Kentucky Vulnerable Road User Safety Assessment

Appendix to the Kentucky 2020-2024 Strategic Highway Safety Plan

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Fatal and serious injury crashes involving vulnerable road users, including bicyclists, pedestrians, and other non-motorized roadway users, have increased in frequency the past several years, not only in Kentucky, but nationwide. In accordance with the Bipartisan Infrastructure Law, Kentucky's initial Vulnerable Road User Safety Assessment supplements the state's 2020-2024 Strategic Highway Safety Plan to provide more insight on vulnerable road user safety. The mission for our Vulnerable Road User Safety Assessment is straightforward – to equitably protect the lives of Kentucky's most vulnerable roadway users by preventing crashes that result in deaths and serious injuries.

This assessment explores safety trends for vulnerable road users in Kentucky, identifies high-risk areas for vulnerable road users, outlines the steps Kentucky is currently taking to improve vulnerable road user safety, and emphasizes effective strategies to improve vulnerable road user safety. Following the principles of the Safe System Approach, we sought input from local leaders, planners, engineers, law enforcement, first responders, and many other vital stakeholders to develop a program of proactive strategies and countermeasures to address vulnerable road user safety in our Commonwealth.

I appreciate all who work diligently to implement opportunities to improve safety for all users as presented in this assessment as well as those who contributed to its creation. That list includes the Governor's Executive Committee on Highway Safety and all of our partners, including safety advocates, local governments, law enforcement and first responders throughout Kentucky, the National Highway Traffic Safety Administration, Federal Highway Administration, Federal Motor Carrier Safety Administration, the Kentucky Transportation Center at the University of Kentucky, and the Kentucky Transportation Cabinet.

Improving safety for Kentucky's vulnerable road users is within reach, and requires a people- centric, equitable, collaborative approach. Together, we can work toward our ultimate safety goal – a Kentucky where everyone who travels reaches their destination safely. Every mode. Every trip. Every time.

Sincerely,

Jim Gray
Secretary

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Section 1 Introduction

The Bipartisan Infrastructure Law directed each state to complete an initial Vulnerable Road User (VRU) Safety Assessment by November 15, 2023, as a part of its Highway Safety Improvement Program (HSIP). The assessment must contain an overview of VRU safety performance, an analysis that identifies high-risk areas, consultation with stakeholders, identification of strategies to address VRU safety, and application of the Safe System Approach to VRUs. This assessment plan must be submitted as an attachment to the state's Strategic Highway Safety Plan (SHSP) and updated each year a new SHSP is published.[1]

Kentucky state leaders want to significantly improve VRU safety and prevent the mortality and morbidity associated with VRU crashes. This objective was outlined in the state's 2020 *Strategic Highway Safety Plan* (SHSP), which has the goal of preventing enough severe crashes such that VRU fatalities fall below 100 by 2024. Unfortunately, it appears Kentucky will not reach this goal. Thus, the VRU Safety Assessment is timely for increasing emphasis on the VRU safety challenge.

Kentucky's SHSP outlines strategic and crosscutting opportunities to prevent deaths and serious injuries on the state's roadways. It identifies six Emphasis Areas to guide highway safety improvements:

- Aggressive Driving
- Distracted Driving
- Impaired Driving
- Occupant Protection
- Roadway Departure
- Vulnerable Road Users

These areas were selected for both the urgency of the problems and the opportunity for improvement. Improvement strategies identified in the plan are organized based on the four Es of road safety — Education, Emergency Medical Services, Enforcement, and Engineering — as well as legislative strategies. Most strategies in the SHSP focus on more than one Emphasis Area.

Implementation of the SHSP is led by the Governor's Executive Committee on Highway Safety (GECHS), an executive-level, multi-agency group of highway safety advocates from different backgrounds who serve with one voice on Kentucky highway safety issues. The Kentucky Office of Highway Safety (KOHS) — housed in the Kentucky Transportation Cabinet (KYTC) — is responsible for coordinating highway safety improvement strategies included in the SHSP. Taskforces focused on each Emphasis Area are responsible for developing action plans, implementing safety improvement strategies, and tracking progress toward the measurable goals identified in the SHSP. This assessment complements ongoing activities of the SHSP VRU Task Force. The assessment team systematically evaluated the nature of VRU crashes in Kentucky and engaged constituents most affected by and best positioned to address the VRU-related safety challenges and opportunities in the state.[2]

This assessment defines VRUs slightly differently than the SHSP as motorcycles are not included. While the SHSP maintains a focus on preventing motorcyclist deaths and serious injuries, this assessment defines VRUs consistent with the FHWA definition:

> "A vulnerable road user is a nonmotorist with a fatality analysis reporting system (FARS) person attribute code for pedestrian, bicyclist, other cyclist, and person on personal conveyance or an injured person that is, or is equivalent to, a pedestrian or pedalcyclist as defined in the ANSI D16.1-2007. (See 23 U.S.C. 148(a)(15) and 23 CFR 490.205). A vulnerable road user may include people walking, biking, or rolling. Please note that a vulnerable road user:
>
> • Includes a highway worker on foot in a work zone, given they are considered a pedestrian.
> • Does not include a motorcyclist."[3]

This assessment looks at the most severe crashes, including those that result in fatalities and/or serious injuries, and considers both demographics and the Safe System Approach.

Section 2 Safe System Approach

The USDOT recently adopted the Safe System Approach as part of the National Road Safety Strategy. Its goal is to improve safety and eliminate all serious injuries and deaths on US roadways. This approach is an effective way to mitigate risks across the transportation system and works by building and reinforcing multiple layers of protection to prevent crashes and minimize harm if crashes do occur. The Safe System Approach has six guiding principles:

- Roadway fatalities and serious injuries are unacceptable and avoidable
- Humans are vulnerable
- Humans make mistakes
- Responsibility is shared by all roadway users
- Safety should be proactive
- Redundancy is key to ensuring safety for all

The objective of the Safe System Approach is to improve safety and minimize crash risks by attending to roadway users, vehicle safety, roads, speeds, and post-crash care. Improving all five of these elements creates the desired redundancy that enhances safety for all roadway users.[4]

Bicyclists and pedestrians are among the most vulnerable roadway users and benefit greatly from increased redundancy within safety-related improvements. As such, the Safe System Approach is a vital strategy to improve user experiences.

