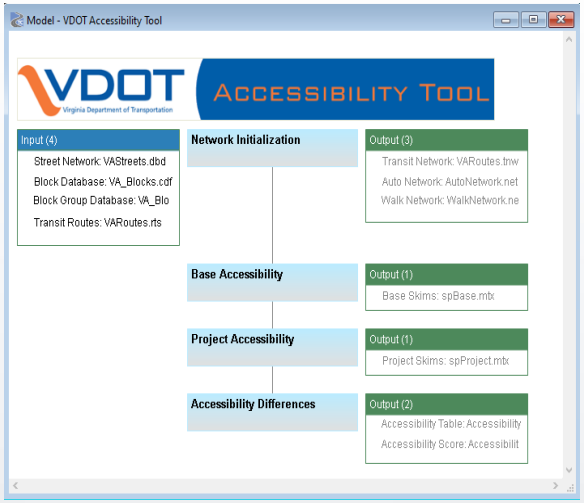
- Developed using GISDK within TransCAD Version 9
- Uses standard GISDK functions, macros, and procedures
- Flowchart manager
- Includes two components
  - Accessibility Models
  - Accessibility Visualizer
- ~4-5 month initial development time
  - 2 months update time for new HERE year, GTFS datasets, and new features

Accessibility Models

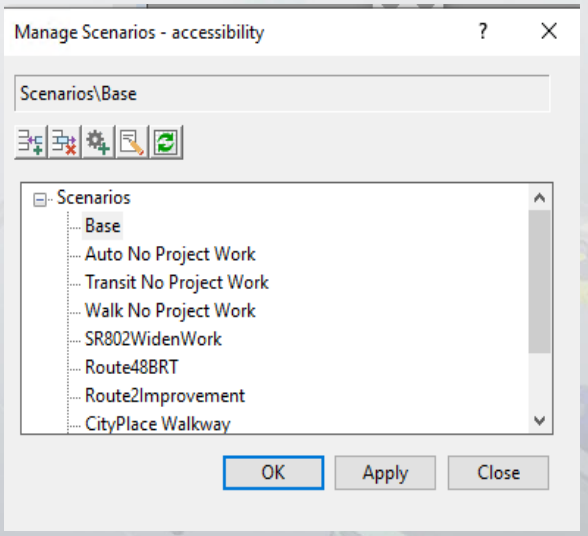
- **Base and Project skimming (block-to-block and block group-to-block group)**
- **Base and Project accessibility calculation**
  - **Total employment accessibility to Block/block group**
  - **Auto, Transit, Bike and Walk projects**
  - **Work (employment) and non-work (POI) accessibilities**
- **Project vs. Base accessibility differences**
  - **Different population and employment weights**
  - **Result is project score input to SMART SCALE**

