Safety Assessment for All Road Users

May 22, 2024

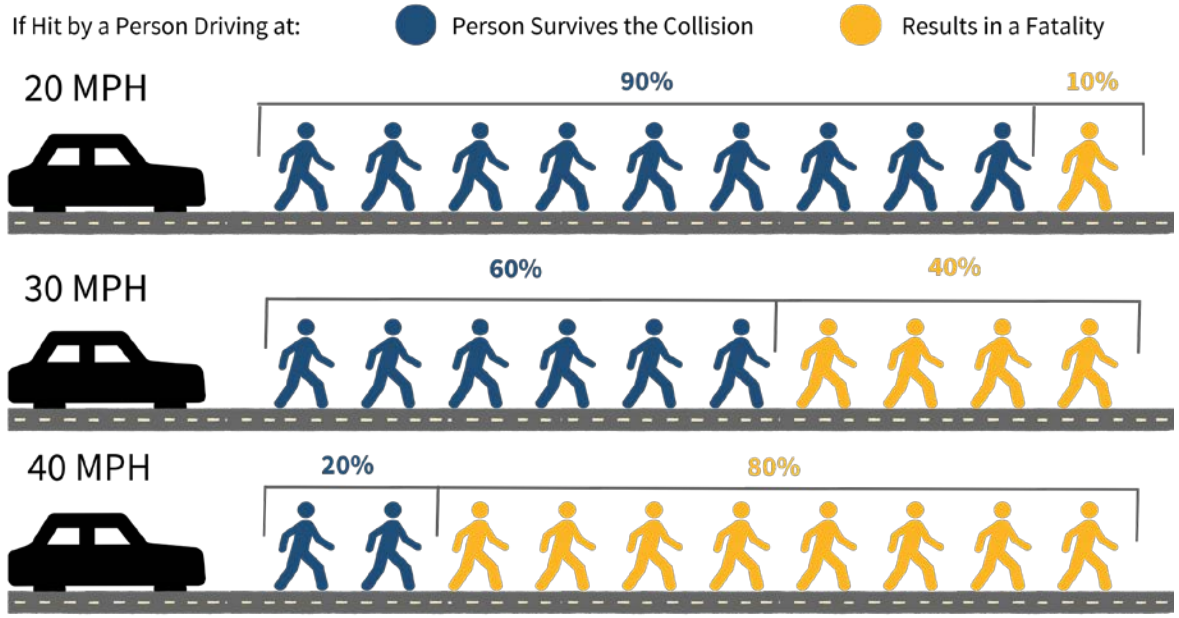
What is a Vulnerable Road User?

- A VRU is a **non-motorist** including a: pedestrian, bicyclist, other cyclist, or a person using a mobility assistance device (ex: wheelchair).
- This includes people walking, biking, or rolling, and also includes highway workers on foot.
- A motorcyclist is **not** considered a VRU.

Photos from pedbikeimages.org

“Vulnerable”

The term **vulnerable** road user is used mainly to describe those **unprotected by an outside shield**, as they sustain a **greater risk of injury** in any collision with a vehicle and are therefore highly in need of protection against such collisions.



Source: National Safety Council

WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

What is a VRU Assessment?

- An assessment of the safety performance of a State with respect to VRUs and the plan of the State to improve the safety of VRUs.
- New requirement from the Federal Highway Administration (FHWA)
- The VRU Assessment is the SHSP Pedestrian Emphasis Area Plan

WEST VIRGINIA
VULNERABLE ROAD USER ASSESSMENT

What is a VRU Assessment?

Quantitative Analysis of VRU Fatalities and Serious Injuries

- Crash data trends
- Demographics of locations of fatalities and serious injuries
- Identifies “high-risk” areas for VRUs

Program of projects or strategies to reduce safety risks to VRUs

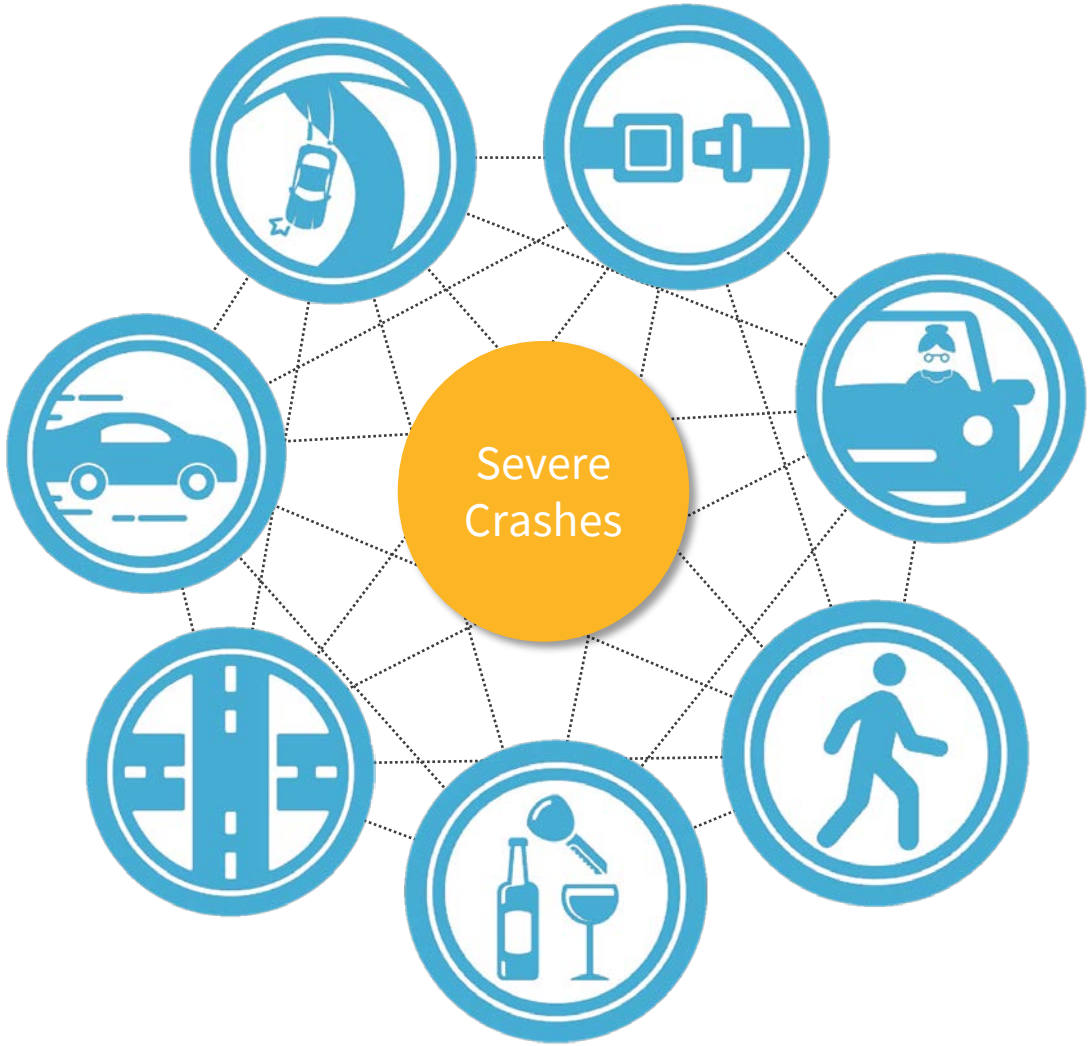
WEST VIRGINIA
VULNERABLE ROAD USER ASSESSMENT

Safe System Approach

- **Safe Roads**: Determine ways to make roads safe for all users
- **Safe Road Users**: Ensure everyone is using the system correctly
- **Safe Speeds**: Match speeds with road context
- **Safe Vehicles**: Understand how innovation can enhance transportation safety
- **Safe Post-Crash Care**: Get emergency response to and from crash site quickly

WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

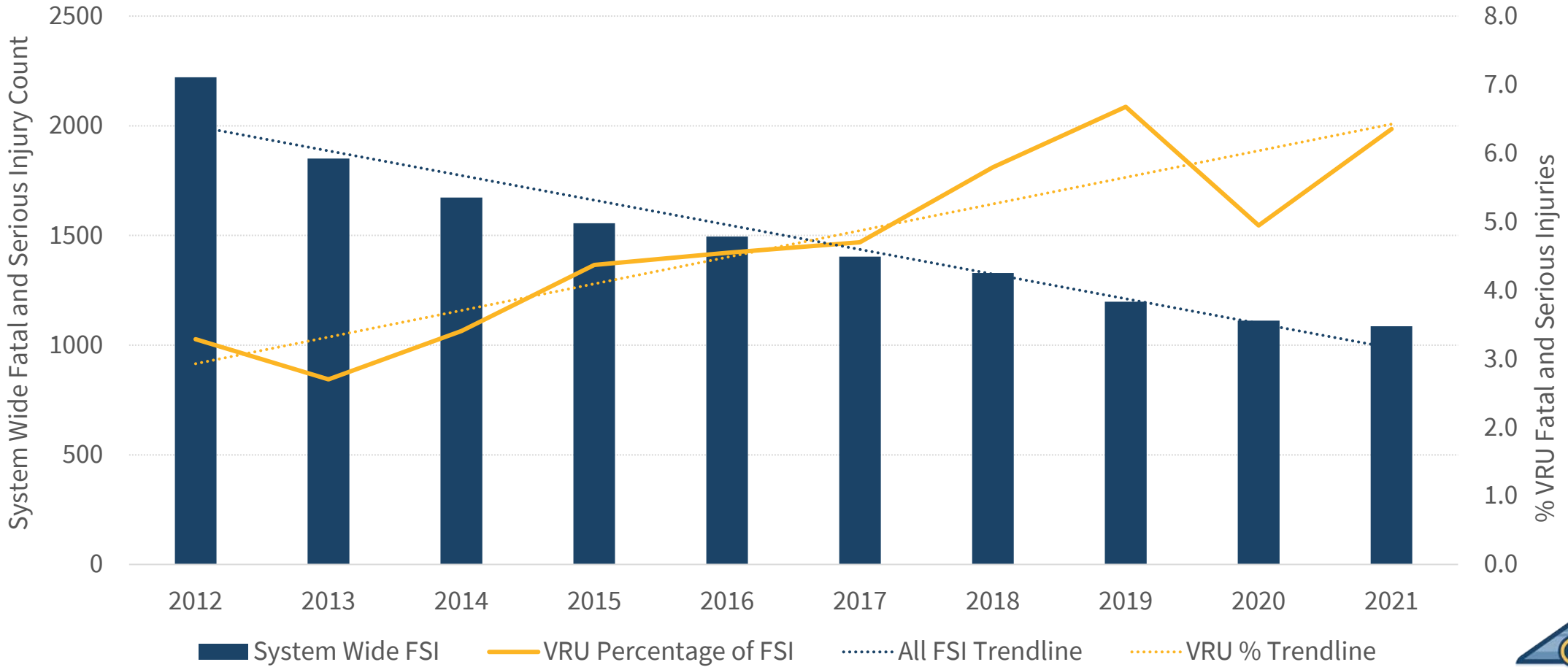
Multidisciplinary Approach



Severe crashes occur for a multitude of reasons. By collaborating with transportation and safety practitioners with diverse backgrounds and perspectives, we can think more holistically about solutions.

WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

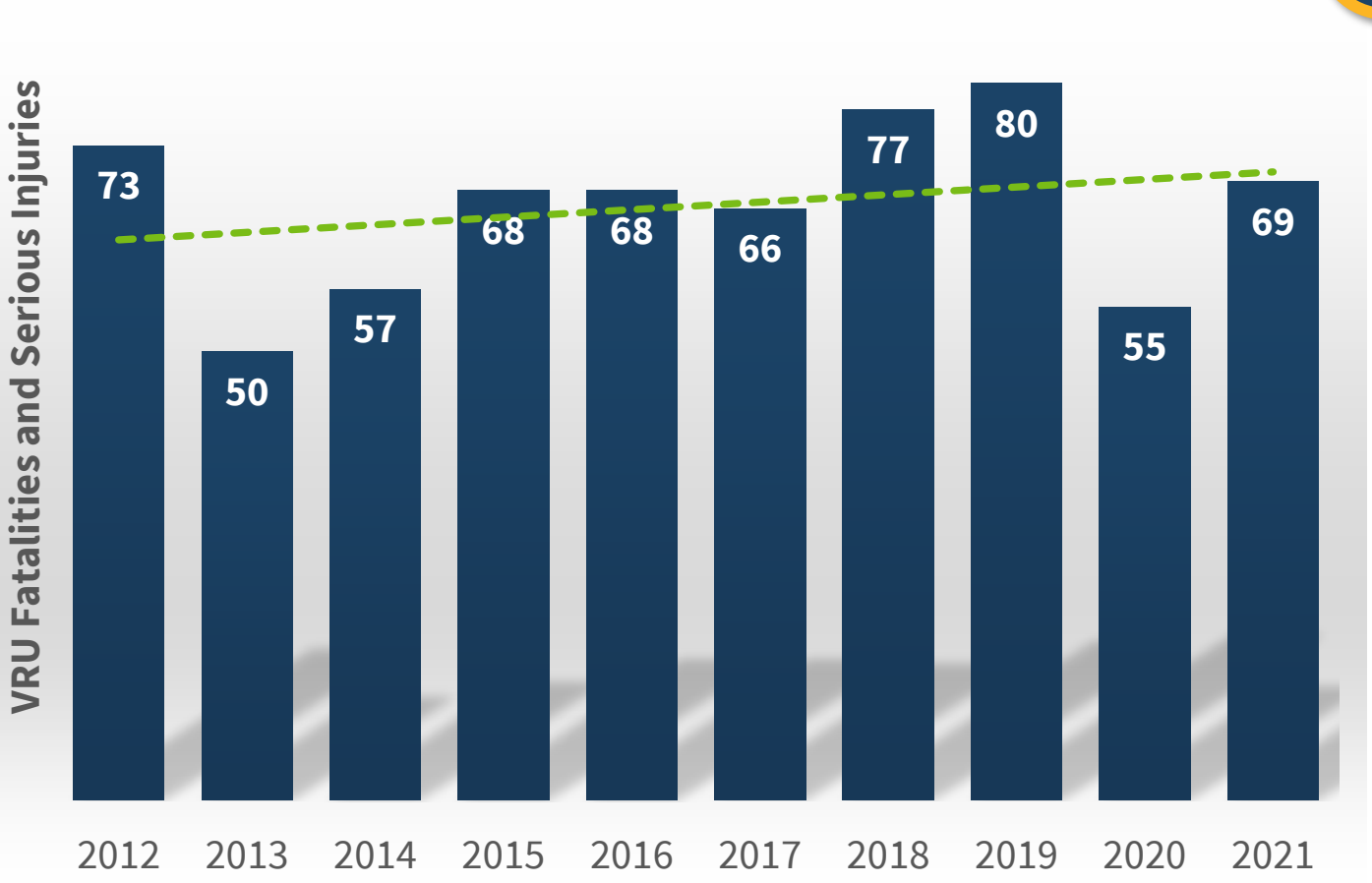
Why is it Important?



WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

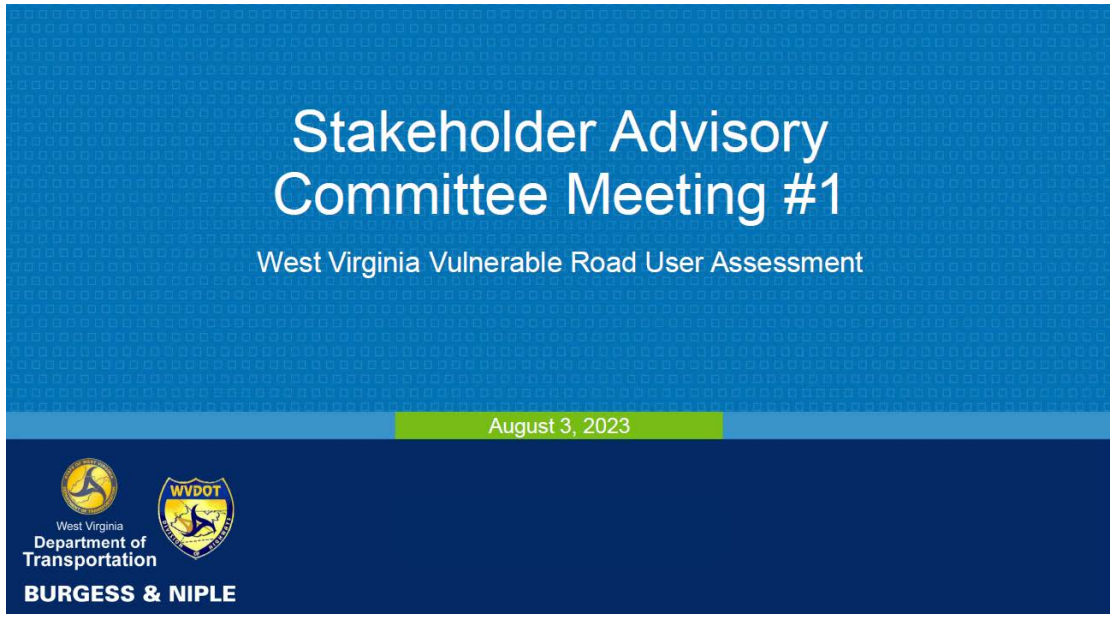
Why is it Important?