Section 3 Demographics

Knowledge of VRU demographics creates an opportunity to implement customized, intentional countermeasures. For VRU Safety Assessments, the FHWA recommends considering five data sources that aggregate demographic data and categorize disadvantaged status:

- Environmental Justice Screening and Mapping Tool (EPA)
- FHWA Socioeconomic and Equity Analysis (FHWA)
- Transportation Disadvantaged Census Tracts (USDOT)
- Climate and Economic Justice Tool (Council on Environmental Quality)
- Social Vulnerability Index (CDC)[5]

After reviewing all five data sources and their respective data elements, Kentucky decided to use the USDOT Transportation Disadvantaged Census Tract database because it incorporates data directly from two of the other recommended datasets (EPA and CDC datasets) and indirectly incorporates similar metrics to the remaining two recommended datasets. The USDOT dataset, in accordance with the Justice40 Initiative, ranks census tracts nationwide on 22 indicators across six categories of transportation disadvantage to determine if a census tract qualifies as a historically disadvantaged community (DAC).

The six categories of disadvantage considered in the USDOT dataset are summarized below. Raw data sources for indicators that comprise each category of disadvantage are included in parentheticals.

- **Transportation Access disadvantage** identifies communities and places that spend more money and time to get where they need to go. (CDC Social Vulnerability Index, Census America Community Survey, EPA Smart Location Map, HUD Location Affordability Index)
- **Health disadvantage** identifies communities based on variables associated with adverse health outcomes, disability, and environmental exposures. (CDC Social Vulnerability Index)
- **Environmental disadvantage** identifies communities with disproportionate pollution burden and inferior environmental quality. (EPA EJ Screen)
- **Economic disadvantage** identifies areas and populations with high poverty, low wealth, lack of local jobs, low homeownership, low educational attainment, and high inequality. (CDC Social Vulnerability Index, Census America Community Survey, FEMA Resilience Analysis & Planning Tool)
- **Resilience disadvantage** identifies communities vulnerable to hazards caused by climate change. (FEMA National Risk Index)
- **Equity disadvantage** identifies communities with a high percentile of persons (age 5+) who speak English less than well. (CDC Social Vulnerability Index)

A census tract's percentile rank is calculated for all 22 indicators. The percentile rank of each census tract is averaged across all indicators in each disadvantage category, which results in a percentile rank for each of the six disadvantage categories. A tract is considered disadvantaged in a category if it has an average percentile ranking of 50th or higher. This means the tract is more disadvantaged in a given category than 50% of the country's census tracts. The resilience disadvantage category is the only exception. In this category, a tract must score in the top 75th percentile to be considered resiliency disadvantaged. Any tract with a disadvantaged rating in four or more categories is defined as a DAC.[6]

According to these criteria, 280 of Kentucky's 1,115 census tracts are DACs. These DACs are home to 27.3% of the state's population and account for 25.1% of its land area.

Section 4 Data Analysis

VRU crash data provide valuable insight into statewide trends and potential focus areas. This section details data analysis in terms of time, user type, and crash type.

Prior to the VRU Safety Assessment mandate, Kentucky monitored the performance of bicyclist and pedestrian safety through the SHSP and HSIP. Bicyclist and pedestrian crashes are two of the 12 crash type emphasis areas Kentucky tracks in its annual HSIP report. Figure 1 displays the number of fatalities and serious injuries annually for bicyclist and pedestrian crashes during the 2013 – 2022 period. The VRU Fatalities and VRU Serious Injuries combine information for bicyclists and pedestrians.[7]

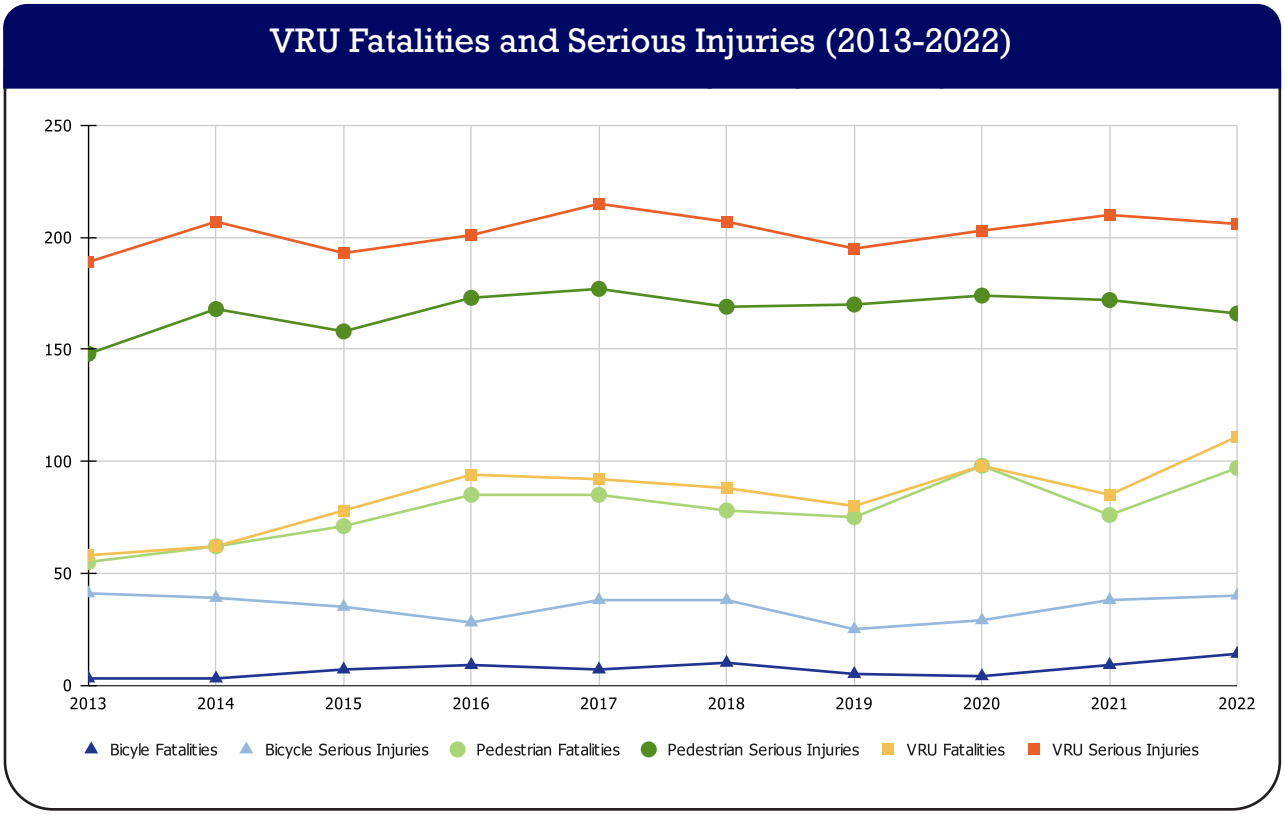

Figure 1 HSIP Pedestrian and Bicyclist Fatality and Serious Injury Data (2013-2022)

Pedestrians and bicyclists exhibit many of the same trends for fatalities and serious injuries. Bicycle and pedestrian fatalities and serious injuries increased between 2013 and 2017 before trending downward through 2019. However, in 2020, pedestrian fatalities increased sharply while bicyclist fatalities slightly decreased. Serious injuries for both crash types rose in 2020. Pedestrian fatalities and serious injuries saw a brief drop in 2021 while bicycle fatalities and serious injuries rose. In 2022, VRU fatalities reached a ten-year high, although VRU serious injuries have remained steady over the past 10 years. Kentucky's SHSP has a goal of reaching 100 or fewer combined fatalities for pedestrian, bicyclist, and motorcycle crashes per year by the end of 2024. Based on the 2022 crash trends for bicyclist and pedestrian fatalities, significant progress on VRU safety is needed achieve this goal.