Accessibility Models

- **Flowchart and visualization of inputs and outputs**

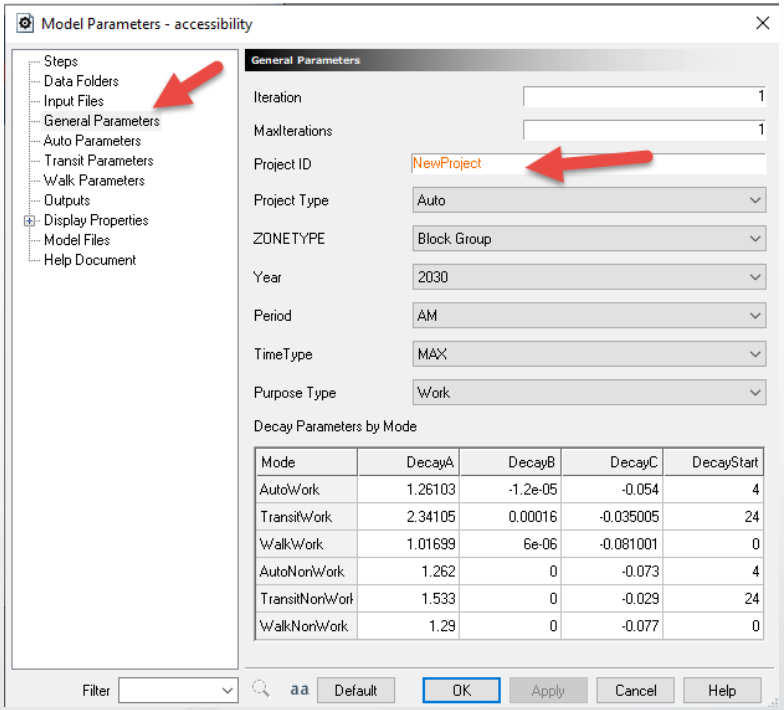


- **Scenario manager within flowchart to define and manage projects**

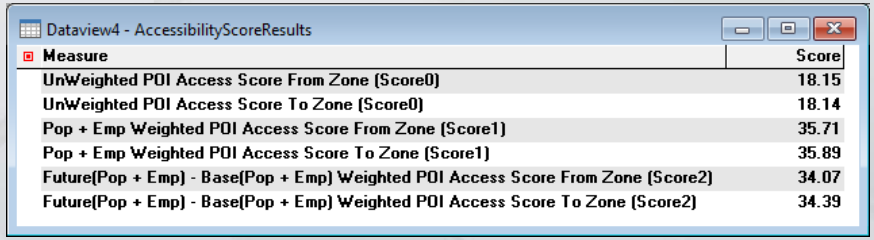


Accessibility Models

- **Project parameter manager**



- **Accessibility score results**

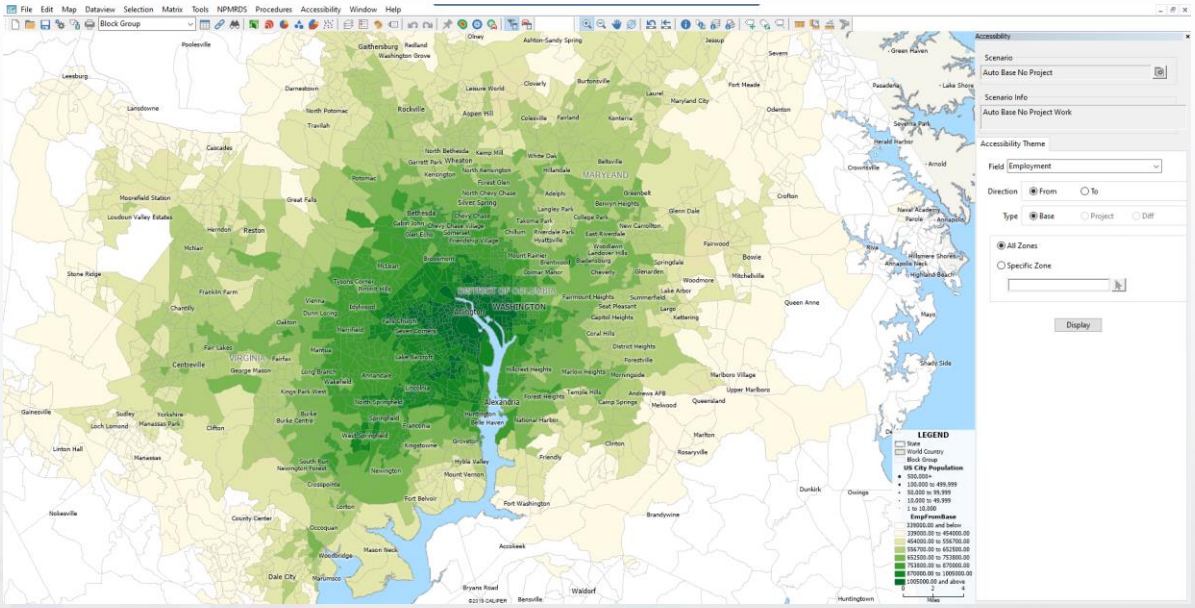


Accessibility Tool Visualizer

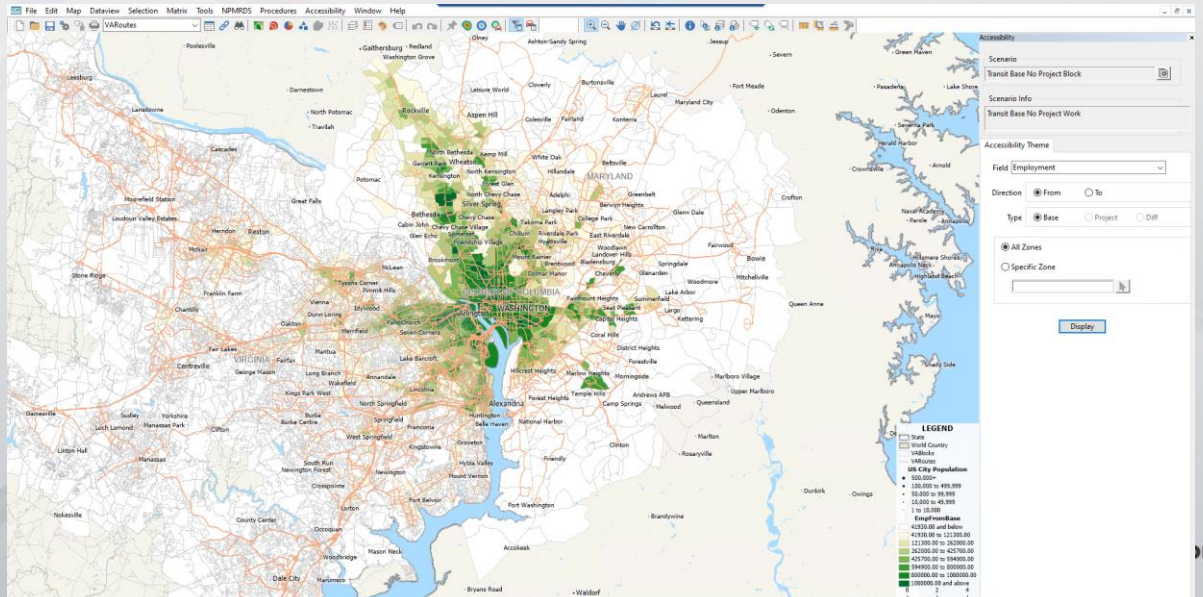
- Visualize accessibilities by block/block group and project
- Employment, Resident Workers, and POI accessibilities from and to zone
- Walk scores
- Project vs. Base differences
- Auto, Transit, Walk accessibilities
- Toolbox control