Annual average of **66** VRU fatalities and serious injuries in West Virginia

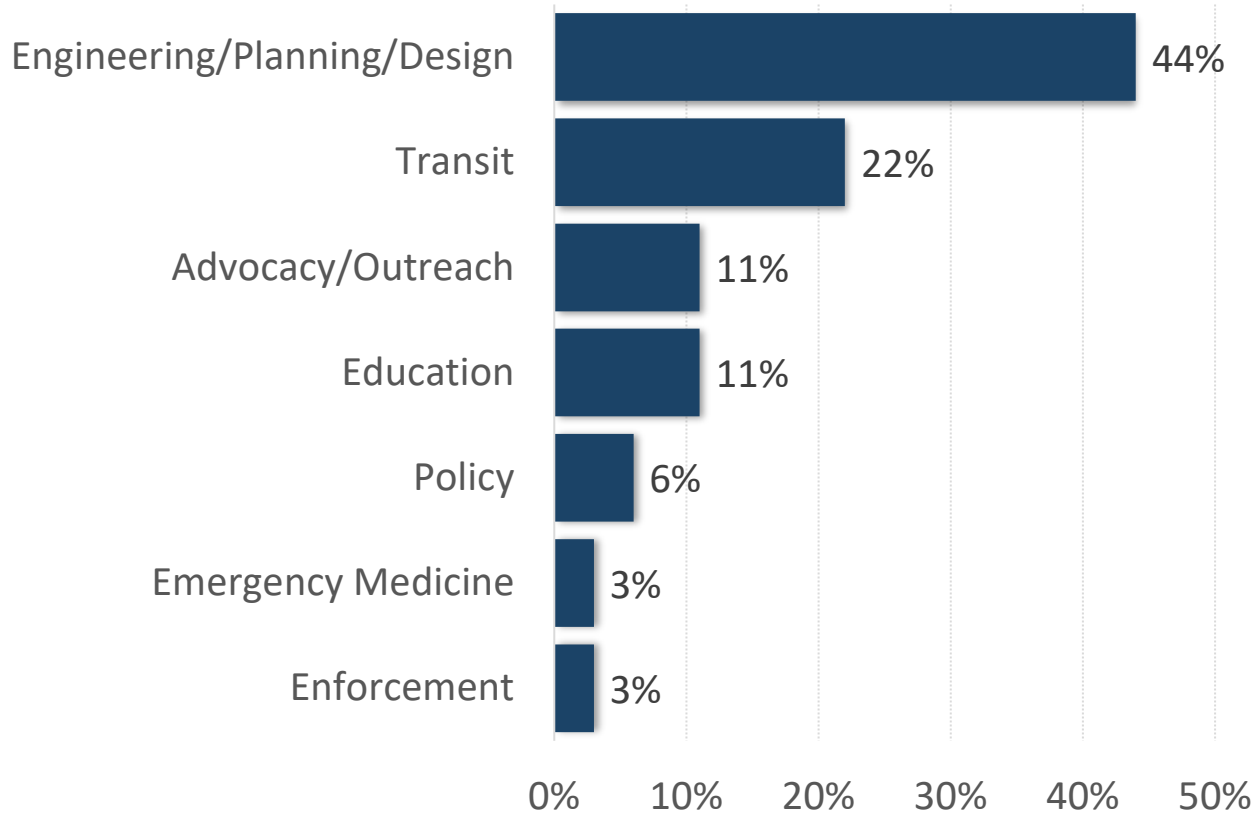


WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

Outreach and Engagement

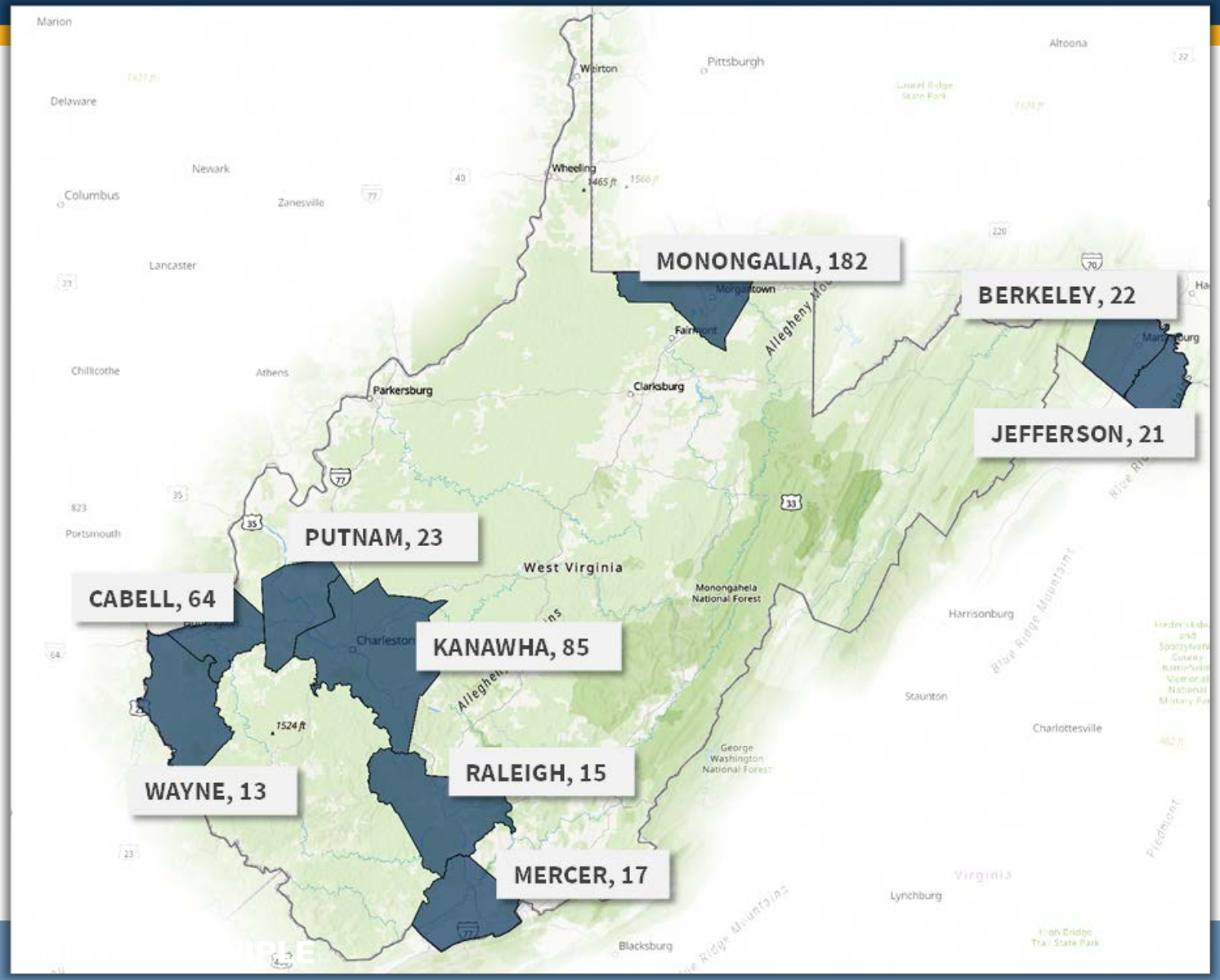


Stakeholder Meetings



WEST VIRGINIA VULNERABLE ROAD USER ASSESSMENT

Public Survey

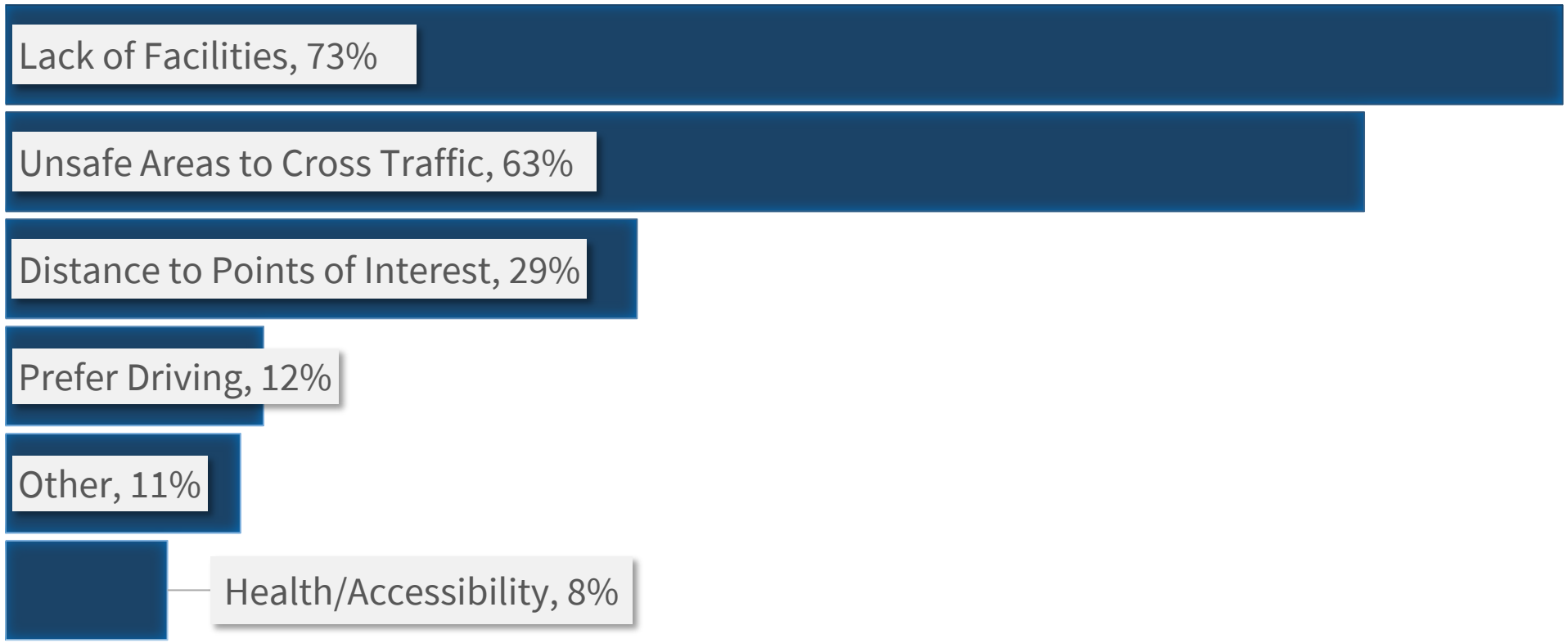


648 Respondents

WEST VIRGINIA VULNERABLE ROAD USER ASSESSMENT

Public Survey

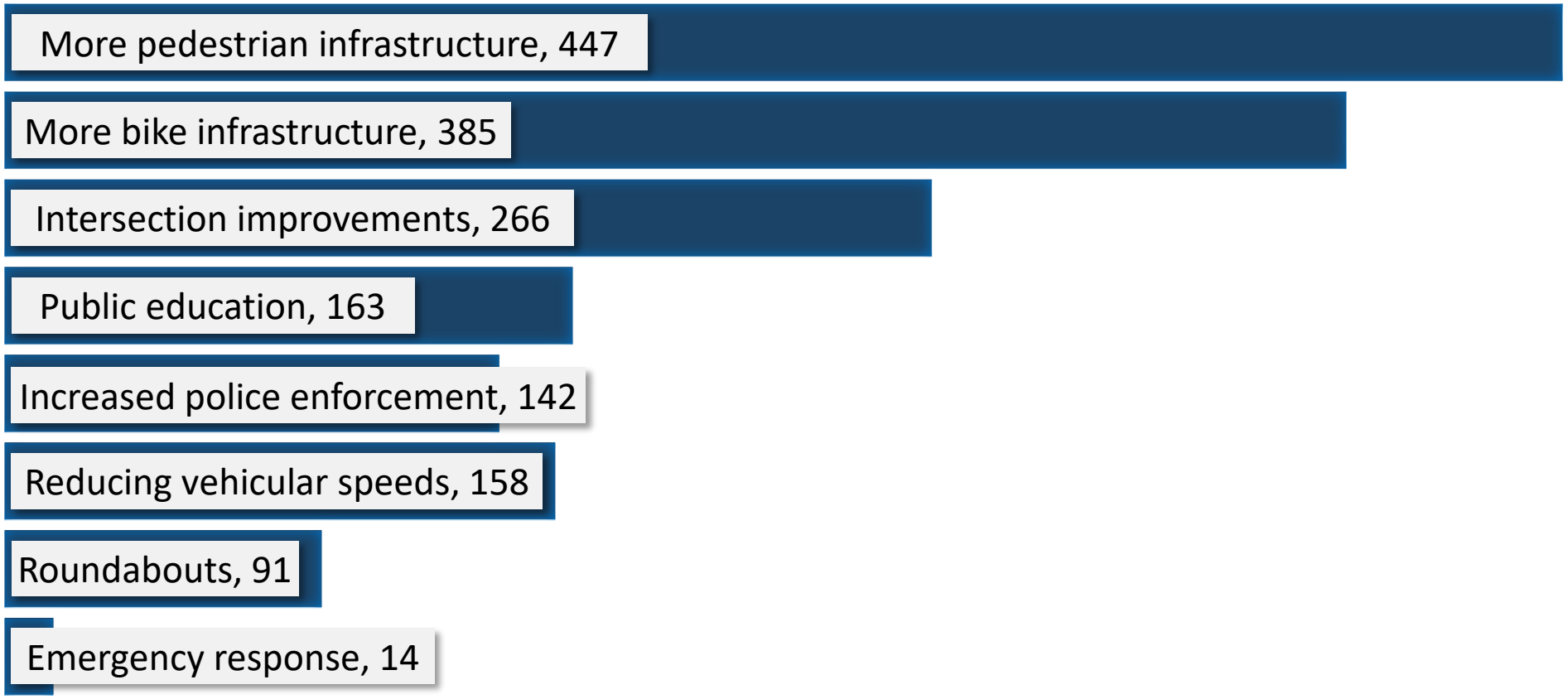
What Barriers Discourage You from Walking or Biking?



WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

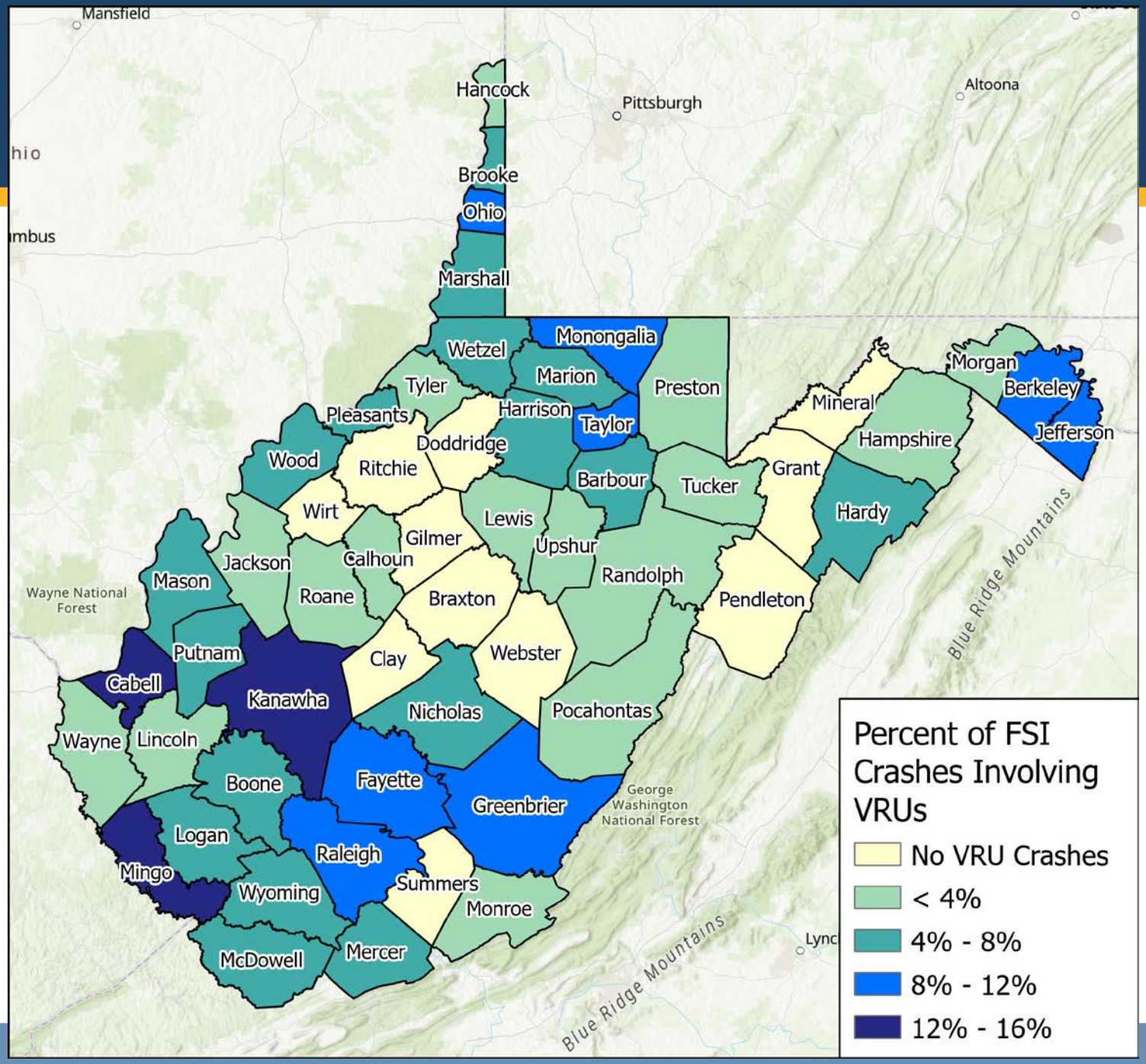
Public Survey

What Do You Think Are the Most Promising Investments for Road Safety?



WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

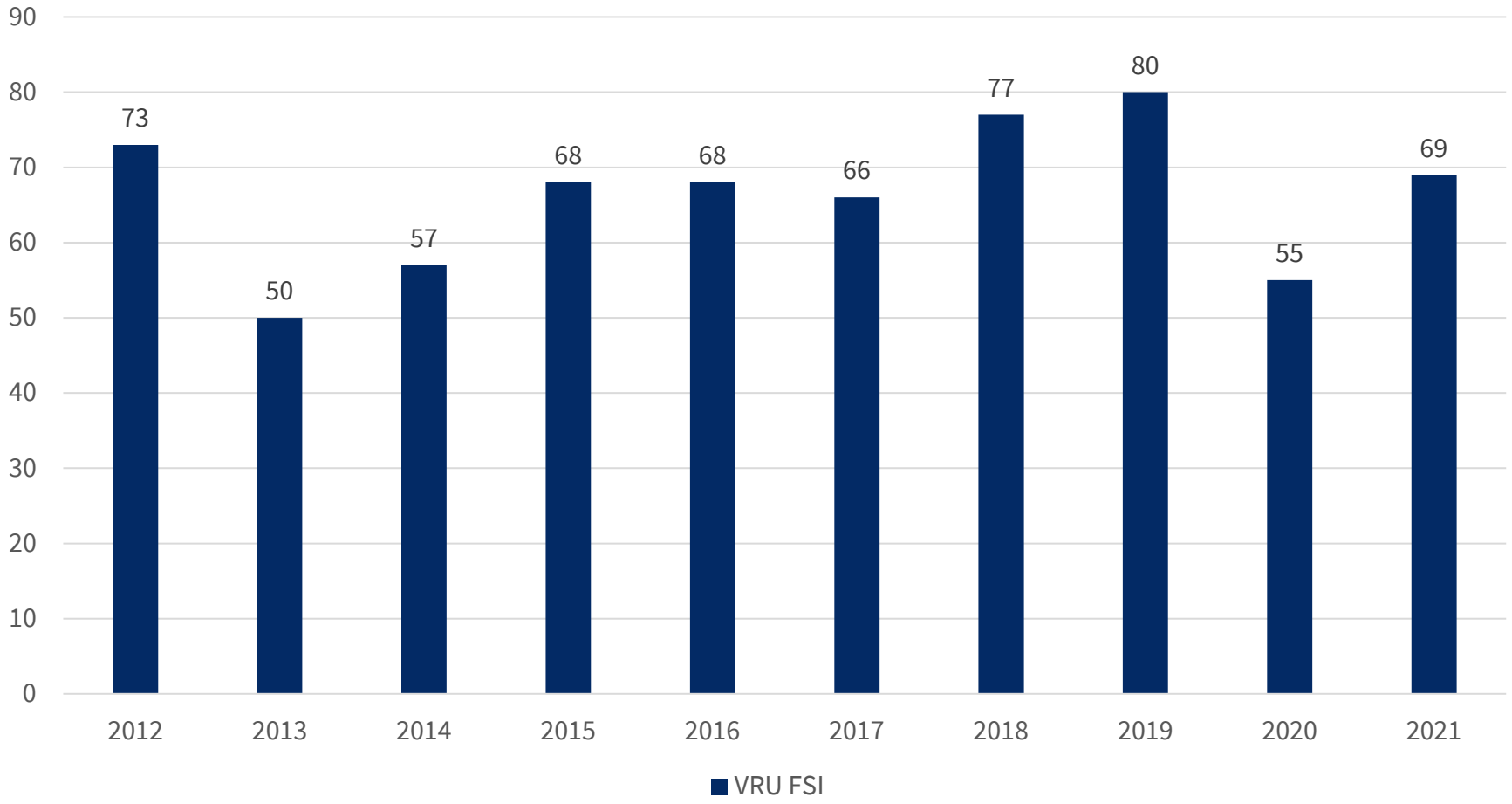
Crash Data



Where are VRU Crashes Occurring?

WEST VIRGINIA
VULNERABLE ROAD USER ASSESSMENT

VRU Fatalities and Serious Injuries by Year



663 VRU Fatal and Serious Injuries

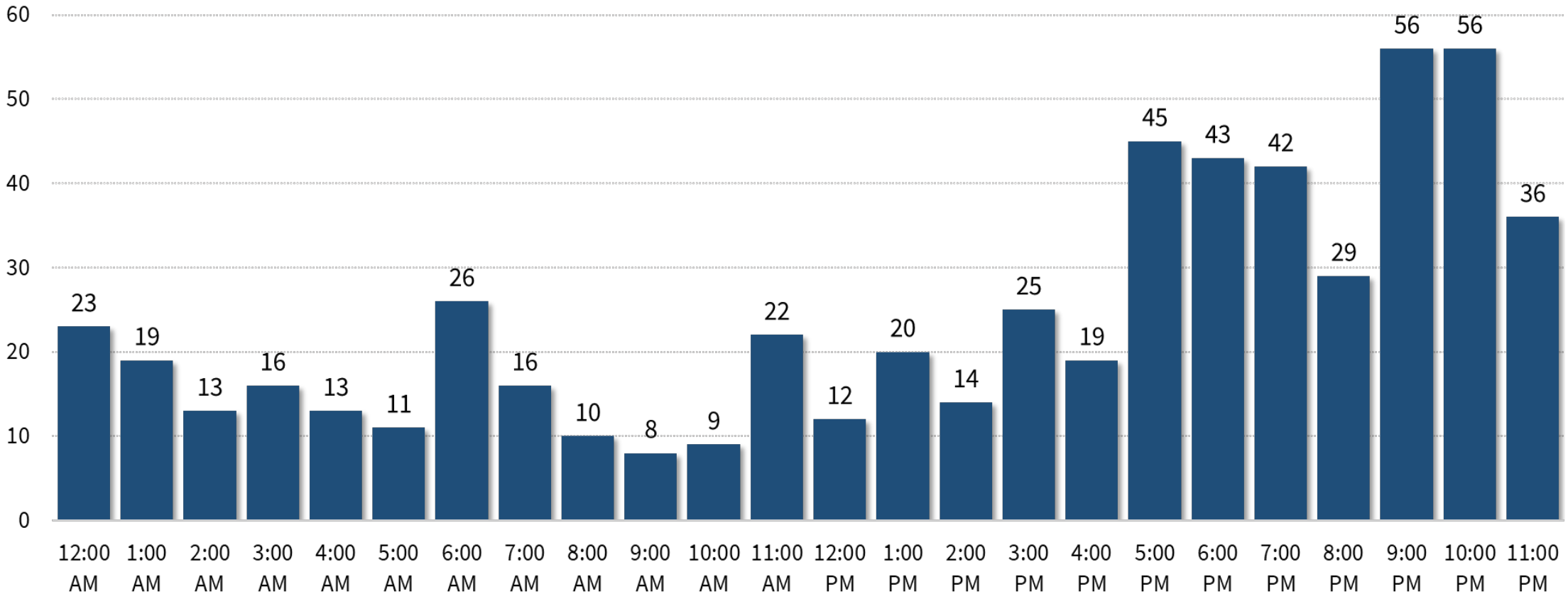
WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

VRU Fatalities and Serious Injuries by Month and Day of Week

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday		
January	9	7	6	11	9	12	4	January	58
February	4	3	10	8	6	7	0	February	38
March	4	5	6	5	8	2	7	March	37
April	4	2	8	9	5	5	6	April	39
May	3	4	7	3	3	9	6	May	35
June	11	7	7	5	9	10	6	June	55
July	3	4	3	5	8	7	5	July	35
August	6	5	8	5	12	18	8	August	62
September	6	5	8	11	10	9	9	September	58
October	9	5	12	7	17	10	7	October	67
November	3	7	10	5	10	6	5	November	46
December	8	8	10	2	4	9	12	December	53
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday		
	70	62	95	76	101	104	75		

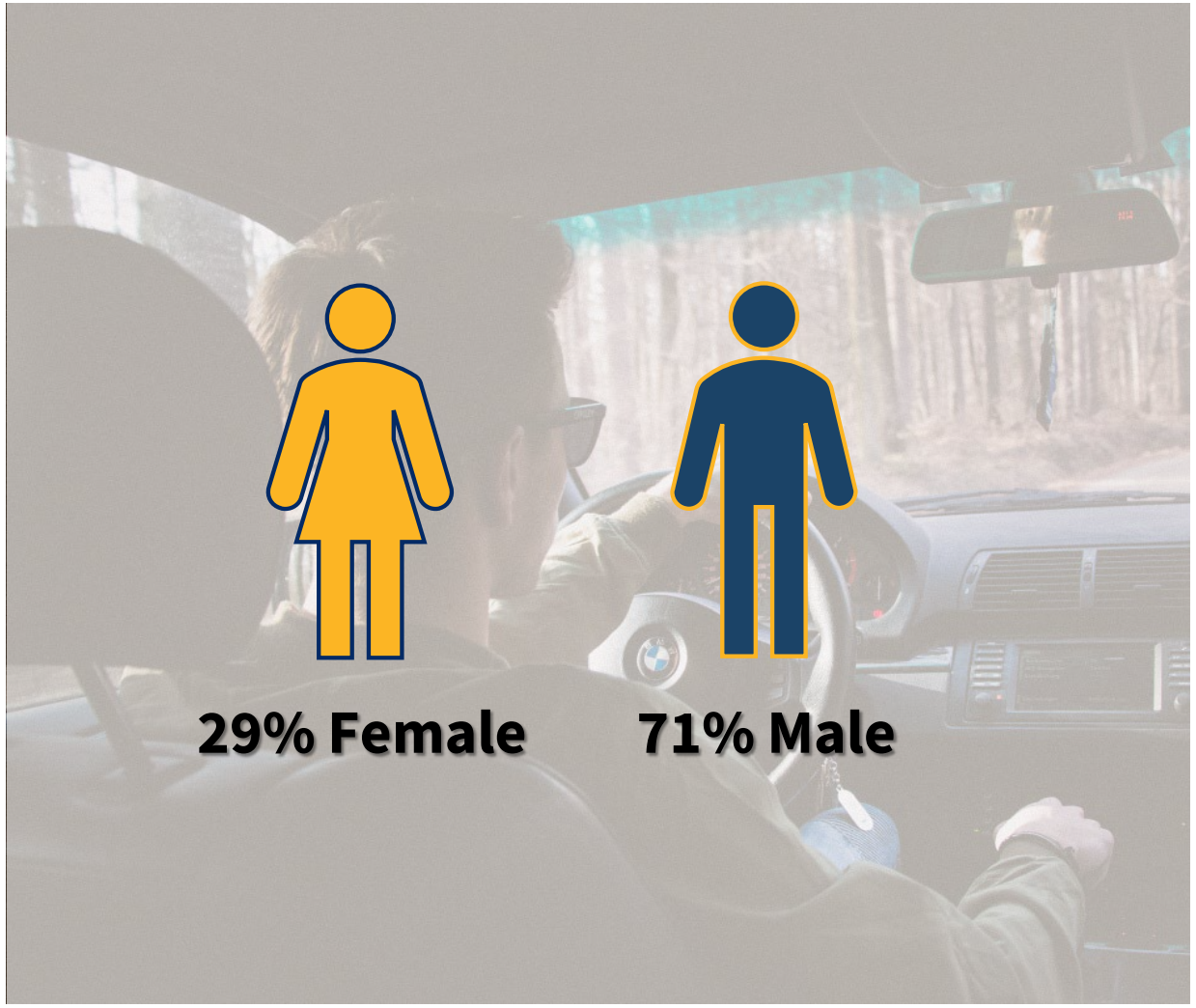
WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

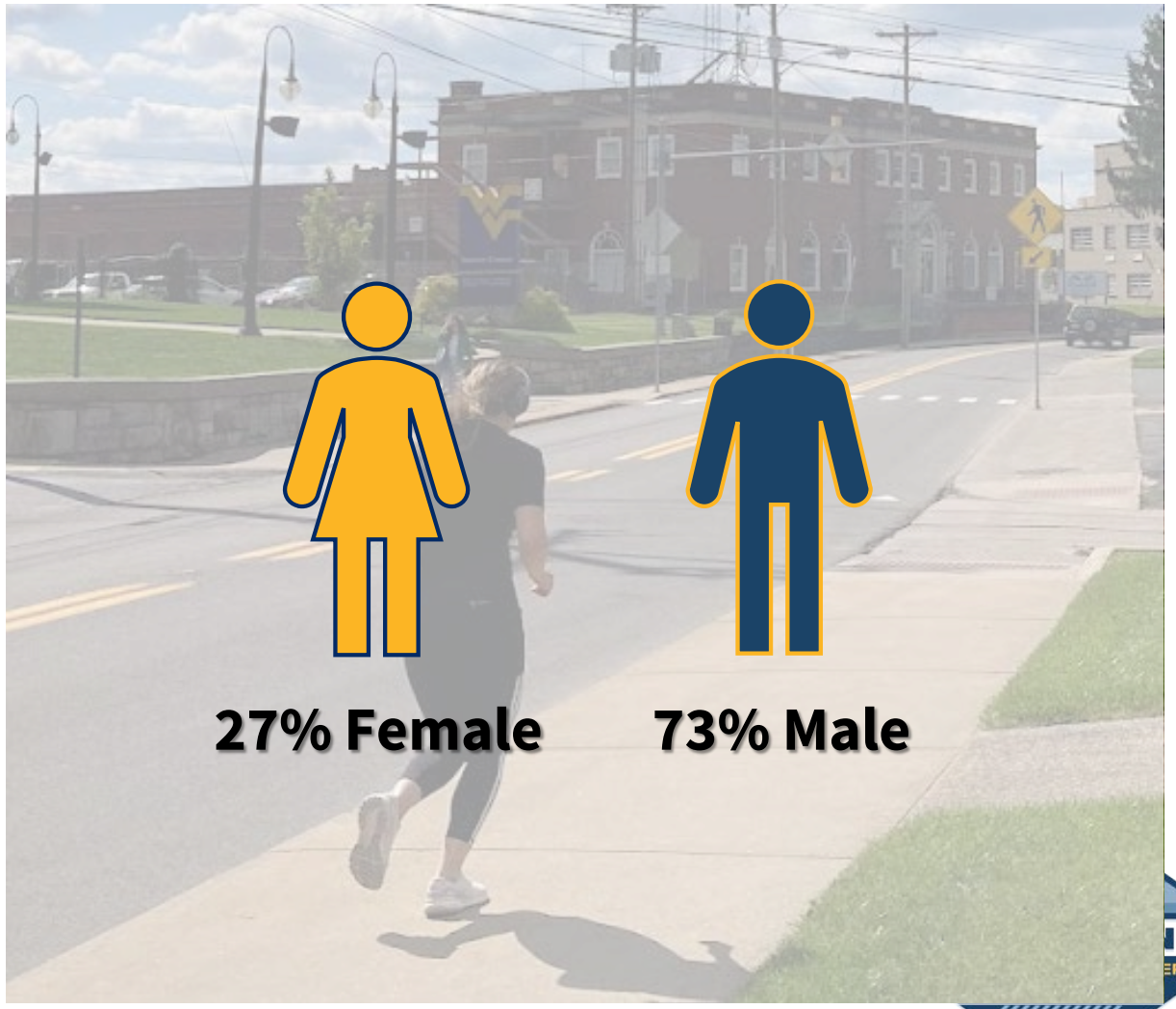
VRU Fatalities and Serious Injuries by Time of Day