To understand trends and risk factors unique to VRU crashes, fatal and serious injury VRU crash data and associated roadway information were compared to all other fatal and serious injury crashes in the state during the same period. Trends among fatal and serious injury bicyclist crashes were compared to trends for pedestrian fatal and serious injury crashes. These comparisons revealed trends unique to VRU crashes, providing insight into risk factors and systemic changes that could potentially improve VRU safety.

The assessment used the most recent five years of statewide crash data (2018 – 2022) for fatal and serious injury crashes and enriched them with roadway feature data from Kentucky's Highway Information System (HIS) database and intersection data from the state's intersection database. Kentucky uses the KABCO scale to categorize crash severity, with K representing fatal crashes and A representing serious injury crashes. Throughout this report, fatal

and serious injury crashes are referred to as *KA crashes*. Additionally, the USDOT DAC designation was identified for each crash location. Most of Kentucky's HIS data cover state-maintained roads, with limited coverage of locally owned roads. Therefore, data enrichment was limited for crashes on locally owned roads. The enrichment process provided the following information for each crash, where applicable:

- Annual Average Daily Traffic
- Number of travel lanes and lane width
- Median type and median width
- Shoulder type and shoulder width
- Intersection classification
- Functional classification
- Urban/Rural designation
- Disadvantaged status

4.1 VRU vs. Non-VRU KA Crashes

Between 2018 and 2022, Kentucky recorded 13,574 non-VRU KA crashes and 1,574 VRU KA crashes. VRU crashes accounted for 478 of the 3,525 fatality crashes and 1,096 of the 11,623 serious injury crashes. In other words, 13.6% of fatal crashes and 9.4% of serious injury crashes in Kentucky involved a VRU. Figure 2 provides a breakdown of VRU and non-VRU crash types for each year.

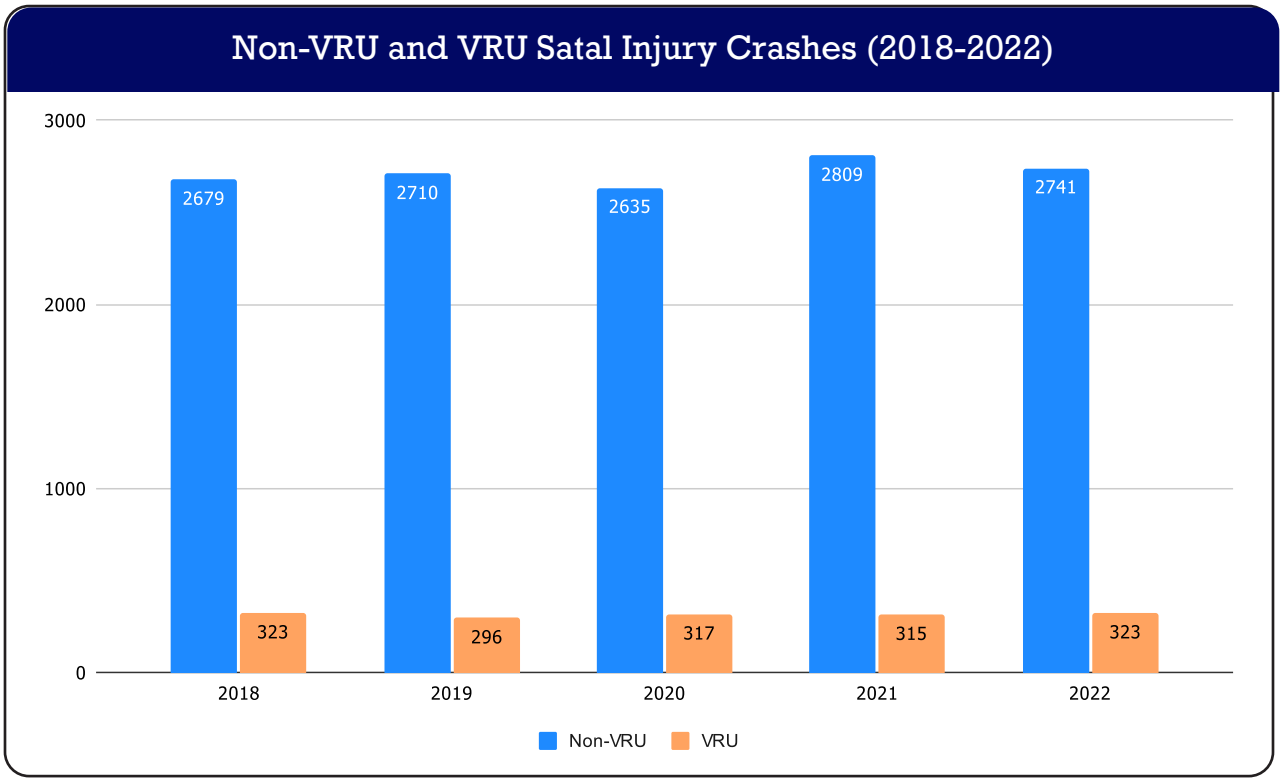

Figure 2 Fatal and Serious Injury Crash Totals for VRU and Non-VRU Crashes in Kentucky (2018-2022)

The data reveal an inverse relationship between VRU crash severity and non-VRU crash severity. In years that non-VRU fatal and serious injury crashes decreased, VRU crashes of the same severity increased, and vice versa.

To further examine the differences between VRU crashes and non-VRU crashes, the assessment team compared the percentage of VRU KA crashes for a given crash/roadway category to the percentage of non-VRU KA crashes for the same category. The greatest disparity was for hit-and-run crashes. 18.7% of VRU KA crashes between 2018 and 2022 were hit and run, while only 2.2% of non-VRU KA crashes were hit and run. That means VRU KA crashes were 8.5 times more likely to be hit-and-run crashes than all other KA crashes.