Accessibility Tool Visualizer

- **Auto accessibilities**

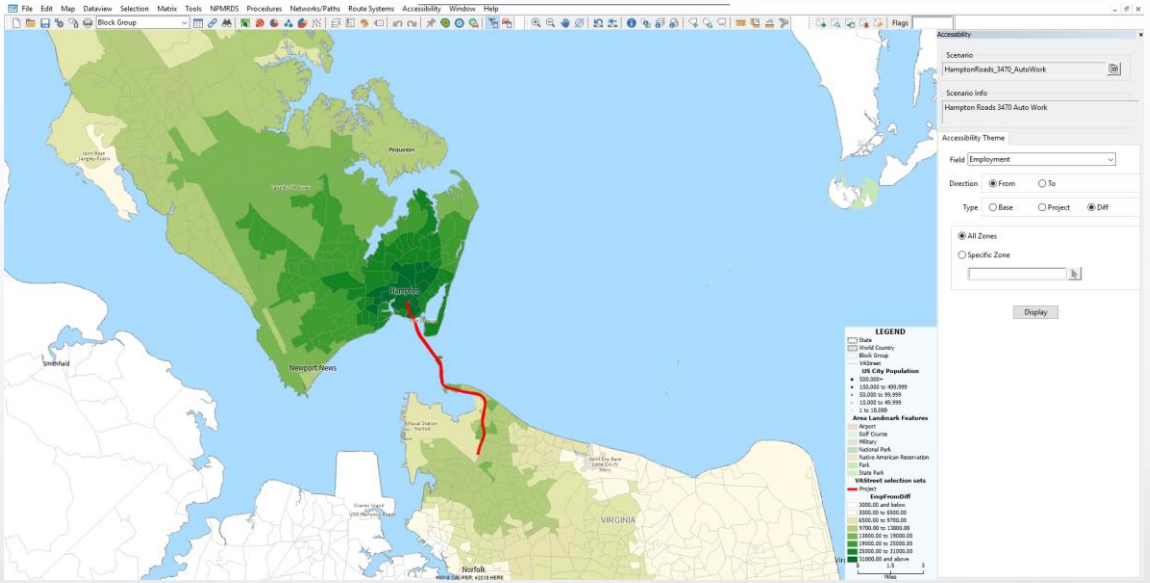


- **Transit Accessibilities**

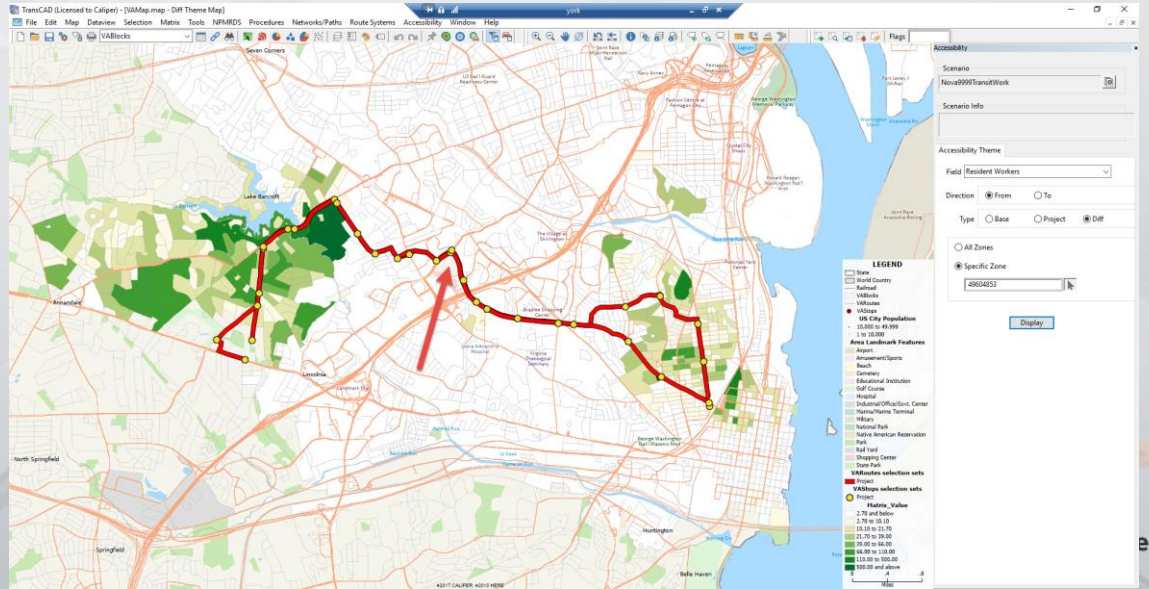


Accessibility Tool Visualizer

- **Project minus base accessibility differences**



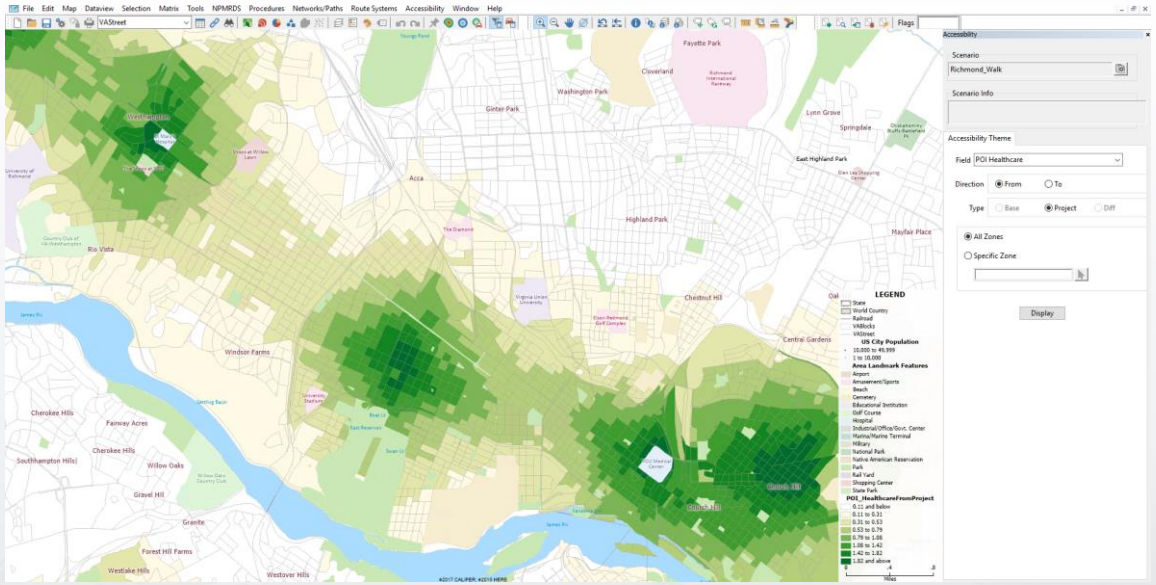
- **Zonal accessibilities**



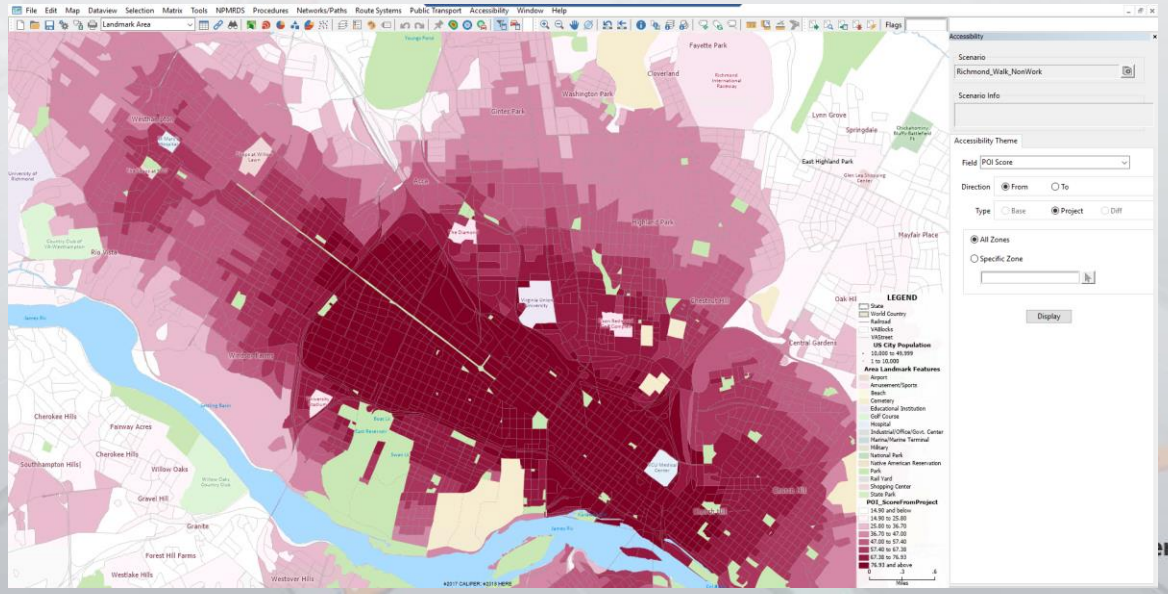
Caliper

Accessibility Tool Visualizer

- **Accessibilities to Health Care**



- **Walk Scores**



Caliper

Live Demo

Application of the Accessibility Tool

Ying (Winnie) Xiong

June 1, 2021

Where to Use the Tool

- Virginia's Smart Scale
  - Picking the right transportation projects for funding and ensuring the best use of limited tax dollars
  - Accessibility is one of the six factor areas that being utilized for quantifying the benefit of each project
- Corridor Improvement Plan: I-64, I-66, I-95 etc.
  - Accessibility benefit evaluation
- Performance Measure for Smart Scale
  - Statewide Accessibility Evaluation
  - Project-level Accessibility Evaluation

Data Sources

System Data	Description	Sources
Network speed data	Speed data	HERE Network
Land use data	Population and employment data (Census Block and Block Group)	MPO, Statewide Weldon Cooper Center population projected, InfoUSA, Woods & Poole
Walk & Bike network	Inventory of existing sidewalks, bike lanes, shared use path, crosswalk, Pedestrian signals	VDOT Maintained sidewalk and bike lane Inventory Map
Transit network	GTFS data (Transit Operator Localities)	Virginia DRPT

How the tool works

- Project Level Accessibility Analysis
  - Evaluate the difference between the accessibility scores for pre-construction period and post-construction period
  - Project type: Auto, Walk & Bike, Transit
- Input

Project Input	Description	Sources
Project Limit	The area that would receive accessibility benefit from the project improvement	Project description and sketch
Auto	Congested speed for base/project scenarios	• Congestion Analysis – SS and CIP projects • Inrix Roadway Analytics tool – Performance Measure Pilot study
Walk & Bike	LOS value of walk/bike facilities for base/project scenarios	Project description, google map 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