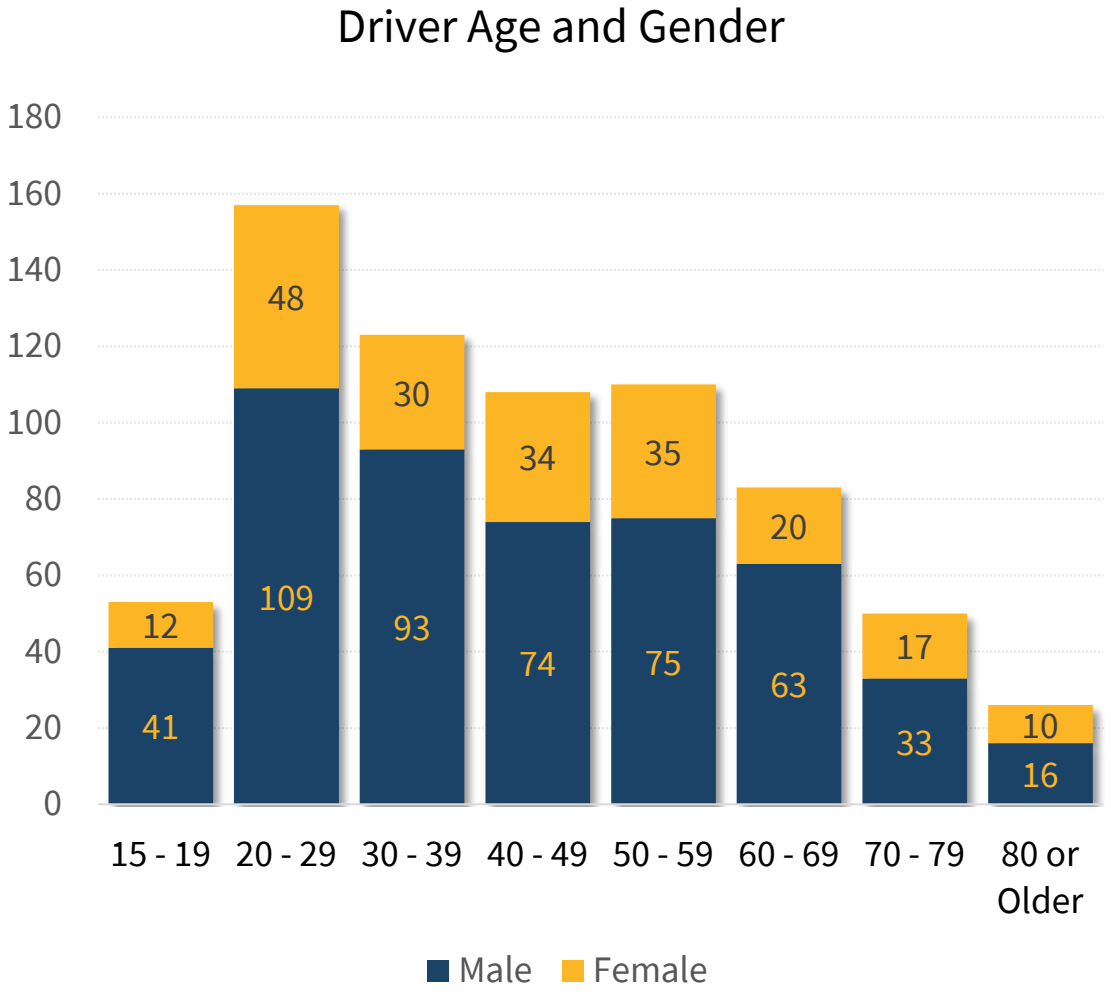
WEST VIRGINIA
VULNERABLE ROAD USER ASSESSMENT

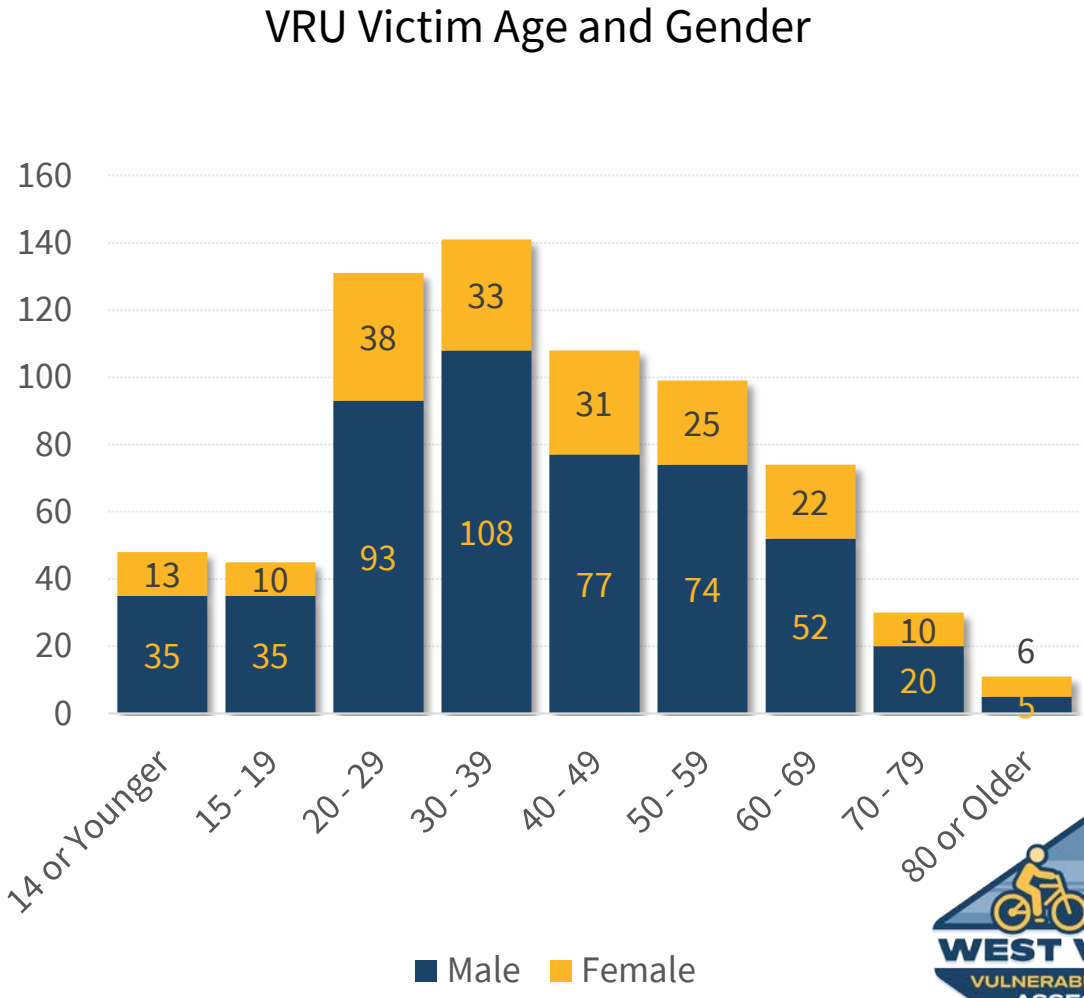
Driver/VRU Demographic





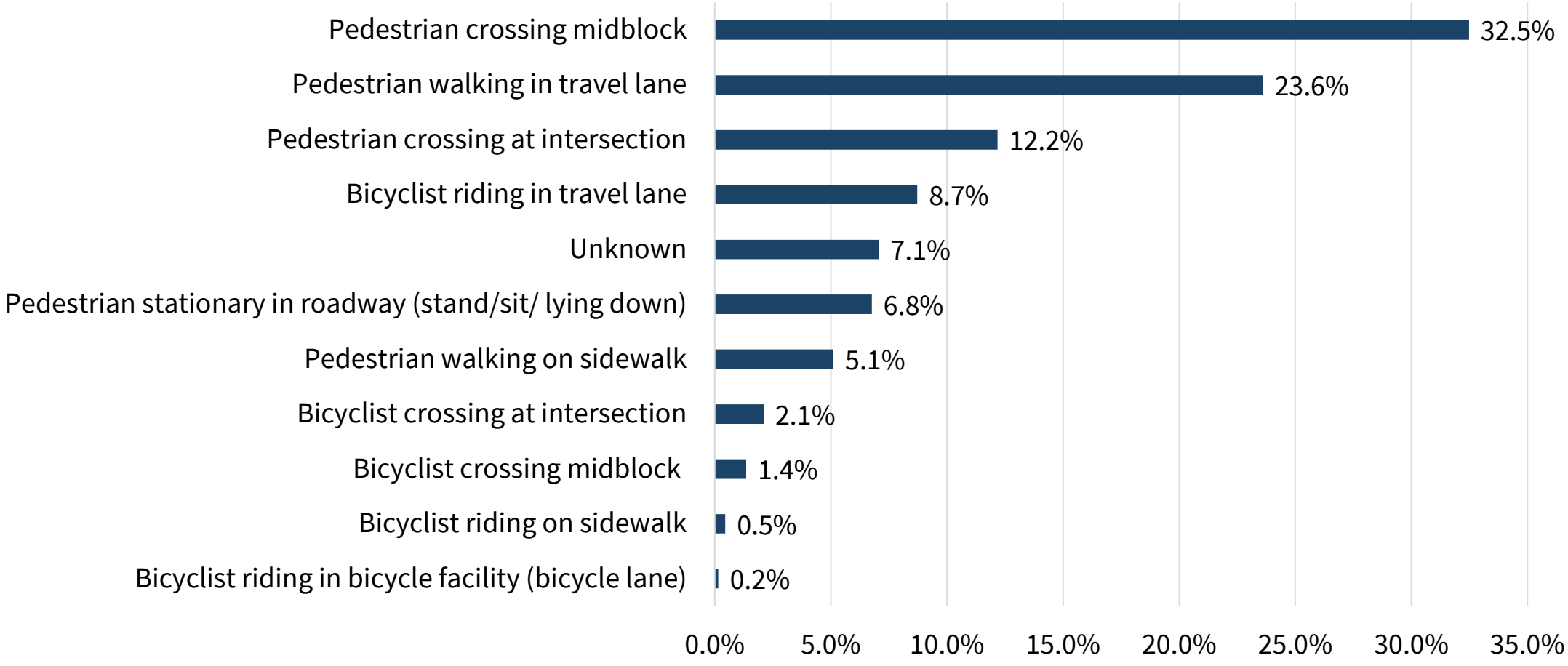
Driver/VRU Demographic





WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

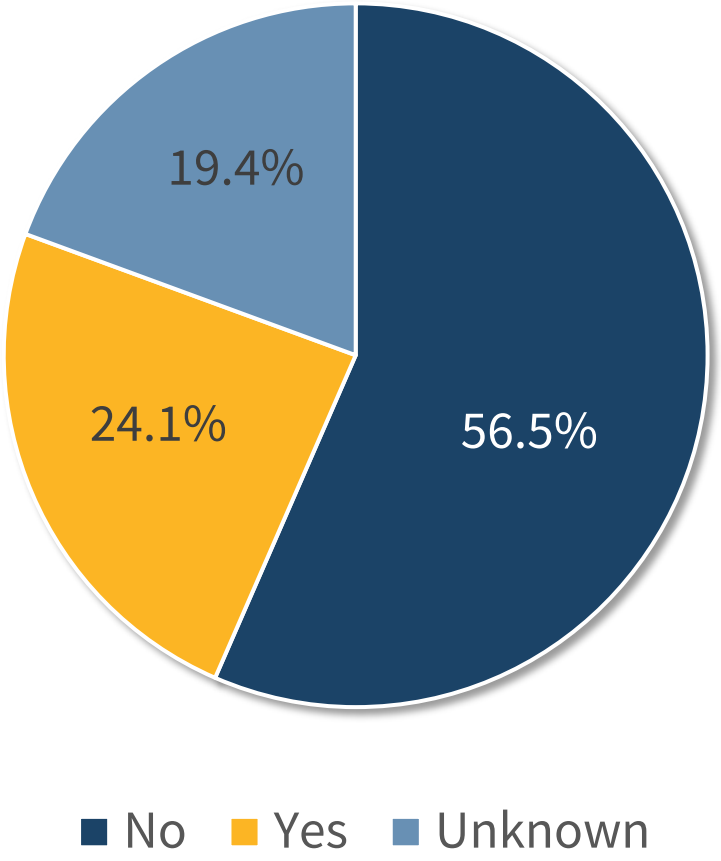
VRU Action in Fatal and Serious Injury Crashes



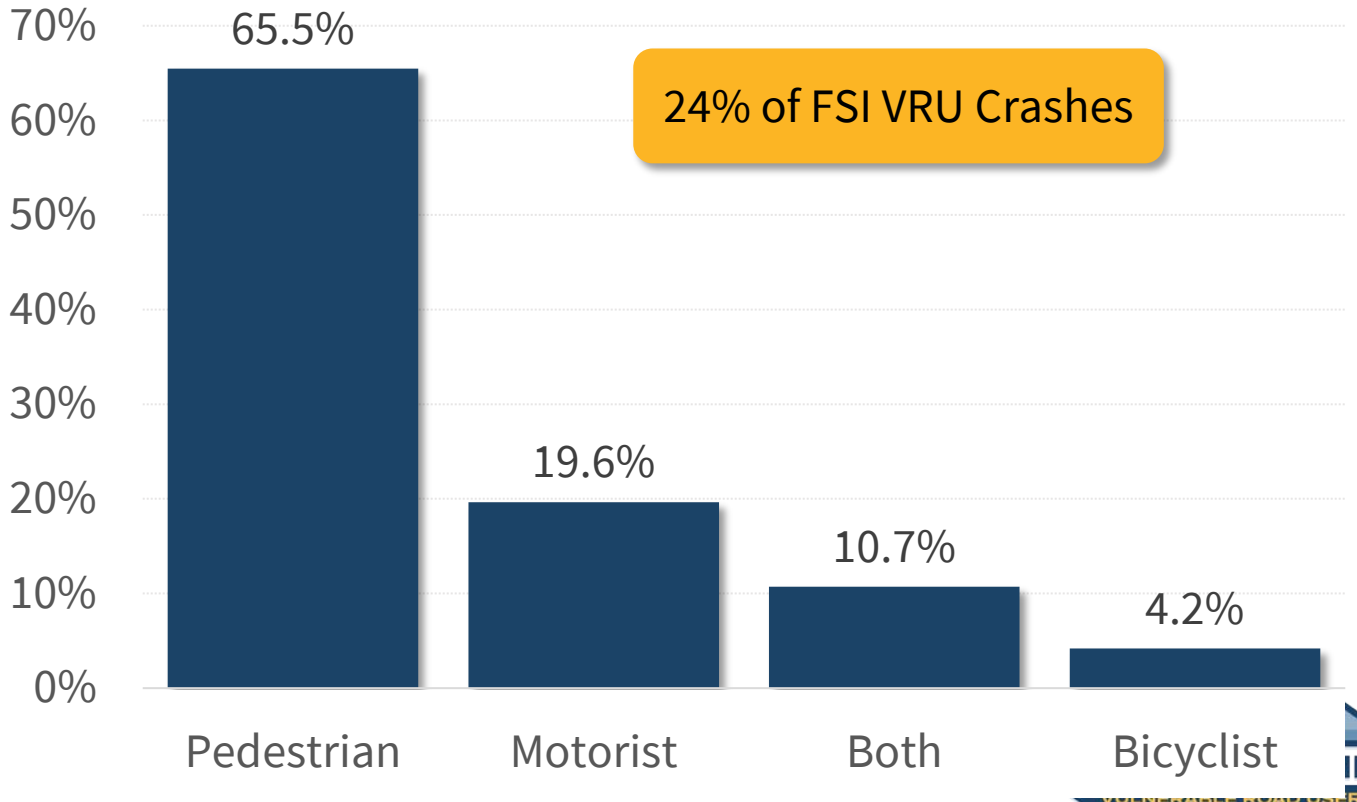
WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

Impairment

Was Impairment Involved (FSI Crashes)?