Nearly 82% of VRU KA crashes occurred in an urban or suburban area, while only 48.6% of non-VRU KA crashes occurred in an urban or suburban area. This indicates VRU safety risk is greatest in urban/suburban areas. Other major differences in crash and roadway characteristics between VRU KA crashes and non-VRU KA crashes are summarized below.

- Over 60% of non-VRU KA crashes occurred on roads with a reported speed limit of 55 mph or greater, whereas 54% of VRU KA crashes occurred on roads with a reported speed limit of 35 mph or less. Kentucky's statutory speed limit in urban/suburban settings is 35 mph.
- KA crashes of all types were most likely to occur at non-intersection locations — 43.9% of VRU KA crashes occurred at intersections while only 27% of non-VRU KA crashes occurred at intersections. The most common intersection types at which VRU KA crashes occurred were undivided, three-leg, urban, partially stop-controlled and undivided, four-leg, urban, signalized intersections. At these intersection types, VRU KA crashes were twice as likely to occur as non-VRU KA crashes.
- Compared to non-VRU KA crashes, a higher proportion of VRU KA crashes occurred on roadways with no data available in Kentucky's HIS database. This indicates VRU KA crashes are more likely to occur on locally owned roads with no information in the HIS database. Data analysis indicated VRU KA crashes are roughly 50% more likely to occur on locally owned roadways than non-VRU KA crashes.
- Between 2018 and 2022, 40.3% of VRU KA crashes occurred during daylight hours, compared to 61.6% of non-VRU KA crashes. This suggests VRU KA crashes are largely a nighttime phenomenon and thus heavily influenced by visibility.
- 55.8% of non-VRU KA crashes occurred on two-lane roads whereas only 40.9% of VRU KA crashes occurred on two-lane roads. VRU KA crashes were more likely to occur on roads with four or more lanes than non-VRU KA crashes.
- VRU KA crashes occurred most frequently in the autumn, while non-VRU KA crashes occurred more frequently in the summer.
- VRU KA crashes occurred most frequently in locations with curb and gutter or 2' shoulders or less. Non-VRU KA crashes occurred more frequently in locations with 3' shoulders or greater.

Along with differences in crash and roadway characteristics, key differences in demographics and person-level crash data between VRU and non-VRU KA crashes were identified:

- KA crashes most often involved males — 70.4% of cyclists and pedestrians involved in VRU KA crashes were male compared to only 62.2% male for non-VRU KA crashes.
- Similar age distributions were generally seen among persons involved in VRU and non-VRU KA crashes. Notably though, VRU KA crashes were twice as likely to involve a person under 10 years of age, and had two-thirds the likelihood of involving persons aged 20 to 29 compared to non-VRU KA crashes.
- Similar human factors contributing to the crash were reported for VRU and non-VRU KA crashes, with *Inattention*, *Not under proper control*, and *Failure to yield right of way* as the most common human factors for each crash group.
- The most meaningful demographic trend identified was the disparity between VRU and non-VRU KA crashes in DACs. Based on USDOT data, 37.4% of VRU KA crashes occurred in a DAC between 2018 and 2022. Conversely, 29.8% of non-VRU KA crashes occurred in DACs. As noted, DACs house 27.3% of the state's population and account for 25.1% of its land area. Proportionally, this indicates KA crashes of all types are slightly overrepresented in DACs. More importantly, compared to non-VRU KA crashes, VRU KA crashes are overrepresented in DACs by a factor of 25%.

4.2 Pedestrian vs. Bicyclist KA Crashes

Between 2018 and 2022, Kentucky recorded 1,368 pedestrian KA crashes and 206 bicyclist KA crashes. Figure 3 provides a year-by-year breakdown of these crashes.

Pedestrian KA crashes peaked in 2020 and dropped slightly after that. Bicyclist KA crashes were lowest in 2019 and rose steadily over the rest of the period. Pedestrian KA crashes accounted for the majority of the state's VRU KA crashes (86.9%), and little progress has been made to lower the KA crashes for either transportation mode

Analysis of bicyclist and pedestrian KA crashes — which mirrored analysis that compared VRU and non-VRU KA crashes — was performed to identify trends for each crash type included under the heading of VRU crashes. Beginning with roadway and crash characteristics, the assessment team identified several trends for bicyclist and pedestrian crashes:.

- Hit-and-run crashes accounted for 24.3% of bicyclist KA crashes and 17.8% of pedestrian KA crashes.
- 63.1% of bicyclist KA crashes occurred on roadways with reported speed limits of 35 mph or less, compared to 53.0% of pedestrian KA crashes on roadways with the same speed limits. On roads with 55 mph speed limits, pedestrian KA crashes were 43% more likely than bicyclist KA crashes.