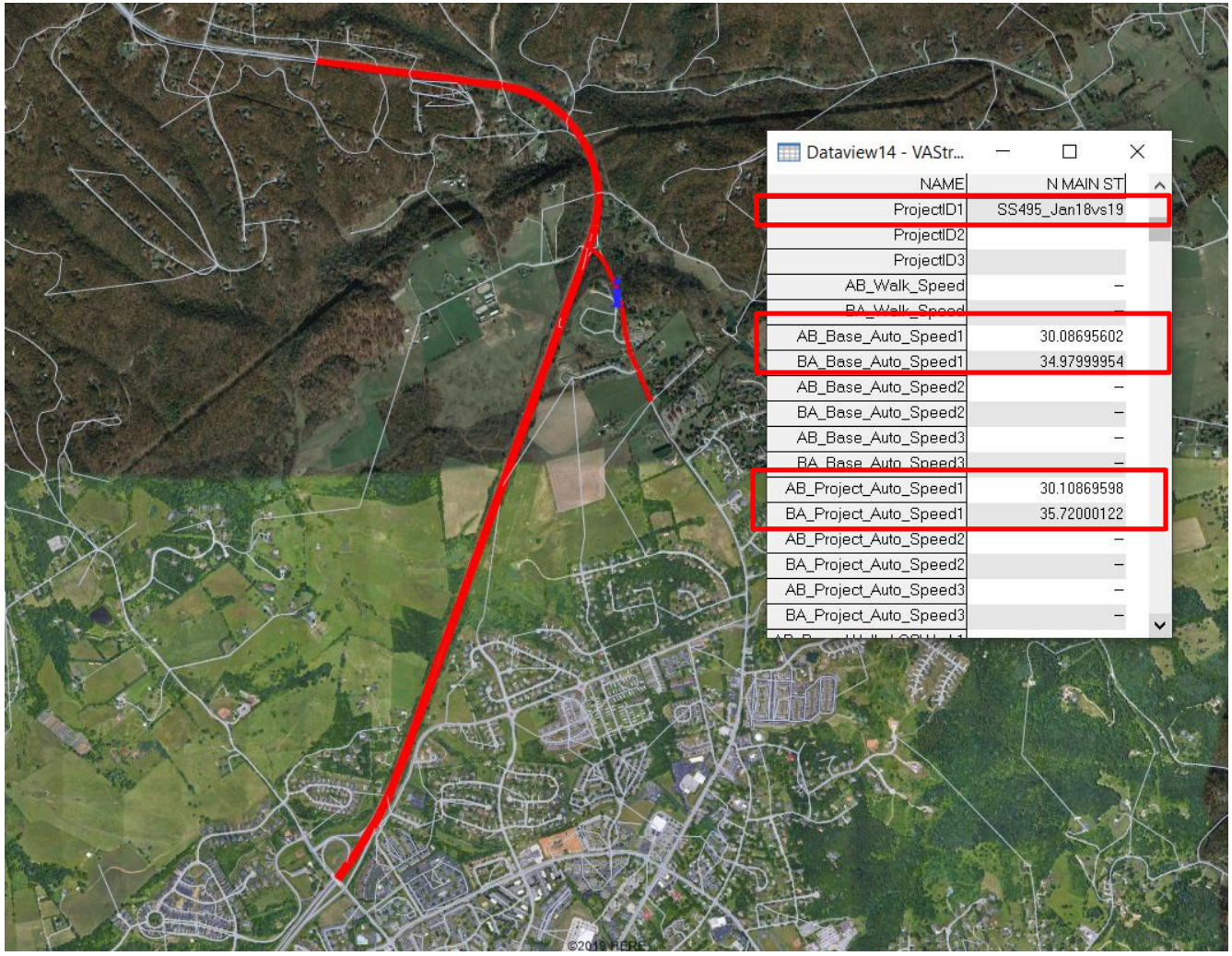
- Output: Number of additional jobs accessible during the AM peak after project implementation
  - A1 Score: Access to Jobs
  - A2 Score: Access to Jobs for disadvantaged populations (low-income, minority, or limited-English proficiency population)

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

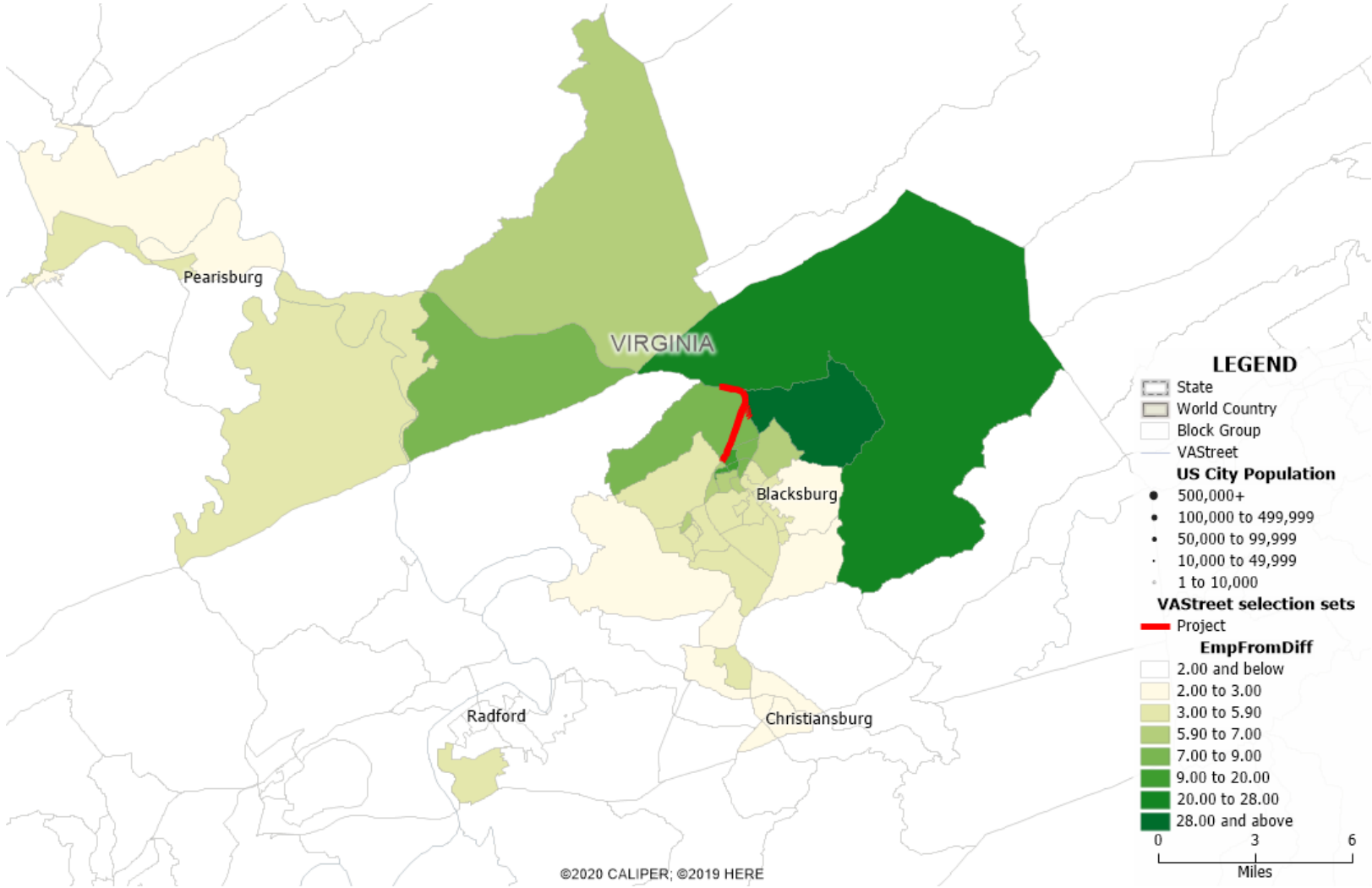


Results:

A1: 0.94

A2: 1.30

Demo1. Zonal Accessibility Improvement for project 495



Demo 2. Walk mode - Project 6655

Project ID	Description	Street Name	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 map or
- Step 3. Check the Level of Service (LOS) value via the Lookup table
- Step 4. Code up the LOS value for base/project conditions on selected project links in the scoring tool
- Step 5. Run the tool to obtain Accessibility scores

Demo 2. Walk mode - Project 6655

- Hey Road
  - Functional Class: 5
  - Number of Lanes: 2
  - Speed Limit: 35 mph

Demo 2. Walk mode - Project 6655

Bike and Pedestrian Notes:

Zone type: Blocks

LOS value for AFTER scenario is C

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:

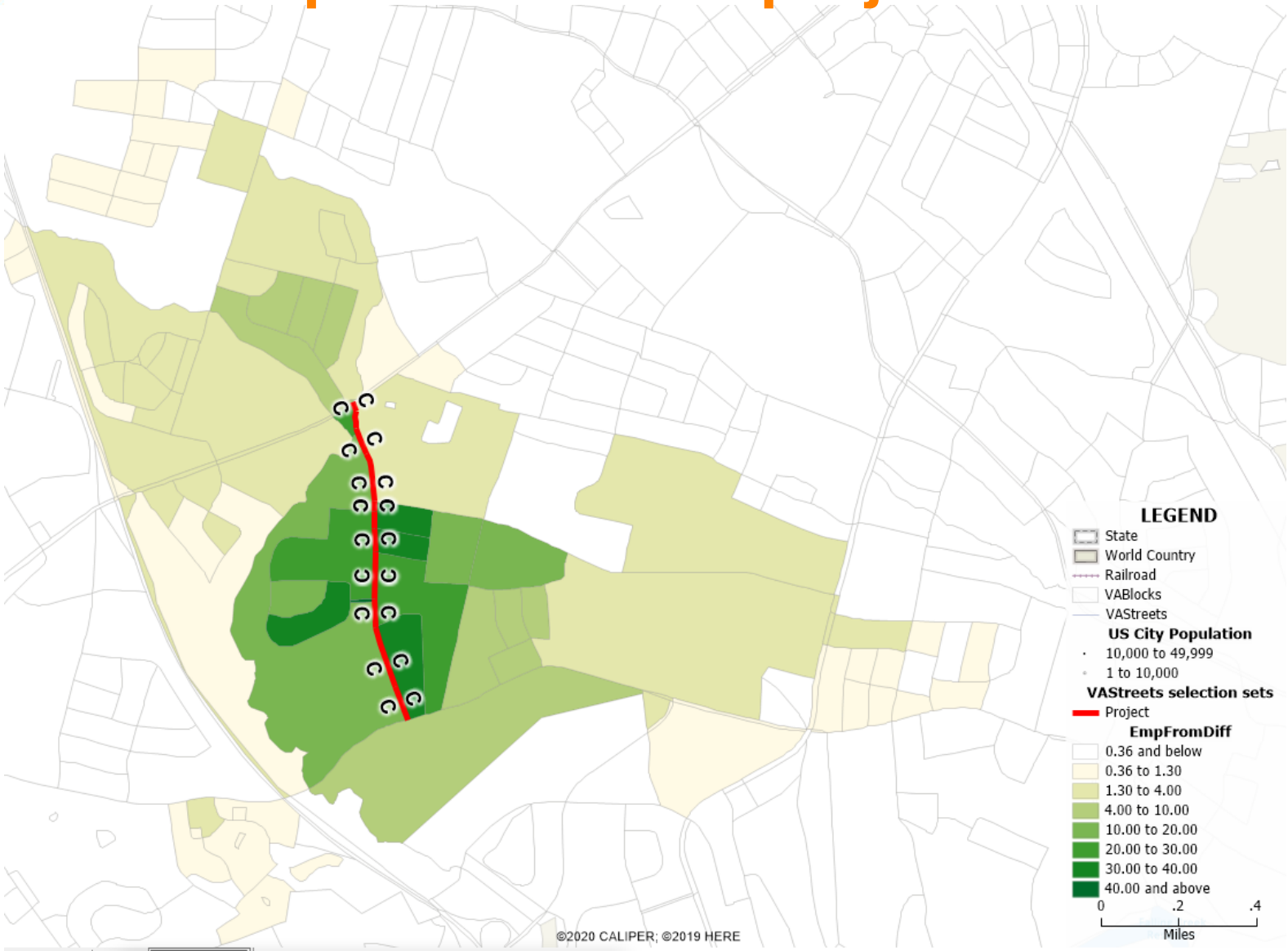
A1: 0.43

A2: 0.51

Dataview1 - VAStreets Info

NAME	HEY RD
ProjectID1	RichmondCity_6655_Walk
AB_Base_Walk_LOSWork1	E
BA_Base_Walk_LOSWork1	E
AB_Base_Walk_LOSWork2	
BA_Base_Walk_LOSWork2	
AB_Base_Walk_LOSWork3	
BA_Base_Walk_LOSWork3	
AB_Project_Walk_LOSWork1	C
BA_Project_Walk_LOSWork1	C
AB_Project_Walk_LOSWork2	
BA_Project_Walk_LOSWork2	
AB_Project_Walk_LOSWork3	
BA_Project_Walk_LOSWork3	
AB_Base_Walk_LOSNonWork1	
BA_Base_Walk_LOSNonWork1	
AB_Base_Walk_LOSNonWork2	
BA_Base_Walk_LOSNonWork2	
AB_Base_Walk_LOSNonWork3	
BA_Base_Walk_LOSNonWork3	
AB_Project_Walk_LOSNonWo	
BA_Project_Walk_LOSNonWo	
AB_Project_Walk_LOSNonWo	
BA_Project_Walk_LOSNonWo	
AB_Project_Walk_LOSNonWo	