Who was Impaired?



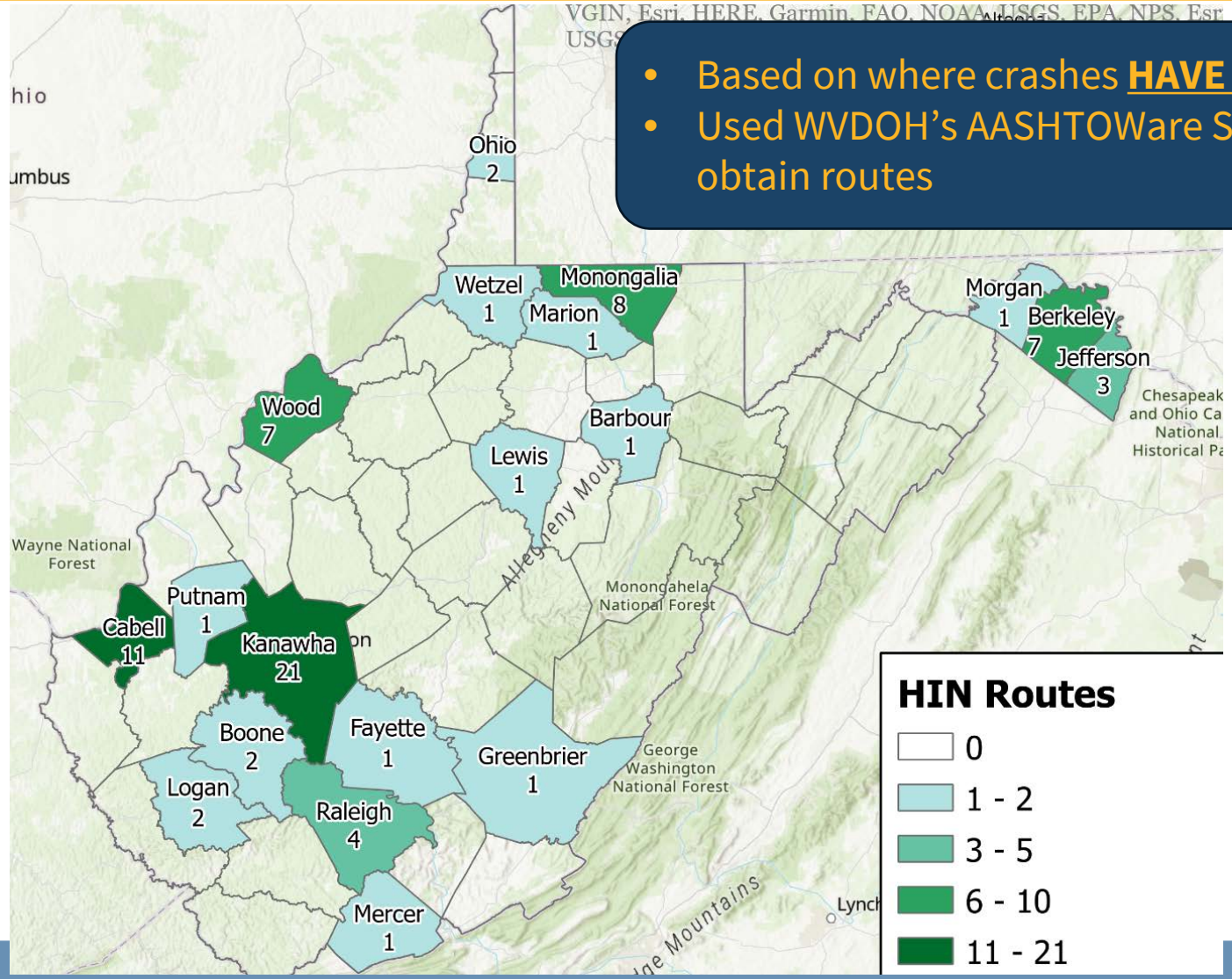
Network-Level Analyses

- **High-Injury Network (REACTIVE)**
  - Segments where **crashes** have occurred regardless of contributing factors
- **Systemic Analysis (PROACTIVE)**
  - Segments where **factors contributing** to crashes are present regardless of crash history

WEST VIRGINIA
VULNERABLE ROAD USER ASSESSMENT

High Injury Network Results

- Based on where crashes **HAVE OCCURRED**
- Used WVDOH's AASHTOWare Safety tool to obtain routes



HIN Results – Identified Sites

Kanawha has sites #1, 2, 5, 9, 16, and 18

Monongalia has sites#2, and 11

Raleigh has sites # 4 and 16

Cabell has sites #6,7, and 8

Putnam has site #9

Boone has site #13

Jefferson has site #14

Street Name	Approximate Limits	City	County	Rank
Dunbar Toll Bridge/10th Street	Dunbar Ave to Dunbar Toll Bridge	Dunbar	Kanawha	1
Patteson Drive/ (WV 705)	Baldwin St to Beechurst Ave	Morgantown	Monongalia	2
Washington Street E (US 60)	Brooks St to Ruffner Ave	Charleston	Kanawha	2
Robert C Byrd Drive	Prince St to City Ave	Beckley	Raleigh	4
US 60	Roxbury Ave to Rock Lake Dr	South Charleston	Kanawha	5
5th Avenue and 31st Street (US 60)	5th Ave to 7th Ave	Huntington	Cabell	6
US 60	River Rd to Martin Dr	Barboursville	Cabell	7
3rd Avenue	18th St to 20th St	Huntington	Cabell	8
Charleston Road	Etta St to Truett St	Poca	Putnam	9
Washington Street W (US 60)	6th Ave to Washington St W	Charleston	Kanawha	9
Rogers Avenue	Woodrow St to CR 857	Morgantown	Monongalia	11
Lee Street E (US 60)	Clendenin St to Court St	Charleston	Kanawha	12
Pond Fork Road	Hickory St to Spring St	Madison	Boone	13
US 340	Jefferson Terrace Rd to Somerset Village Rd	Charles Town	Jefferson	14
Williamsport Pike	Hinton Ct to Warm Springs Ave	Martinsburg	Berkeley	15
Robert C Byrd Drive	Trieste Ave to Hubbard St	Beckley	Raleigh	16
MacCorkle Avenue SW (US 60)	Broyles Blvd to Park Ave	South Charleston	Kanawha	16
Lee Street E	Summer St to Brooks St	Charleston	Kanawha	18
Grand Central Avenue	12th St to 16th St	Vienna	Wood	19
Washington Heritage Trail (US 522)	Market St to Union St	Berkeley Springs	Morgan	20

Berkeley has site #15

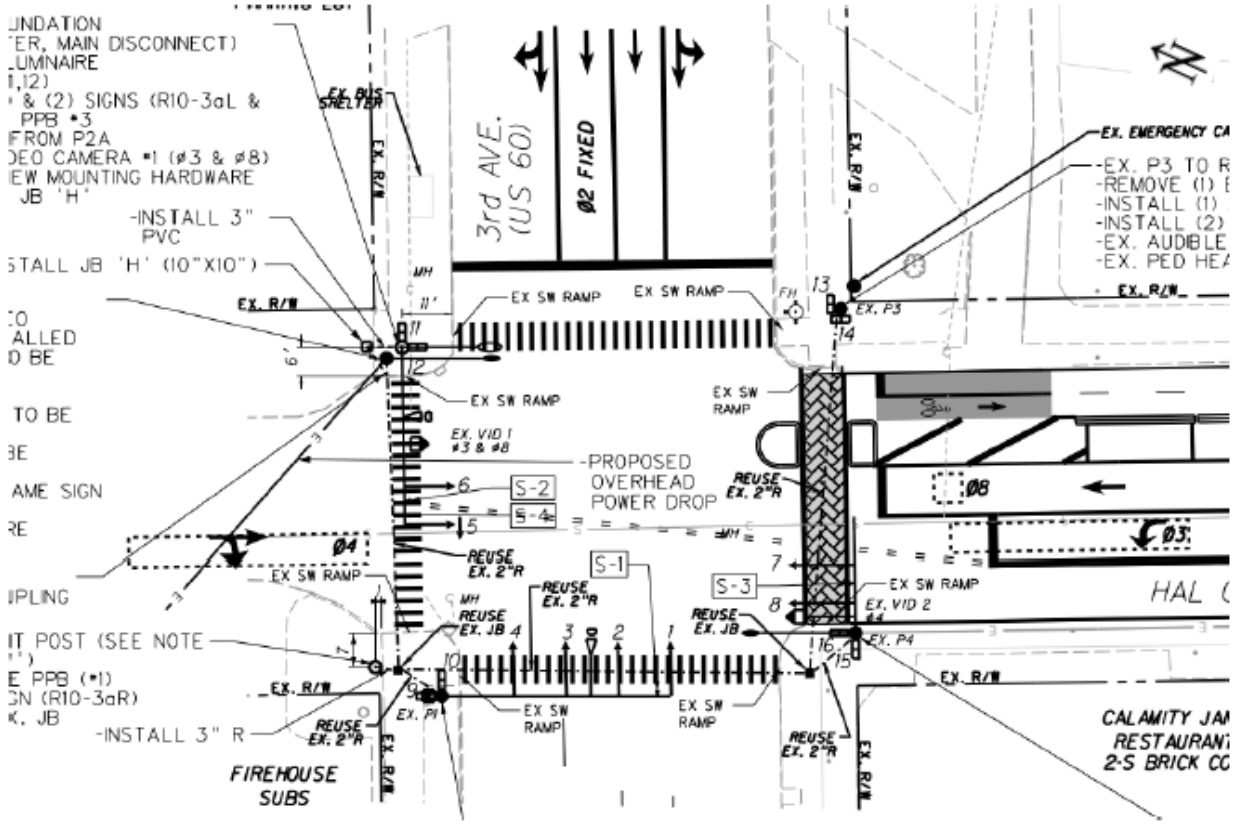
Wood has site #19

Morgan has site #20

WEST VIRGINIA
VULNERABLE ROAD USER ASSESSMENT

What Do These Projects look like?

3rd Avenue and Hal Greer Boulevard



WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

What Do These Projects look like?

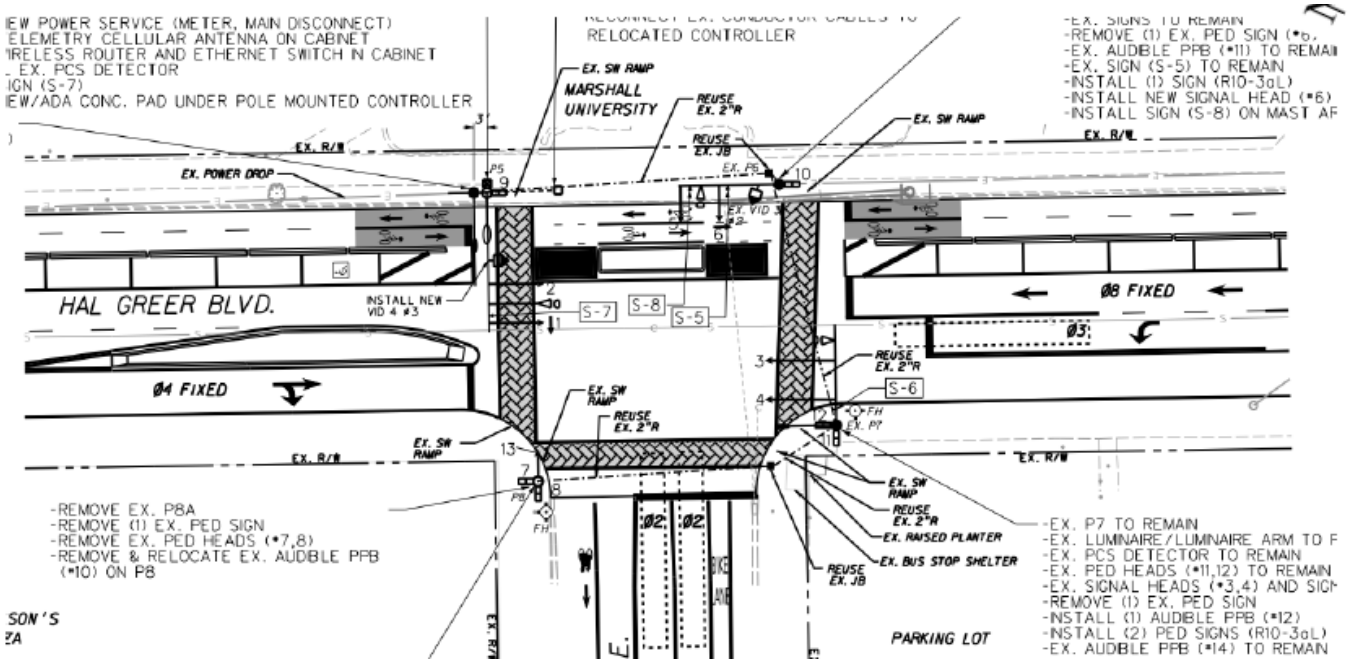
- At the signalized intersections there would be two thru lanes, as well as a left and right-turn lane
- Reducing the number of lanes and narrowing the lanes may lead to speed reductions
- Turning the outside lanes into only turn-lanes may reduce crashes involving cars abruptly changing lanes to avoid turning vehicles slowing down
- Bump outs are proposed at multiple locations throughout the corridors to reduce the distance pedestrians must cross

Example of bump outs used on a one-way road

WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

What Do These Projects look like?