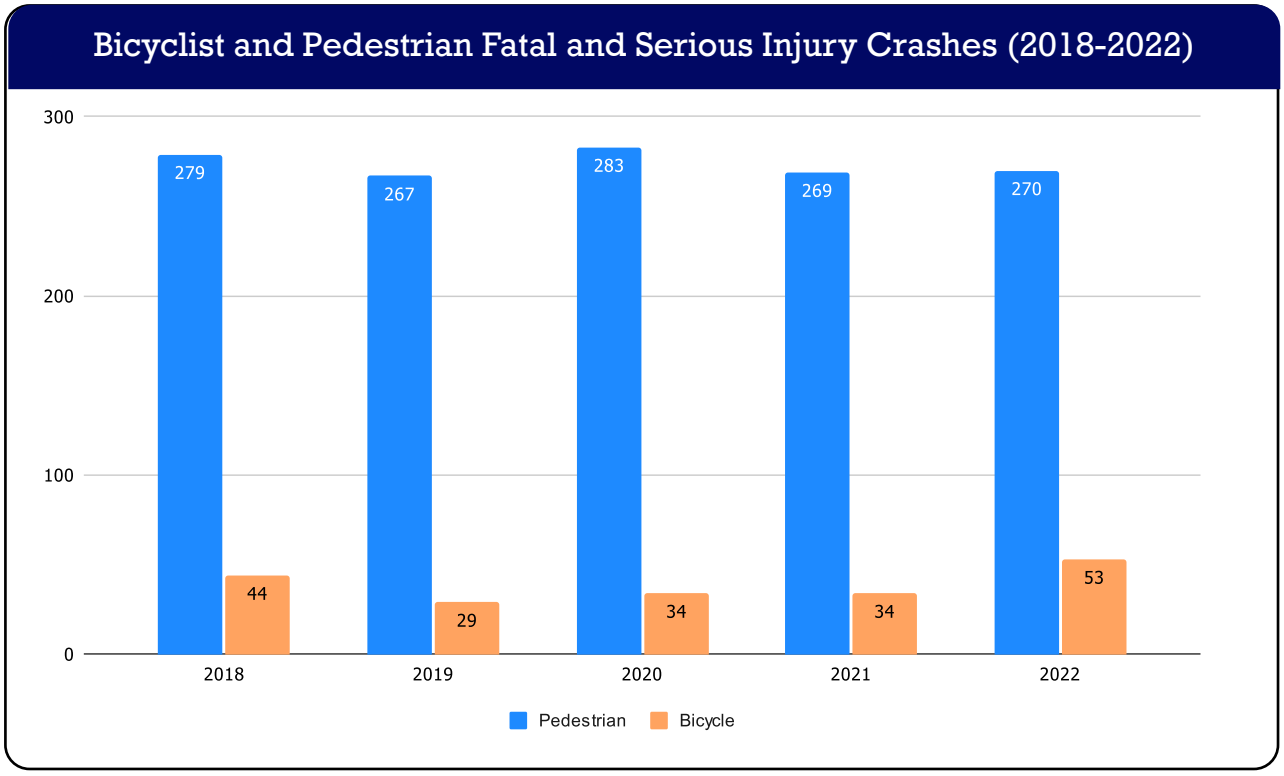

Figure 3 Fatal and Serious Injury Crash Totals for Pedestrian and Bicyclist Crashes in Kentucky (2018-2022)

- Two-lane roads accounted for 48.5% of bicyclist KA crashes and 39.8% of pedestrian KA crashes.
- Both bicyclist and pedestrian KA crashes occurred in approximately equal proportions on locally owned roadways — around 18% of all KA crashes for each crash type.
- 54.4% of bicyclist KA crashes occurred during daylight hours, compared to 38.5% of pedestrian crashes. This indicates pedestrians are more vulnerable in low-light conditions and/or VRUs are less likely to choose bicycling as a mode of transportation in low-light conditions.
- Fewer than half (43.2%) of all pedestrian KA crashes occurred at intersections, but more than half (56.3%) of bicyclist KA crashes occurred at intersections. The most common intersection type for bicyclist KA crashes was undivided, three-leg, urban, partially stop-controlled intersections, which recorded 14.1% of all bicyclist KA crashes. The next most common intersection type for bicyclist KA crashes was the undivided, four-leg, urban, signalized intersection, with 7.3% of bicyclist KA crashes. This intersection type was also the most common for pedestrian KA crashes, with 10% of all pedestrian KA crashes occurring at this type of intersection between 2018 and 2022.

Along with differences in crash and roadway characteristics, the assessment team identified key differences in demographics and person-level crash data between bicyclist and pedestrian KA crashes.

- Males were overwhelmingly overrepresented in bicyclist KA crashes. They were the cyclist in 85.2% of all bicyclist KA crashes. 67.3% of pedestrians involved in pedestrian KA crashes were male.
- Ages of persons involved in bicycle crashes skewed younger compared to those involved in pedestrian KA crashes. 12% of pedestrian KA crashes involved a person 70 years old or older compared to only 2.4% of bicyclist KA crashes. Persons aged 10 to 19 and those aged 50 to 59 accounted for higher percentages of bicyclist KA crashes than people of the same age involved pedestrian KA crashes.
- Both bicyclist and pedestrian KA crashes are significantly overrepresented in DACs. 39.8% of bicyclist KA crashes and 37.1% of pedestrian KA crashes occurred in DACs, compared to 29.8% of non-VRU KA crashes that occurred in DACs.

Section 5 High-Risk VRU Areas

A critical component of a VRU Safety Assessment is understanding the spatial distribution of crashes. This section discusses statewide trends as well as more granular data at specific location types. The assessment team mapped county-level VRU KA crash data for 2018 – 2022 (Figure 4).

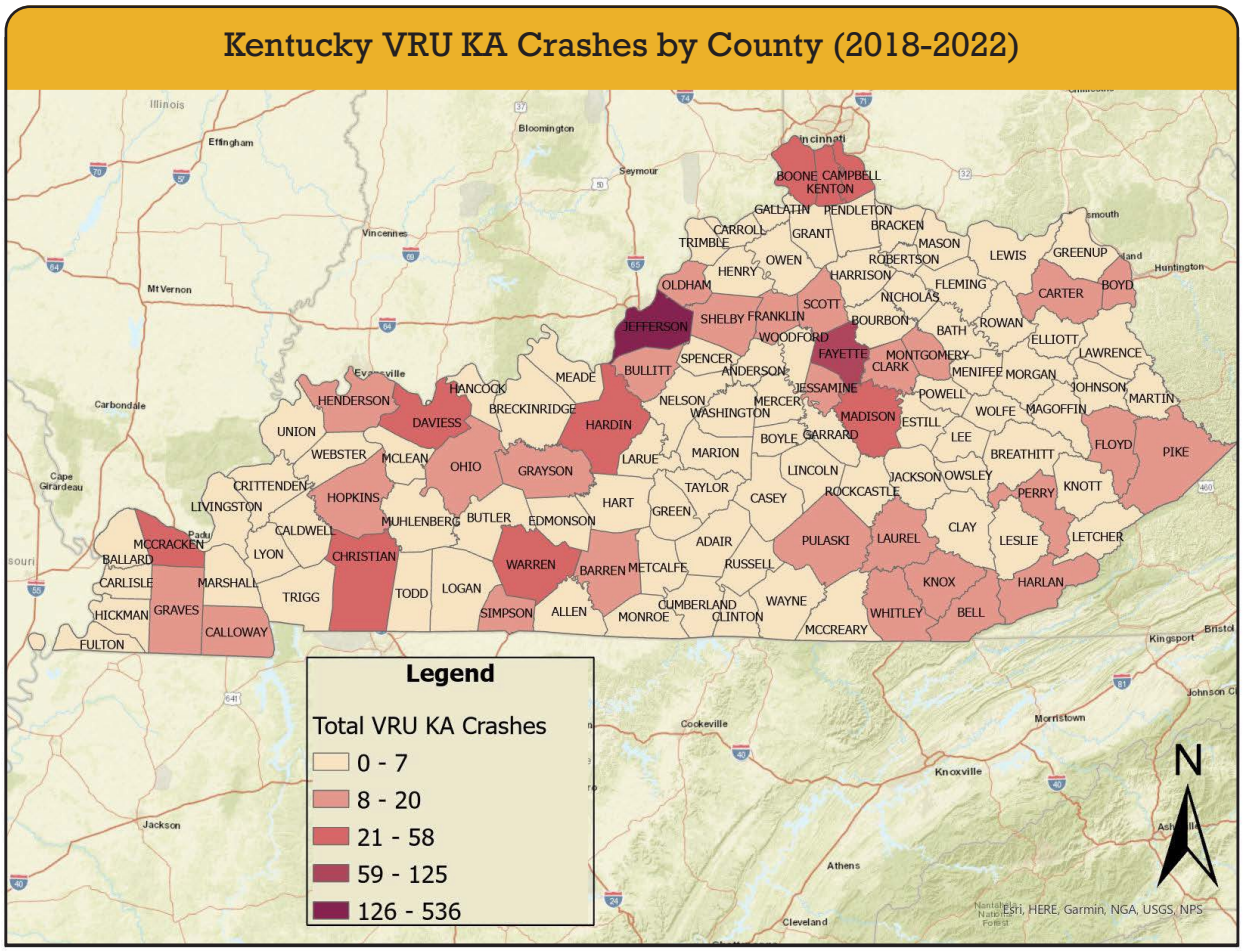

Figure 4 Kentucky VRU Fatal and Serious Injury Crashes by County (2018-2022)