Demo2. Zonal Accessibility Improvement for project 6655



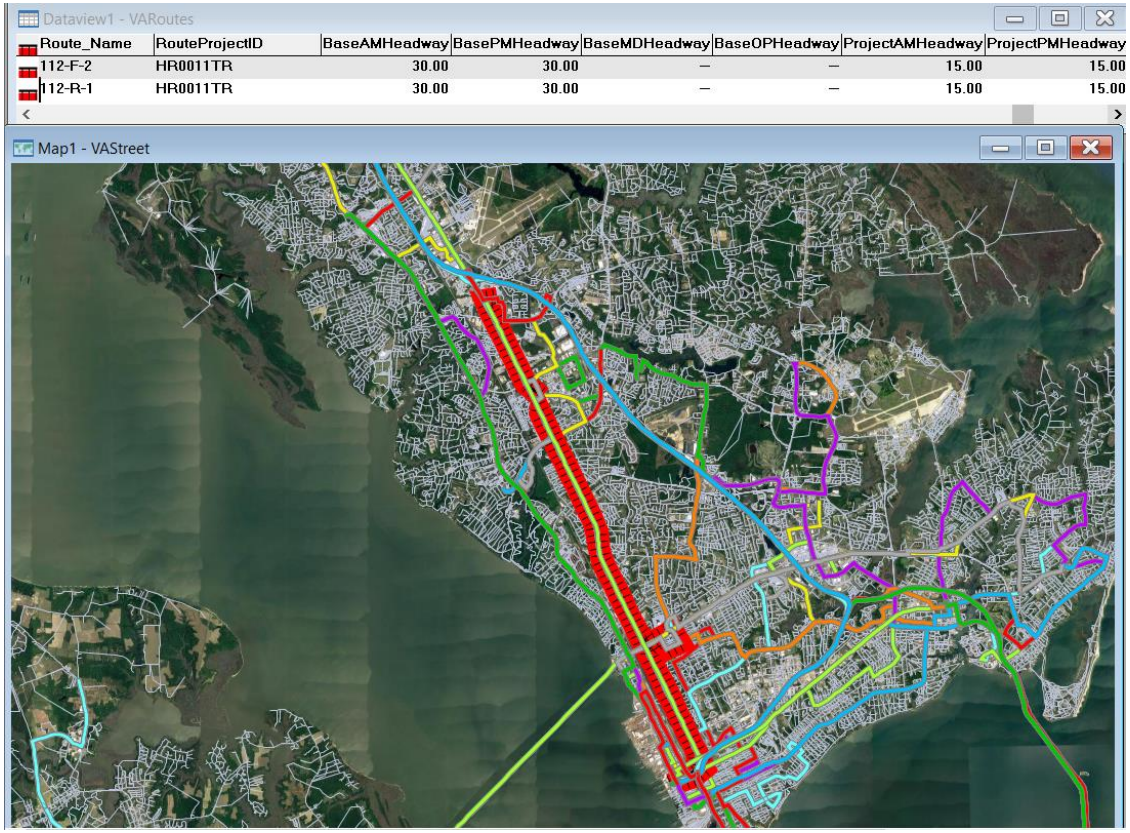
Demo 3. Transit mode

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 3. Transit mode – Project 3080 Change in Headway

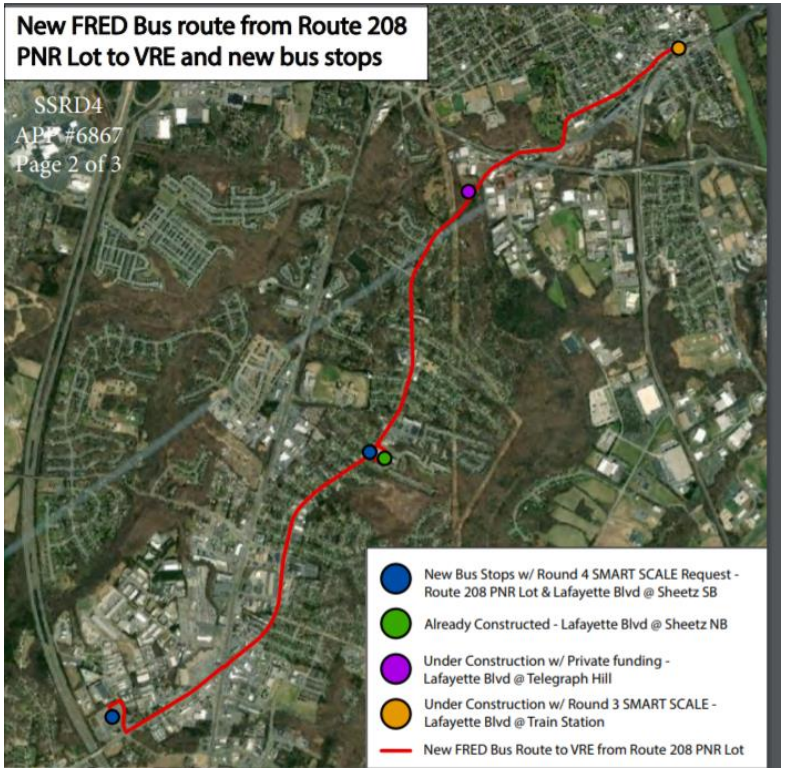
- Newport News Route 112
- Increase peak frequency from 30-minutes to every 15 minutes
- Results:

A1: 19.14
A2: 19.52



Demo 3. Transit mode – Project 6867 Adding New Route

- New VRE Feeder Bus from Rte 208 PNR 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



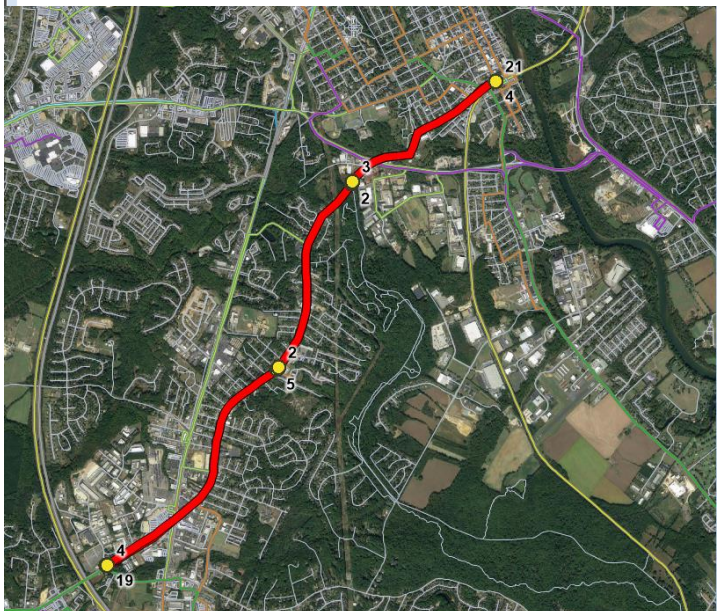
Demo 3. Transit mode – Project 6867 Adding New Route

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	–

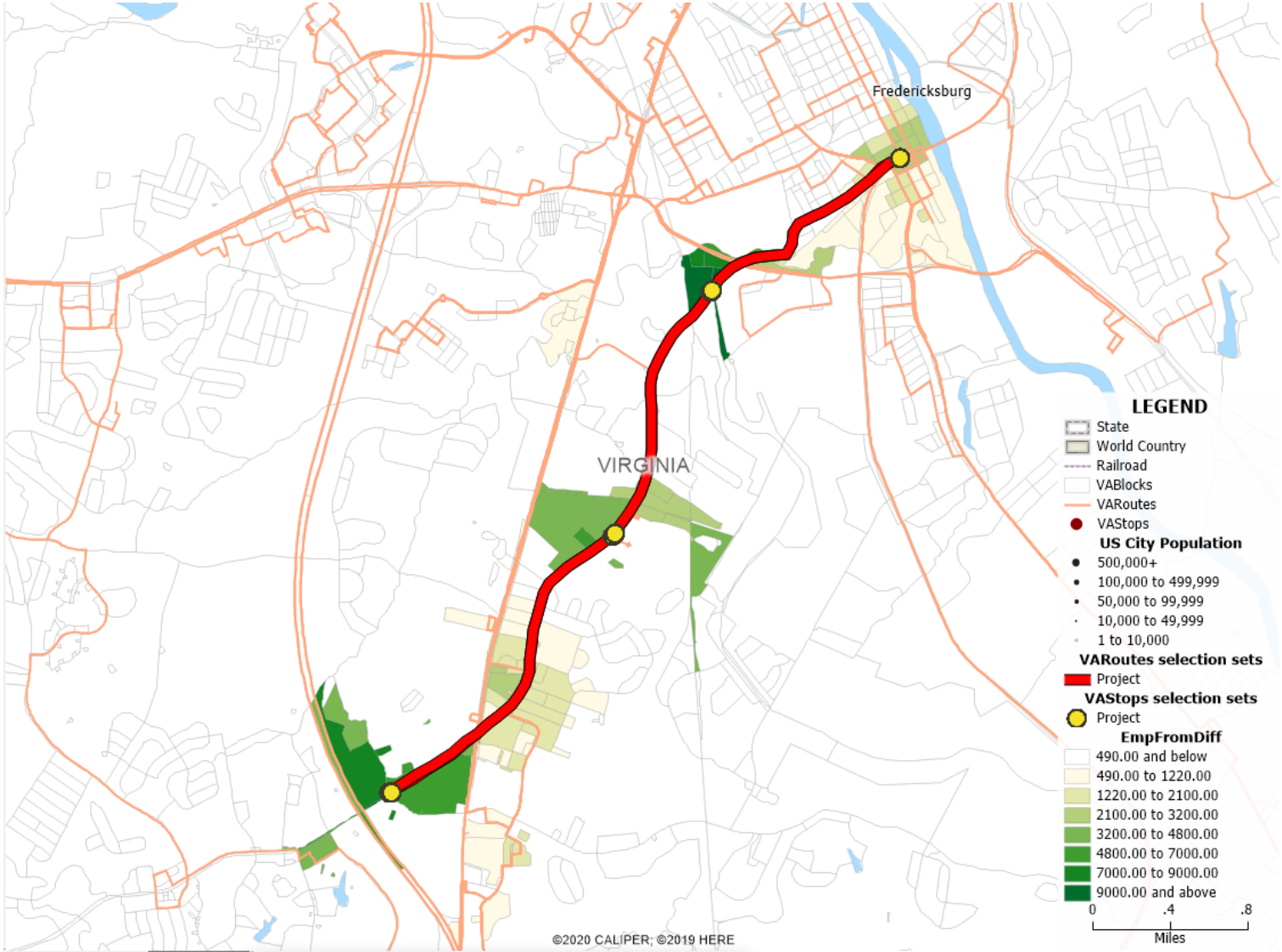
Dataview3 - RoutesAndStops

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

Demo3. Zonal Accessibility Improvement for project 6867



THANK YOU!

Q & A