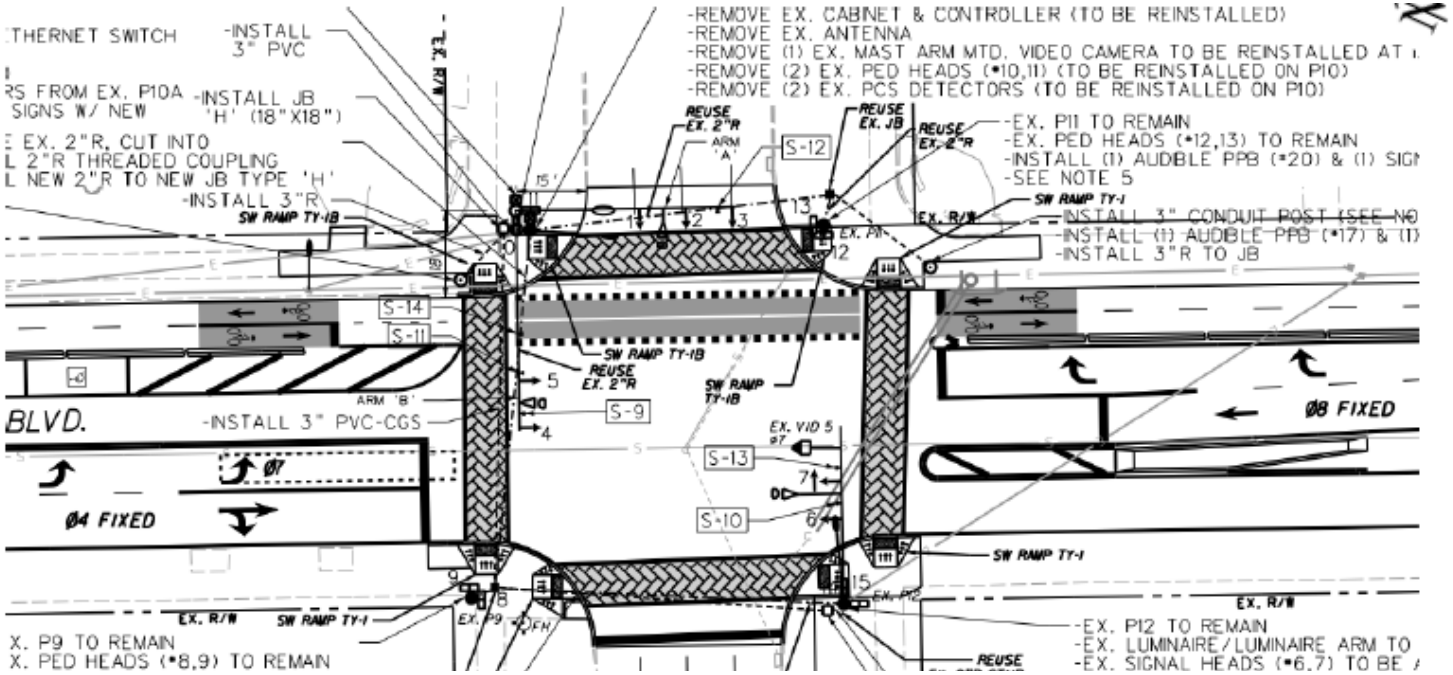
4th Avenue and Hal Greer Boulevard Possible Changes



WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

What Do These Projects look like?

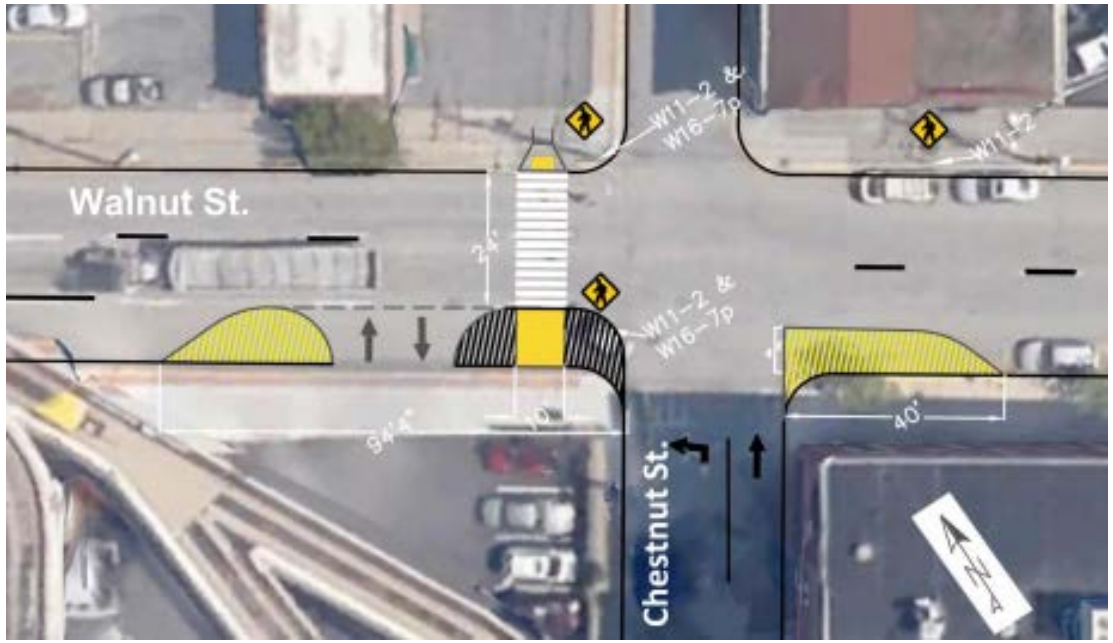
5th Avenue and Hal Greer Boulevard Changes



WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

Projects in Design - Morgantown

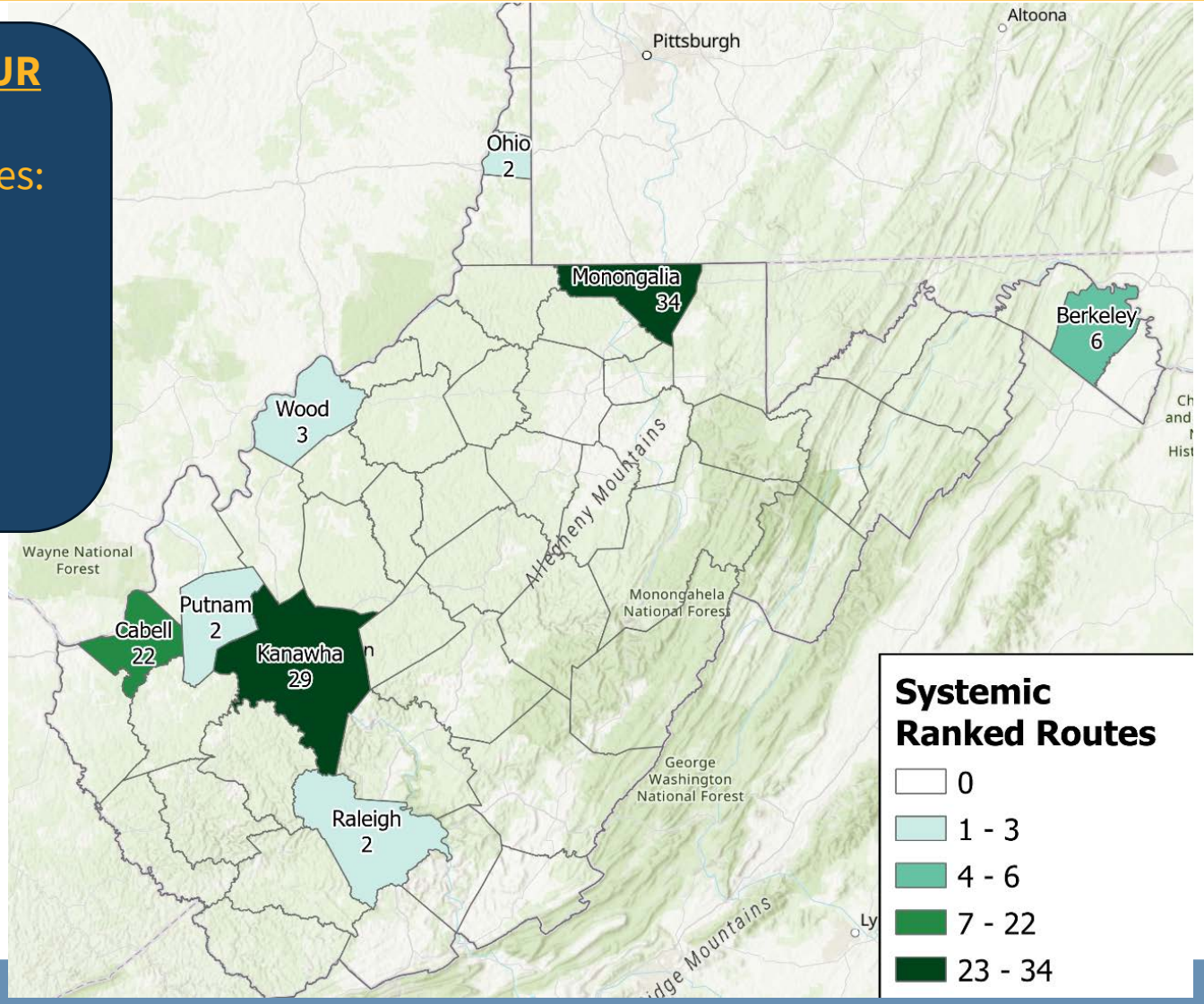
Walnut St and Chestnut Changes



WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

Systemic Analysis Results

- Based on where crashes **MAY OCCUR**
- Determined by presence of “risk factors” contributing to VRU Crashes:
  - Roadway Width
  - Speed Limit
  - Rural vs. Urban
  - Traffic Volumes
  - Population
  - VRU Generators



WEST VIRGINIA VULNERABLE ROAD USER ASSESSMENT

Systemic Analysis Continued

Monongalia has sites # 1, 2, 2, 4, 5, 6, 8, 9, 11, 12, 14 and 23

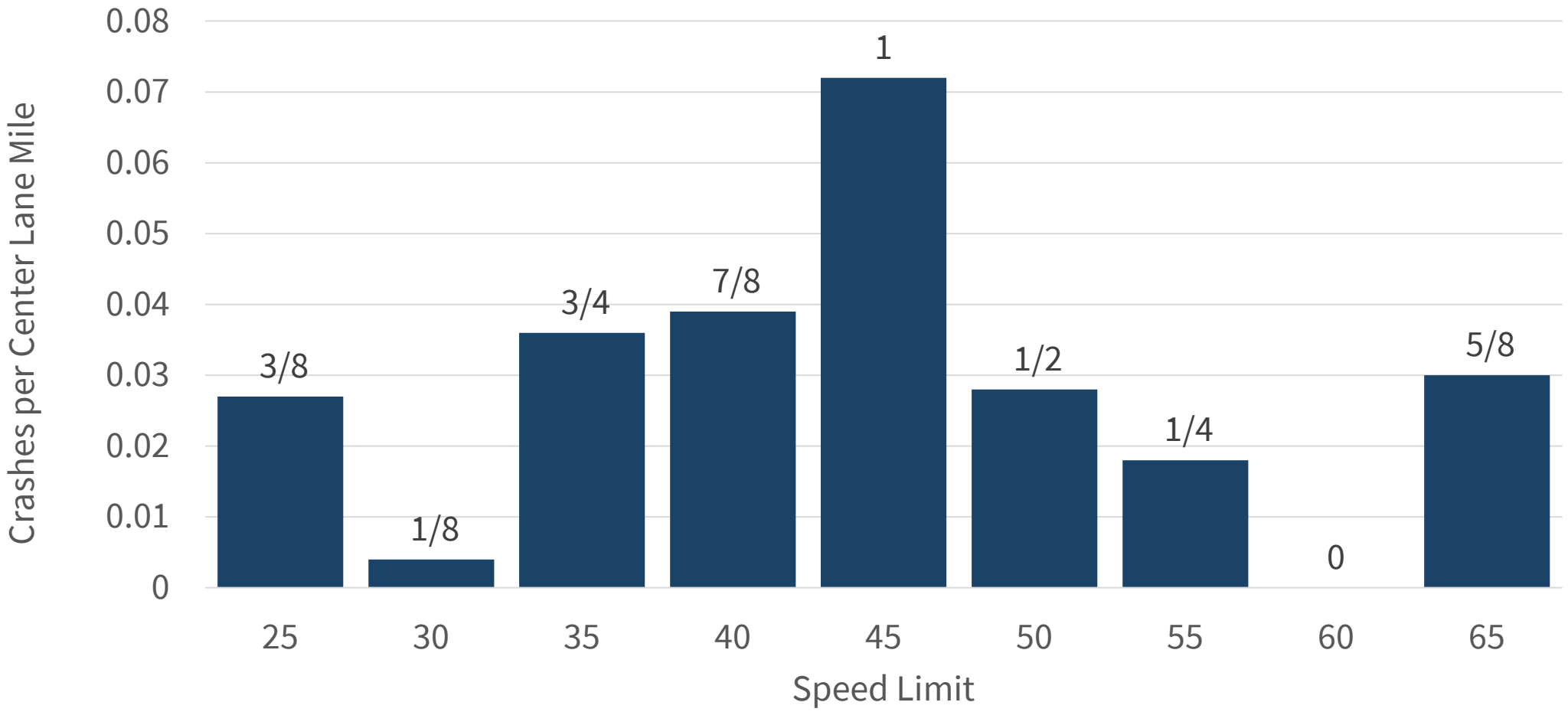
Cabell has sites #7, 9, 18, 19, 20, 21, 24 and 25

Wood has site #22

Street Name	Approximate Limits	City	County	Rank
Beechurst Ave	8th St to University Ave	Morgantown	Monongalia	1
University Ave	WV 705 to 8th St	Morgantown	Monongalia	2
University Ave	North St to College Ave	Morgantown	Monongalia	2
College Ave/ University Ave	Willey St to Jacob St	Morgantown	Monongalia	4
Evansdale Dr	University Ave to Rawley Ave	Morgantown	Monongalia	5
Campus Dr	Beechurst Ave to University Ave	Morgantown	Monongalia	6
8th Ave	8th St to 13th St	Huntington	Cabell	7
N Willey St (US 119)	Spruce St to Monongalia Ave	Morgantown	Monongalia	8
Willey St (US 119)	N High St to Spruce St	Morgantown	Monongalia	9
3rd Ave	Hal Greer Blvd to 22nd St	Huntington	Cabell	9
Evansdale Dr	Beechurst Ave to Rawley Ave	Morgantown	Monongalia	11
University Ave (US 119)	Pleasant St to Court St	Morgantown	Monongalia	12
5th Ave	10th St to 11th St	Huntington	Cabell	13
University Ave/ Beechurst Ave	Wall St to Fayette St	Morgantown	Monongalia	14
Court St	Virginia St E to Donnally St	Charleston	Kanawha	15
Kanawha Blvd E	Brooks St to Greenbrier St	Charleston	Kanawha	16
Virginia St E	Pennsylvania Ave to Dunbar St	Charleston	Kanawha	16
3rd Ave	22nd St to 24th St	Huntington	Cabell	18
3rd Ave	24th St to 29th St	Huntington	Cabell	19
8th Ave	6th St to 8th St	Huntington	Cabell	20
5th Ave	Hal Greer Blvd to 29th St	Huntington	Cabell	21
Grand Central Ave	9th St to Grand Central Mall	Parkersburg	Wood	22
Willowdale Rd	Northwestern Ave to Ira Errett Rodgers Dr	Evansdale	Monongalia	23
10th St	8th Ave to 11th Ave	Huntington	Cabell	24
6th Ave	8th St to 8th St	Huntington	Cabell	25

WEST VIRGINIA
VULNERABLE ROAD USER ASSESSMENT

Systemic Analysis Scoring



What Will These Studies be Looking For?

VRU Crossing Countermeasures

Countermeasure:	Leading Pedestrian Interval	High-Visibility Crosswalk	Rectangular Rapid Flashing Beacon (RRFB)	Turning Vehicles Yield to Pedestrian Signage at Intersections with High Pedestrian Traffic
Image/Graphic:	 *Leading pedestrian interval sign, highways.dot.gov*	 *High-Visibility Crosswalk, highways.dot.gov*	 *Rectangular Rapid Flashing Beacon, highways.dot.gov*	 *Turning Vehicle Yield to Pedestrian Sign, accuform.com*
How it Works:	A leading pedestrian interval (LPI) gives pedestrians the opportunity to enter the crosswalk at an intersection 3-7 seconds before vehicles are given a green indication. Pedestrians can better establish their presence in the crosswalk before vehicles have priority to turn right or left. There is also a secondary benefit as this increased all-red time for motorized traffic can also help reduce angle crashes between vehicles.	High-visibility crosswalks use patterns (i.e., bar pairs, continental, ladder) that are visible to both the driver and pedestrian from farther away compared to traditional transverse line crosswalks. They should be considered at all midblock pedestrian crossings and uncontrolled intersections. Agencies should use materials such as inlay or thermoplastic tape, instead of paint or brick, for highly reflective crosswalk markings.	To enhance pedestrian conspicuity and increase driver awareness at uncontrolled, marked crosswalks, transportation agencies can install a pedestrian actuated Rectangular Rapid Flashing Beacon (RRFB) to accompany a pedestrian warning sign. RRFBs consist of two, rectangular- shaped yellow indications, each with a light-emitting diode (LED)-array-based light source. RRFBs flash with an alternating high frequency when activated to enhance conspicuity of pedestrians at the crossing to drivers.	Adding signage to increase driver attention of high-volume pedestrian movements may help assist in visibility of vulnerable road users.
Anticipated CMF:	0.41	0.60	0.93	Not Studied
Other Information:	FHWA Proven Countermeasure	FHWA Proven Countermeasure	FHWA Proven Countermeasure	FWHA

WEST VIRGINIA VULNERABLE ROAD USER ASSESSMENT

What Will These Studies be Looking For?