Jefferson and Fayette counties — the most populous in Kentucky — recorded the most VRU KA crashes by a large margin. Combined, 41.9% of VRU KA crashes occurred here. To account for the distribution of populations across the state, VRU KA crash data totals were normalized by each county's population (i.e., per 1,000 residents). Figure 5 maps KA VRU crashes per 1,000 residents at the county level.

Jefferson County had the most VRU KA crashes per 1,000 residents. But Fayette County is no longer a clear second. Bell, Simpson, and Knox counties now follow Jefferson in terms of highest VRU KA crashes per 1,000 residents. Note, however, that these counties each had fewer than 10 KA VRU crashes during the study period.

To provide a more granular understanding of VRU risk statewide, the assessment team prioritized three levels of high-risk areas: census tracts, routes, and intersections. The prioritization procedure for each area type is as follows:

- Census tracts were scored and ranked by total VRU KA crashes per 1,000 residents with an additional 25% adjustment for DAC census tracts.
- Route segments were scored and ranked by total VRU KA crashes per route segment, with an additional 25% adjustment for routes in a DAC census tract. Routes were segmented at census tract boundaries to ensure reasonable segment lengths and an accurate accounting of a route's disadvantaged status.

- Intersections were scored and ranked by total VRU KA crashes with an additional 25% adjustment for intersections in a DAC census tract. Kentucky's intersection database defines each intersection in the state using a polygon, containing the approaches as well as the central intersection. Only crashes inside that polygon were treated as intersection crashes.

The 25% adjustment for DAC census tracts accounts for the 25% overrepresentation of VRU KA crashes among DACs. This adjustment was made at each step of the prioritization procedure. The adjustment factor accounts for the magnitude of overrepresentation of VRU KA crashes in these locations and ensures the demographics of those residing in DACs are considered. Table 1 lists the 25 census tracts with highest risk for VRUs.

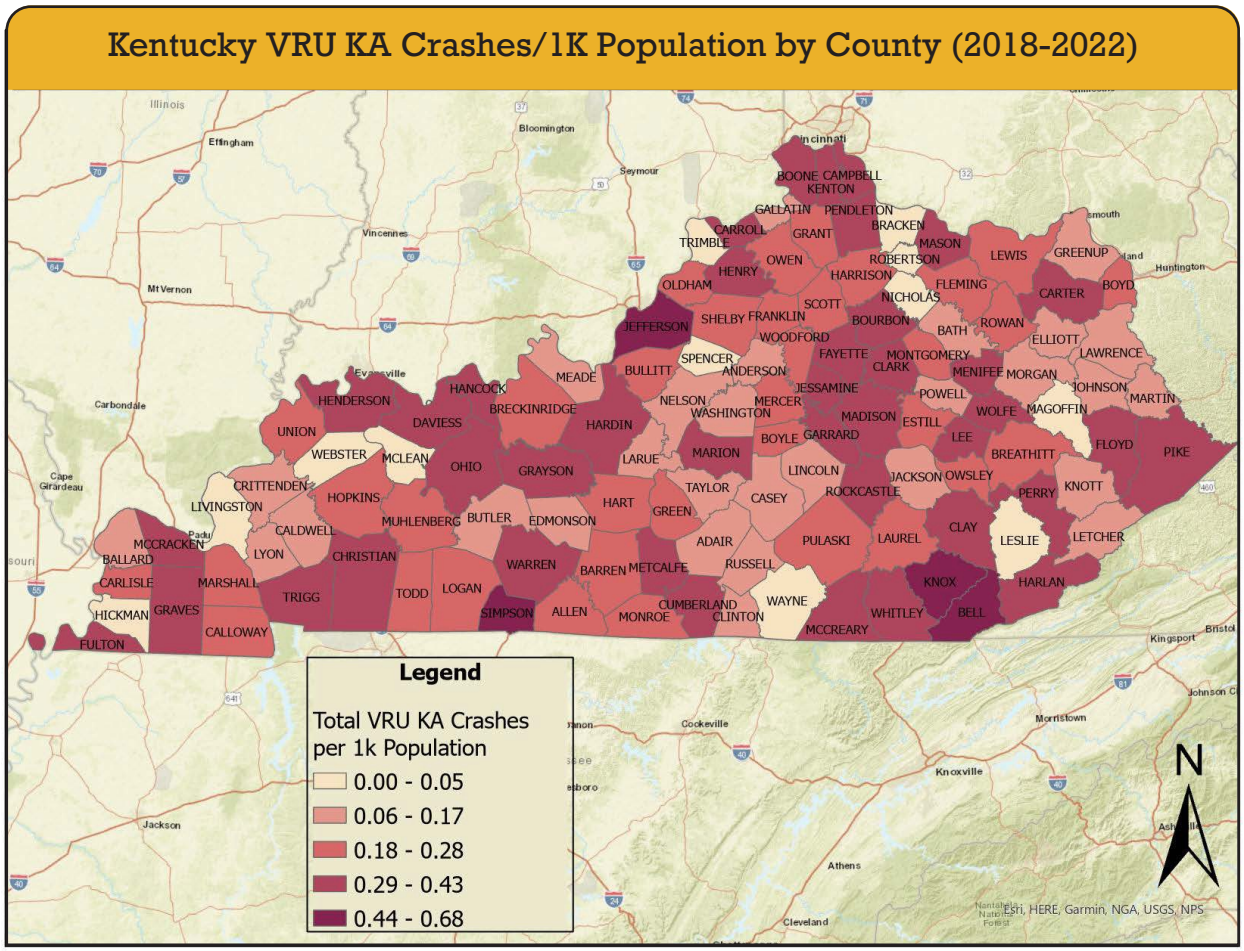

Figure 5 Kentucky VRU Fatal and Serious Injury Crashes per 1,000 Population by County (2018-2022)

Table 1 Top 25 Highest Risk Census Tracts in Kentucky for VRU Fatal and Serious Injury Crashes