VRU Crossing Countermeasures				
Countermeasure:	**Pedestrian Crossing Signals**	**Raised Crosswalk/Raised Intersection/Speed Table**	**Pedestrian Hybrid Beacons**	**Curb Ramps**
Image/Graphic:	 *Pedestrians Crossing Signal, driversed.com*	 *Raised Crosswalk, nycstreetdesign.info*	 *Pedestrian Hybrid Beacon, highways.dot.gov*	 *Curb Ramps, concreteconstruction.net*
How it Works:	Pedestrian crossing signals at traffic signals give the pedestrian enough time to cross the street and raise awareness to drivers that a pedestrian may be present. Adding a countdown signal allows for additional safety benefits. The countdown helps pedestrians to know when it is safe to cross, pedestrians should not begin crossing during the countdown phase. The timing for each phase is based on the crossing time as indicated in the MUTCD.	Raised crosswalks are ramped speed tables in the road that allow pedestrians to cross at the same level with the sidewalk, reducing vehicle speeds as they travel over the crosswalk and enhancing the pedestrian crossing environment.	The pedestrian hybrid beacon (PHB) is a traffic control device designed to help pedestrians safely cross higher-speed roadways at midblock crossings and uncontrolled intersections. The beacon head consists of two red lenses above a single yellow lens. The lenses remain "dark" until a pedestrian desiring to cross the street pushes the call button to activate the beacon, which then initiates a yellow to red lighting sequence consisting of flashing and steady lights that directs motorists to slow and come to a stop and provides the right-of-way to the pedestrian to safely cross the roadway before going dark again.	Title II of the Americans with Disabilities Act (ADA) of 1990 requires that public entities, including state and local governments, ensure that persons with disabilities have access to the pedestrian routes in the public right of way. A curb ramp provides a flush, gradual transition from the sidewalk to the street level. It also includes detectable warnings (small, truncated domes) where the ramp meets the vehicular area to serve as a warning to visually impaired pedestrians that they are about to leave the pedestrian space and enter the street.
Anticipated CMF:	Varies (formula based on ADT and area type)	0.64	0.45	CMF not Defined
Other Information:	CMF Clearinghouse	CMF Clearinghouse	FHWA Proven Countermeasure	U.S. Access Board

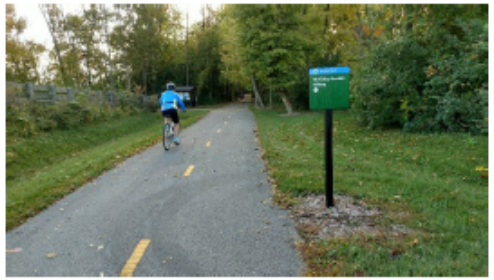
WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

What Will These Studies be Looking For?

VRU Crossing Countermeasures				
Countermeasure:	**Prohibiting "Turn on Red"**	**Accessible Pedestrian Signals**	**Curb Extensions/Bulb Outs/Refuge Islands**	**Calibrate/Add Detection for Bicycles**
Image/Graphic:	 *No Turn on Red Sign, safetysign.com*	 *Accessible Pedestrian Signal, dralegal.org*	 *Refuge Island, highway.dot.gov*	 *http://www.trafficsign.us/r10.html*
How it Works:	Prohibiting "Right Turn on Red" is a simple, low-cost measure that can benefit pedestrians with minimal impact on traffic. "No Turn on Red" should be considered in areas with substantial pedestrian volumes and can even be made as part time prohibitions that are put in place during the busiest times of the day.	Accessible pedestrian signals (APS) translate the pedestrian signal into audio and vibrotactile features to inform people with visual impairments. Every time the APS is activated, the audio beacon indicates that the "DON'T WALK" phase has turned into the "WALK" phase. APS can be added to existing signals. The Pedestrian Right-of-Way Accessibility Guidelines (PROWAG) requires that pedestrian signals or warning beacons include accessible push buttons when the signal or beacon is installed or altered.	Shortening the distance that a pedestrian must cross decreases the time they are on the roadway exposed to moving traffic. The "bulb outs" also increase the visibility of the pedestrian getting ready to cross a street. A pedestrian refuge island (or crossing area) is a median with a refuge area that is intended to help protect pedestrians who are crossing a road and enables them to cross one direction of moving vehicular traffic at a time.	Bicycle detection is used at actuated signals to alert the signal controller of bicycle crossing demand on a particular approach. Bicycle detection occurs either through the use of pushbuttons or by automated means (e.g., in-pavement loops, video, microwave, etc.). Inductive loop vehicle detection at many signalized intersections is calibrated to the size or metallic mass of a vehicle. For bicycles to be detected, the loop must be adjusted for bicycle metallic mass. Otherwise, undetected bicyclists must either wait for a vehicle to arrive, dismount, and push the pedestrian button (if available), or cross illegally.
Anticipated CMF:	Value Determined by Formula	CMF not Defined	0.44	Not studied
Other Information:	FHWA	U.S. Access Board	FHWA Proven Countermeasure	NACTO

WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

What Will These Studies be Looking For?

Off Street Facilities				
Countermeasure:	**Sidewalks**	**Shared-Use Paths**	**Cycle Tracks/Separated Bike Lane**	**Side Paths**
Image/Graphic:	 *Sidewalk in Huntington, WV, Burgess & Niple*	 *Shared-Use Path, Columbus, OH, Burgess & Niple*	 *Separated Bike Lane in Russellville, AR Planning + Design*	 *Side path in Upper Arlington, OH, Burgess & Niple*
How it Works:	Sidewalks are a dedicated space for pedestrians to walk along the roadway. They are typically separated from the road by a buffer and/or curb.	Shared-use paths provide a lower-stress, separate space for both bicyclists and pedestrians. This separated space is most critical on higher volume, higher speed streets. Shared use paths are away from the road and can also be considered trails.	Cycle tracks, also called separated bike lanes, are bikeways that are at street level and use a variety of methods for physical separation from passing traffic. A protected cycle track may be combined with a parking lane or other barrier between the cycle track and the motor vehicle travel lane.	Side paths are similar to shared-use paths in that they accommodate both pedestrians and cyclists, but they are typically next to a roadway like sidewalks.
Anticipated CMF:	0.26	0.75	CMF: 0.55 - 2-5 meters from traveled way	0.75
Other Information:	CMF Clearinghouse	CMF Clearinghouse	CMF Clearinghouse; Rural Design Guide	Rural Design Guide

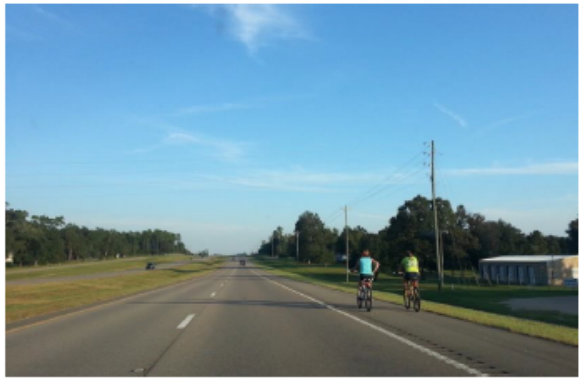
WEST VIRGINIA VULNERABLE ROAD USER ASSESSMENT

What Will These Studies be Looking For?

On Street Facilities			
Countermeasure:	**Bicycle Boulevard**	**Buffered Bike Lanes/Bike Lanes**	**Shared Lane Markings (Sharrows)**
Image/Graphic:	 *Bicycle Boulevard, nacto.org*	 *Buffered Bike Lanes, Columbus, OH, Burgess & Niple*	 *Shared Lane Marking, Indianapolis, IN, Burgess & Niple*
How it Works:	Signs and pavement markings create the basic elements of a bicycle boulevard. They indicate that a roadway is intended as a shared, slow street, and reinforce the intention of priority for bicyclists along a given route. This could also be accompanied with limiting through traffic on certain roadway segments. Signs and pavement markings alone do not create a safe and effective bicycle boulevard, but act as reinforcements to other traffic calming and operational changes made to the roadway.	Providing bicycle facilities can mitigate or prevent interactions, conflicts, and crashes between bicyclists and motor vehicles, and create a network of safer roadways for bicycling. Bicycle lanes align with the Safe System Approach principle of recognizing human vulnerability—where separating users in space can enhance safety for all road users.	Sharrows are road markings that designate a space for both motorists and bicyclists. This allows for the combined use of bikes and motor vehicles and can designate the best position within the lane for bicyclists to ride. Before implementing sharrows, it is important to take careful considerations for the speed and volume of the road and passing width.
Anticipated CMF:	Not Studied - Individual CMF's may be available	0.44	Not Fully Studied
Other Information:	NACTO , Small Town and Rural Design Guide	FHWA Proven Countermeasure; CMF Clearinghouse	NACTO

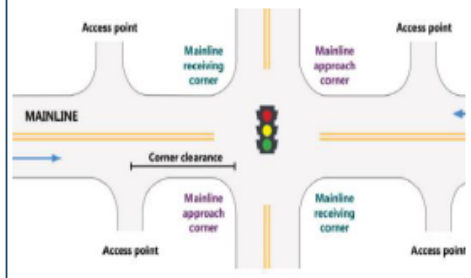
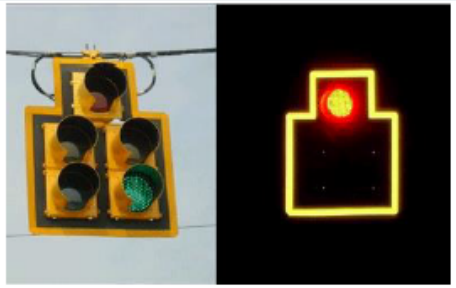
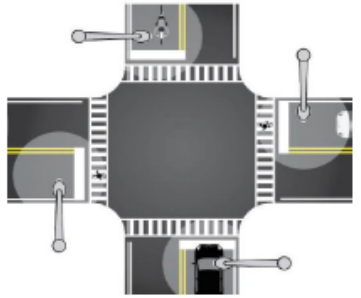
WEST VIRGINIA VULNERABLE ROAD USER ASSESSMENT

What Will These Studies be Looking For?

On Street Facilities			
Countermeasure:	**Yield Roadway**	**Pedestrian Lane**	**Paved Shoulder**
Image/Graphic:	 *Yield Roadway, rouraldesignguide.com*	 *Pedestrian Lane in Detroit, OR, rouraldesignguide.com*	 *Paved Shoulder North of D'Iberville, MS, rouraldesignguide.com*
How it Works:	A yield roadway is a shared space for all road users: vehicles, pedestrians, and cyclists. Yield roadways are intended for use on narrow roads 20 ft wide or less with low traffic volumes (less than 2,000 vehicle ADT) and average speeds of 20 MPH or less.	Pedestrian lanes are intended to function as temporary pedestrian facilities. They are lane markings that are a cost-effective way to create a designated space for pedestrians, and potentially cyclists. They are intended for use on roadways with a 2,000 vehicle ADT or less and average speeds of 20 MPH or less.	When there are no facilities to accommodate a pedestrian or cyclist, a paved shoulder, the edge of the roadway, could provide a space for walking or biking in the right context. This could be accompanied with rumble strips and signage.
Anticipated CMF:	Not Fully Studied	Paved shoulder studies have been shown to reduce "pedestrian walking along roadway" crashes by 71%	Can reduce "bicyclist struck from behind" crashes, which represent a significant portion of rural road crashes and pedestrian "walking along roadway" crashes
Other Information:	Small Town and Rural Design Guide	Small Town and Rural Design Guide	Small Town and Rural Design Guide

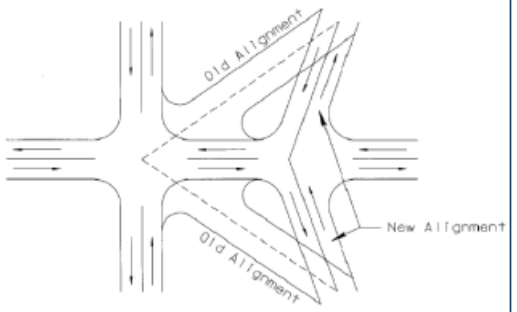
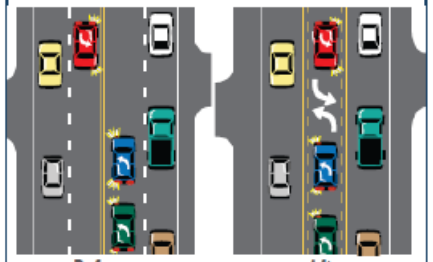
WEST VIRGINIA VULNERABLE ROAD USER ASSESSMENT

What Will These Studies be Looking For?

Indirect VRU Safety Improvements				
Countermeasure:	**Complete Streets/Designing for all Users**	**Access Control Through Medians**	**Backplates with Retroreflective Boarders**	**Street Lighting**
Image/Graphic:	 *Complete Street Design, strongtowns.org*	 *Access Points Schematic, highways.dot.gov*	 *Traffic light with reflective backplate, usbarricades.com*	 *Street Lighting, highways.dot.org*
How it Works:	Complete Streets are streets for everyone. Complete Streets is an approach to planning, designing, building, operating, and maintaining streets that enables safe access for all people who need to use them, including pedestrians, bicyclists, motorists and transit riders of all ages and abilities.	Thoughtful access management along a corridor can simultaneously enhance safety for all modes, facilitate walking and biking, and reduce trip delay and congestion.	Backplates added to a traffic signal head improve the visibility of the illuminated face of the signal by introducing a controlled-contrast background. The improved visibility of a signal head with a backplate is made even more conspicuous by framing it with a 1- to 3-inch yellow retroreflective border. Signal heads that have backplates equipped with retroreflective borders are more visible and conspicuous in both daytime and nighttime conditions, which could help approaching vehicles stop for pedestrians or cyclists who are crossing.	At nighttime, vehicles traveling at higher speeds may not have the ability to stop once a hazard or change in the road ahead becomes visible by the headlights. Therefore, lighting can be applied continuously along segments and at spot locations such as intersections and pedestrian crossings in order to reduce the chances of a crash.
Anticipated CMF:	Varies depending on Treatments	0.69-0.95	0.85	0.58
Other Information:	CMF Clearinghouse	FHWA Proven Countermeasure	FHWA Proven Countermeasure	FHWA Proven Countermeasure

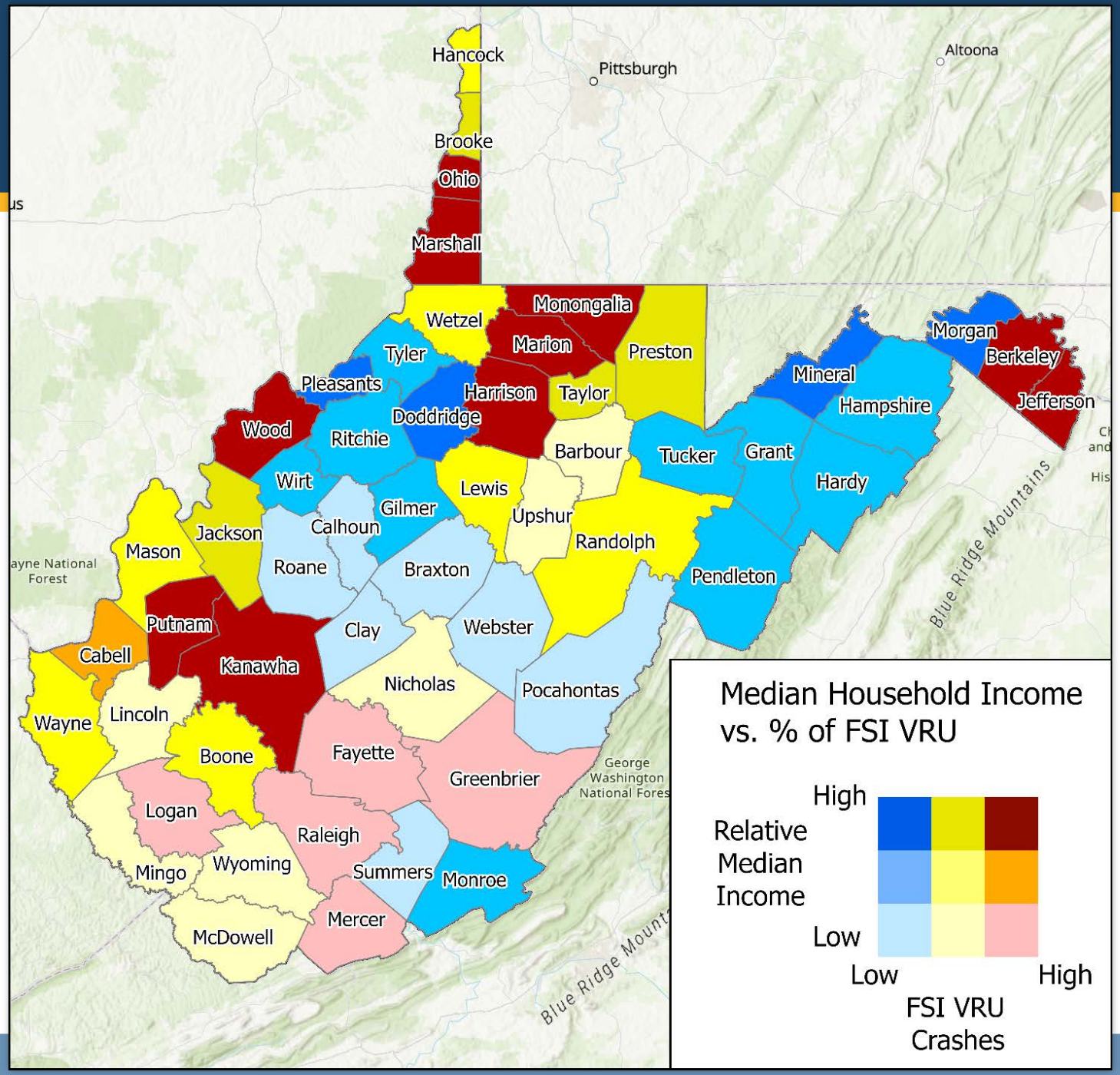
WEST VIRGINIA VULNERABLE ROAD USER ASSESSMENT

What Will These Studies be Looking For?

Indirect VRU Safety Improvements				
Countermeasure:	**Improved Geometry**	**Roundabout**	**Traffic Calming**	**Road Diet**
Image/Graphic:	 *Improved Intersection Geometry, cedengineering.com*	 *Roundabout, highways.dot.gov*	 *Traffic Calming, thinkstreetsmart.org*	 *Road Diet, safety.fhwa.dot.gov*
How it Works:	Geometry improvements such as positive offset of left turn lanes, skew elimination, and sight distance improvements all can have great effects on the number of crashes in the intersection and can help increase pedestrian safety when crossing.	The modern roundabout is an intersection with a circular configuration that safely and efficiently moves traffic. Roundabouts feature channelized, curved approaches that reduce vehicle speed, entry yield control that gives right-of way to circulating traffic, and counterclockwise flow around a central island that minimizes conflict points. The net result of lower speeds and reduced conflicts at roundabouts is an environment where crashes that cause injury or fatality are substantially reduced. They also reduce the crossing distance for pedestrians.	Traffic calming reduces motor vehicle speeds or volumes, mainly through the use of physical measures, to improve the quality of life in both residential and commercial areas and increase the safety and comfort of walking and bicycling.	A roadway reconfiguration known as a road diet offers several high-value improvements at a low cost by reallocating vehicular lanes. The primary benefits of a road diet include enhanced safety, mobility, and access for all road users and a "complete streets" environment to accommodate a variety of transportation modes. A road diet can better align left turning vehicles, encourage safer speeds, and potentially add separate space for cyclists or transit.
Anticipated CMF:	Varies	0.66	Varies Depending on Treatment	0.53
Other Information:	CMF Clearinghouse	FHWA Proven Countermeasure; CMF Clearinghouse	CMF Clearinghouse	CMF Clearinghouse

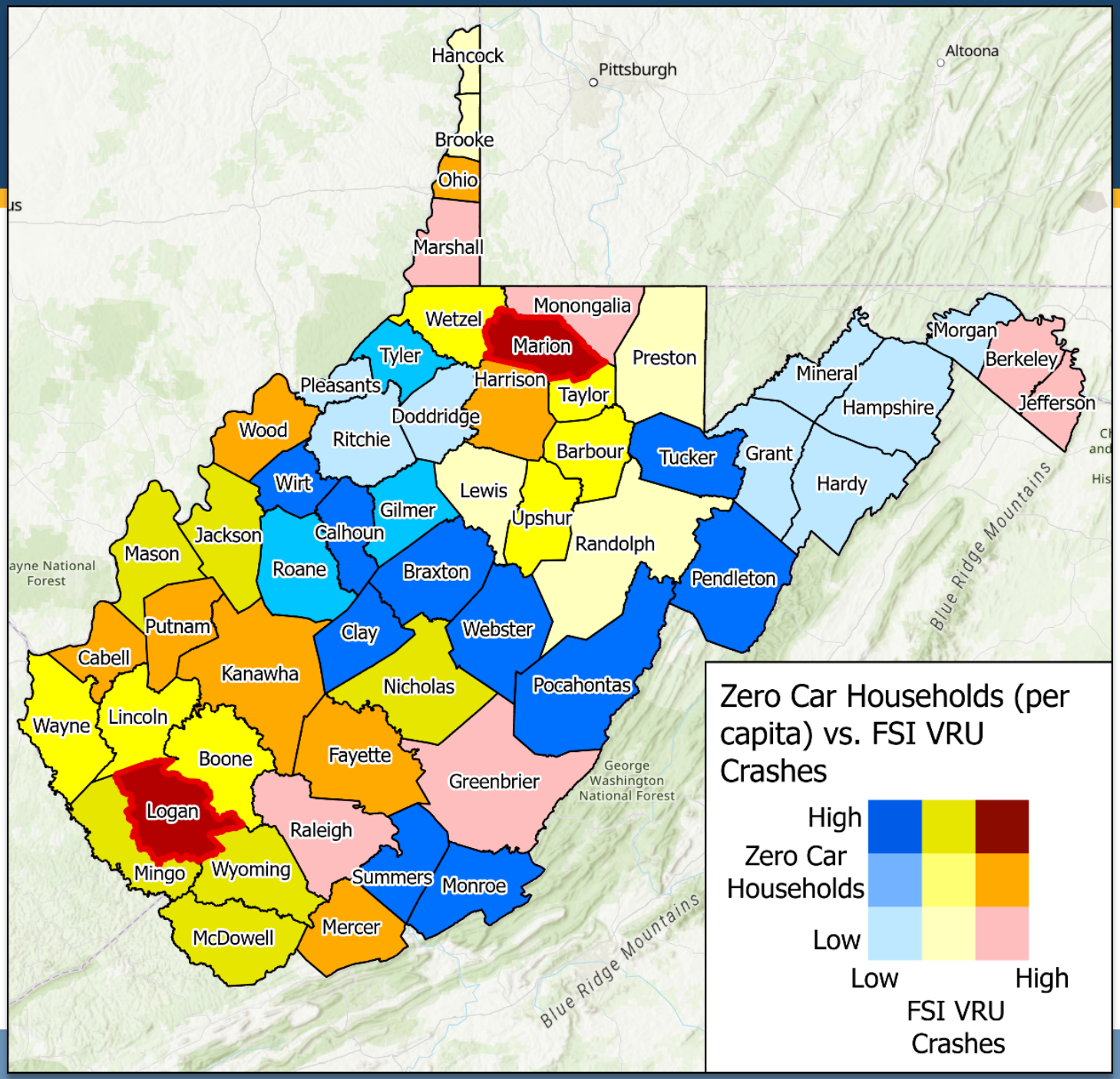
WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT

Equity Analysis



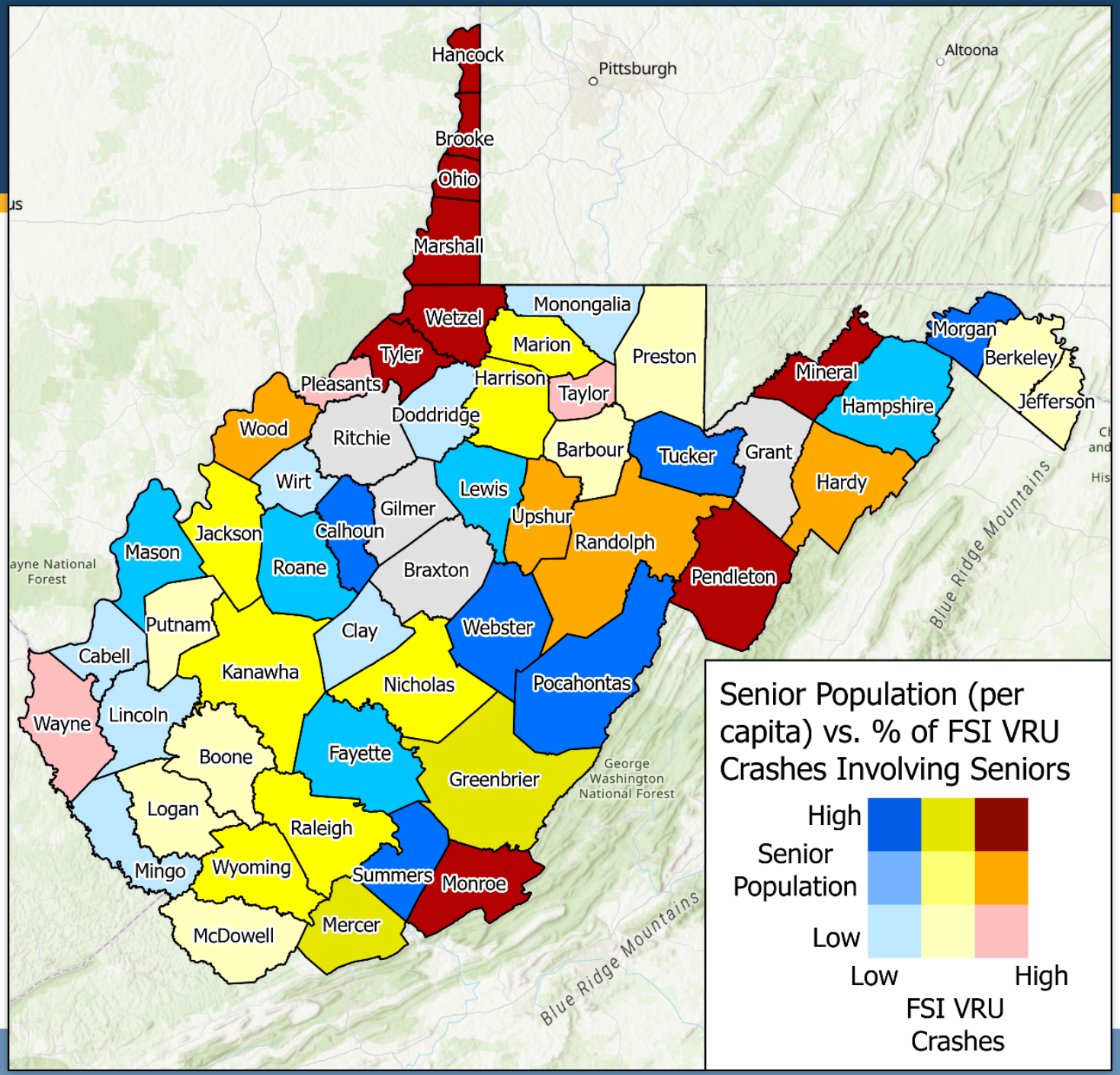
Median Household Income

WEST VIRGINIA
VULNERABLE ROAD USER ASSESSMENT



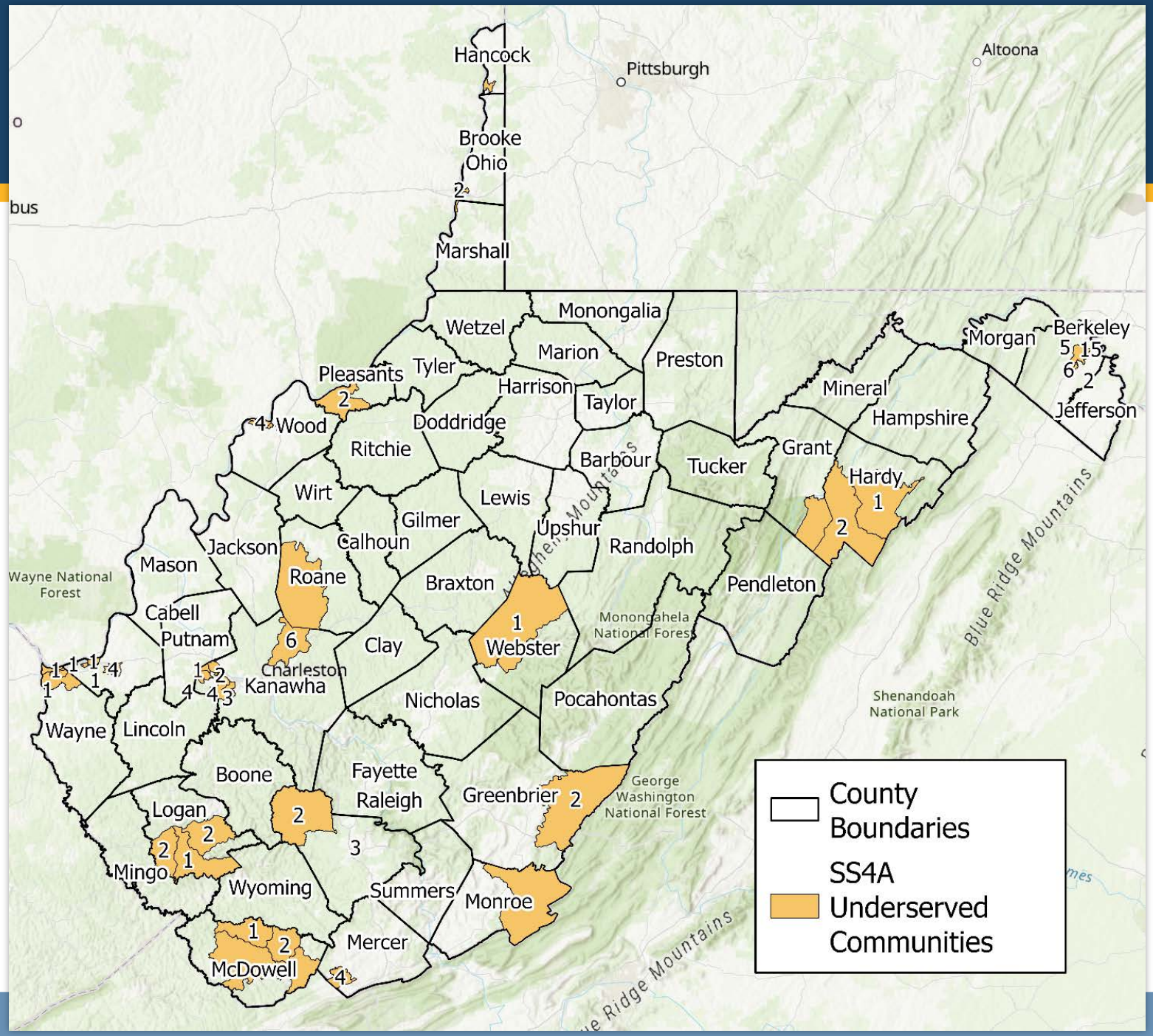
Zero Car Households

WEST VIRGINIA
VULNERABLE ROAD USER ASSESSMENT



Elderly Population

WEST VIRGINIA
VULNERABLE ROAD USER ASSESSMENT



Population	7.8%
Area	9.6%
VRU FSI	**13.9%**

Underserved Communities

WEST VIRGINIA
VULNERABLE ROAD USER ASSESSMENT

Strategies

- Provide VRU accommodations along the HIN and High-Risk Segments
- Educate road users on VRU safety
- Reduce vehicle speeds in areas with high VRU presence
- Update crash reports for more specific VRU details
- Bi-annual reviews of VRU crash data and the status of strategy implementation

WEST VIRGINIA
VULNERABLE ROAD USER ASSESSMENT

Questions?

Donna J. Hardy, PE
Donna.j.hardy@wv.gov

WEST VIRGINIA
VULNERABLE ROAD USER
ASSESSMENT