Census Tract ID	County	Pop.	DAC Status	VRU Crashes	VRU Crashes (per 1k Pop)	Score	Rank
21221980100	Trigg	23	Not DAC	1	43.48	43.48	1
21111009103	Jefferson	1624	DAC	8	4.93	6.16	2
21111004900	Jefferson	4088	Not DAC	24	5.87	5.87	3
21111011301	Jefferson	2599	DAC	10	3.85	4.81	4
21111003900	Jefferson	3785	DAC	14	3.70	4.63	5
21111003700	Jefferson	1706	DAC	6	3.52	4.40	6
21111011800	Jefferson	2645	DAC	8	3.02	3.78	7
21111006200	Jefferson	2134	Not DAC	8	3.75	3.75	8
21067001300	Fayette	2066	DAC	6	2.90	3.63	9

Census Tract ID	County	Pop.	DAC Status	VRU Crashes	VRU Crashes (per 1K Pop.)	Scores	Rank
21067001500	Fayette	2185	DAC	6	2.75	3.44	10
21111000600	Jefferson	1790	Not DAC	6	3.35	3.35	11
21111000200	Jefferson	2802	DAC	7	2.50	3.13	12
21111001800	Jefferson	1358	Not DAC	4	2.95	2.95	13
21059000300	Daviess	1727	DAC	4	2.32	2.90	14
21111011901	Jefferson	868	DAC	2	2.30	2.88	15
21019030200	Boyd	1060	Not DAC	3	2.83	2.83	16
21067001400	Fayette	2222	DAC	5	2.25	2.81	17
21145030300	McCracken	1366	DAC	3	2.20	2.75	18
21111005900	Jefferson	5090	DAC	11	2.16	2.70	19
21111002700	Jefferson	2403	DAC	5	2.08	2.60	20
21111004500	Jefferson	2892	DAC	6	2.07	2.59	21
21111003600	Jefferson	4773	Not DAC	12	2.51	2.51	22
21111001600	Jefferson	2604	DAC	5	1.92	2.40	23
21067000200	Fayette	3827	Not DAC	9	2.35	2.35	24
21067000102	Fayette	1723	Not DAC	4	2.32	2.32	25

The most at-risk census tract is located in Trigg County (a small, rural county). This tract has a population of 23 and recorded one VRU KA crash from 2018 to 2022, giving the tract an exceptionally high number of VRU KA crashes per 1,000 residents. This tract encompasses Land Between the Lakes, a recreational area that hosts many tourists, but which has few residents. As such, there were issues normalizing this tract for population, so it is considered an outlier. Of the remaining 24 tracts on the list, 21 are in Jefferson and Fayette counties. Over half of the highest-risk census tracts are in a DAC. Table 2 shows the top 25 routes that pose the highest risk to VRUs in Kentucky.

Table 2 Top 25 Highest Risk Routes in Kentucky for VRU Fatal and Serious Injury Crashes

County	Route	BMP	EMP	Length (Miles)	DAC Status	Total VRU KA Crashes	Score	Rank
Jefferson	Fern Valley Rd.	0.76	1.94	1.17	DAC	6	7.5	1.5
Jefferson	Dixie Highway	11.30	12.53	1.24	DAC	6	7.5	1.5
Jefferson	Broadway	1.94	2.70	0.76	Not DAC	7	7	4
Fayette	N Broadway	7.06	7.85	0.79	Not DAC	7	7	4
Jefferson	Dixie Highway	4.57	6.24	1.67	Not DAC	7	7	4
Jefferson	Berry Blvd.	0.60	1.58	0.98	DAC	5	6.25	6.5
Jefferson	Poplar Level	10.25	11.33	1.08	DAC	5	6.25	6.5
Jefferson	Bardstown Rd.	11.12	12.03	0.91	Not DAC	6	6	8.5
Jefferson	Cane Run Rd.	8.78	10.48	1.70	Not DAC	6	6	8.5
Fayette	E New Circle	10.90	11.34	0.44	DAC	4	5	15.5
Jefferson	Preston Hwy	5.73	6.34	0.61	DAC	4	5	15.5
Jefferson	I 65	135.25	136.11	0.86	DAC	4	5	15.5
Jefferson	7th St.	8.71	9.62	0.91	DAC	4	5	15.5
Jefferson	Cane Run Rd.	7.77	8.78	1.01	DAC	4	5	15.5
Daviess	W 2nd St.	0.38	1.48	1.09	DAC	4	5	15.5
Jefferson	Dixie Highway	6.38	7.54	1.16	Not DAC	5	5	15.5

County	Route	BMP	EMP	Length (Miles)	DAC Status	Total VRU KA Crash-es	Score	Rank
Jefferson	Dixie Highway	12.53	13.80	1.27	DAC	4	5	15.5
Jefferson	Poplar Level	7.42	8.88	1.46	Not DAC	5	5	15.5
Jefferson	National Turnpike	3.62	5.38	1.75	DAC	4	5	15.5
Rowan	Flemingsburg Rd.	5.06	8.30	3.24	DAC	4	5	15.5
Floyd	US 23	0.00	8.98	8.98	DAC	4	5	15.5
Fayette	S Broadway	5.49	6.43	0.93	Not DAC	4	4	23
Jefferson	Preston Hwy	0.00	1.40	1.40	Not DAC	4	4	23
Knox	US 25 E N	22.08	26.20	4.12	Not DAC	4	4	23
Jefferson	056-US-0031W -000	16.78	16.84	0.05	DAC	3	3.75	30

Table 3 lists the 25 highest-risk intersections for VRUs in Kentucky. Only two are outside of Jefferson and Fayette counties. About half of the highest-risk intersections are in a DAC.

Table 3 Top 25 Highest Risk Intersections in Kentucky for VRU Fatal and Serious Injury Crashes

County	Main Route	Minor Route	DAC Status	Total VRU KA Crashes	Score	Rank
Jefferson	Preston Hwy	E Indian Trail	DAC	3	3.75	1
Jefferson	Taylor Blvd.	W Kenwood Dr.	DAC	3	3.75	1
Jefferson	National Turnpike	Tolls Ln.	DAC	3	3.75	1
Fayette	E New Circle	Russell Cave Rd.	DAC	3	3.75	1
Jefferson	Dixie Highway	San Jose Ave.	DAC	3	3.75	1
Jefferson	Broadway	6th St.	Not DAC	3	3	6
Hardin	North Dixie Ave.	Ring Rd.	Not DAC	3	3	6
Jefferson	W Hill St.	12th St.	DAC	2	2.5	8
Jefferson	Dixie Highway	Youngland Ave.	DAC	2	2.5	8
Jefferson	Berry Blvd.	Algonquin Pkwy.	DAC	2	2.5	8
Jefferson	Preston Hwy	Lorette St.	DAC	2	2.5	8
Fayette	E New Circle	Golden Way	DAC	2	2.5	8
Fayette	Virginia	S Limestone	DAC	2	2.5	8
Fayette	Richmond	Old Todds Rd	DAC	2	2.5	8
Jefferson	Fern Valley Rd.	Preston Hwy.	DAC	2	2.5	8
Mason	W 3rd St.	Limestone St.	Not DAC	2	2	16
Jefferson	2nd St.	Market	Not DAC	2	2	16
Jefferson	W Liberty St.	4th St.	Not DAC	2	2	16
Jefferson	Broadway	1st St.	Not DAC	2	2	16
Jefferson	Garland Ave.	28th St.	Not DAC	2	2	16
Jefferson	Dixie Highway	Garland Ave.	Not DAC	2	2	16
Jefferson	Bardstown Rd.	Lucia Ave.	Not DAC	2	2	16
Jefferson	Dutchmans Ln.	Cannons Ln.	Not DAC	2	2	16
Jefferson	7th St.	Phyllis Ave.	Not DAC	2	2	16
Jefferson	Breckenridge Ln.	Landside Dr.	Not DAC	2	2	16

At all levels of evaluation, the assessment indicated that Jefferson and Fayette counties are the highest-risk locations for VRU safety. These counties had the highest total VRU KA crashes during the 2018 – 2022 period and include the vast majority of the highest-risk census tracts, routes, and intersections. Most of the high-risk areas in these counties are in DACs. As such, these counties should be prioritized for VRU safety countermeasures, with an emphasis on ensuring equity among the DACs in the counties.

Section 6 Stakeholder Involvement

Jefferson and Fayette counties recorded for 41.9% of the state's VRU KA crashes between 2018 and 2022 and have 21 of the top 25 census tracts that pose the highest risk to VRUs. VRU crashes overwhelmingly tend to be an urban phenomenon (81.9% of VRU crashes statewide occurred in urban areas). Jefferson and Fayette counties have the largest urban cores in the state (Louisville and Lexington, respectively). Given they have the highest risk for VRU crashes, Jefferson and Fayette counties have greatest potential for safety improvement. Therefore, these counties were identified as good locations for stakeholder involvement. One stakeholder meeting was held for each county. When combined with the data-driven analysis, stakeholder feedback provided a broader perspective and identified realistic steps to bolster VRU safety.

Stakeholder meetings had four main goals:

- Inform stakeholders of the high VRU risk in their areas
- Connect local stakeholders with KYTC personnel to build relationships
- Inform stakeholders of ongoing efforts in the state to enhance VRU safety
- Seek input from stakeholders on strategies and countermeasures to increase VRU safety in their areas

Meetings were scheduled for 1.5 hours, hosted virtually through Zoom and followed this general agenda:

- Introductions
- Overview of the VRU Safety Assessment purpose
- Explanation of the Safe System Approach
- Presentation of VRU safety performance in the state
- Presentation of VRU safety performance in the county
- Overview of the high-risk areas for VRUs in the county (list of routes and intersections)
- Overview of Kentucky's current efforts with VRU safety
- Brainstorming session for strategies and countermeasures to improve VRU safety with a focus on the Safe System Approach
- Summary of brainstorming discussions and outcomes

The first 30 minutes of each meeting was used to provide background on the VRU Safety Assessment, summarize statewide and local VRU trends, discuss high-risk areas, and explain Kentucky's current efforts to enhance VRU safety. The remaining hour of was used to discuss VRU safety and seek input from local stakeholders.

During brainstorming sessions, meeting attendees joined virtual breakout rooms, each of which had at most 10 local stakeholders. A representative of the VRU Safety Assessment team was assigned to each group to lead a discussion on local VRU safety concerns and potential strategies/countermeasures to increase local VRU safety. Stakeholders had five minutes to independently brainstorm ideas while being presented with a slide outlining the five elements of the Safe System Approach and example countermeasures for each element. For the next 35 minutes, stakeholders shared their ideas while the VRU Safety Assessment team member documented their ideas on a virtual whiteboard. Using smaller breakout groups ensured each stakeholder could be heard by other stakeholders and the VRU Safety Assessment team. Smaller group sizes also helped to facilitate discussions between stakeholders who otherwise might not have had the opportunity to meet. Following the breakout room discussions, the full stakeholder meeting regrouped. Each VRU Safety Assessment team member summarized discussions from their breakout groups.

6.1 Jefferson County Stakeholder Meeting

Approximately 50 stakeholders participated in the Jefferson County meeting, with representatives from the following organizations:

- Open Mobility Foundation
- Parks Alliance of Louisville
- Louisville Metro Transportation Planning
- Kentucky Transportation Cabinet Central Office: Traffic Safety and Planning Divisions
- Kentucky Transportation Cabinet District 5 Office
- Louisville Metro Public Works

- Institute of Transportation Studies
- Louisville Metro Department of Public Health and Wellness
- Louisville Metro Police Department
- Louisville City Council: Metro Council District 21
- Louisville Parks & Recreation
- WSP
- Burgess & Niple
- FHWA Kentucky Office
- Norton Children's Hospital Emergency Department
- Transit Authority of River City (TARC)
- University of Louisville Civil Engineering Department
- Matthew's Bridge Inc. (501c3)
- Louisville Metro Emergency Services
- University of Kentucky Civil Engineering Department
- Kentucky Transportation Center

A common theme that emerged in all breakout groups is the need for better guidance and policies to help agencies implement countermeasures that enhance VRU safety. Stakeholders identified the following policy and guidance needs:

- Standardize guidelines to identify intersection and corridor lighting needs.
- Provide guidance on using solar powered lighting versus partnering with local energy providers to hardwire lighting power.
- Include considerations for VRUs when scoring all potential roadway projects statewide.
- Provide statewide guidance on the type of bicyclist and pedestrian facilities appropriate for a given roadway functional class.
- Consider legislation that would authorize camera enforcement of speeding violations.
- Revise the state's resurfacing program to include opportunities to reassign roadway right of way to VRUs.
- Create policies to limit roadway widening without prior consideration of non-vehicular roadway users.
- Mandate helmet usage for cyclists via local or statewide policies.
- Enact policies to maintain connectivity when work zones disrupt dedicated VRU facilities.
- Develop a program to collect accurate data on pedestrian and cyclist volumes to use when preparing demand calculations for VRU facilities.
- Include considerations for DACs when prioritizing roadway projects. Transportation projects outside of DACs could be charged a "tax" to fund equity projects within DACs.

This stakeholder group included an emergency services representative and a children's emergency room doctor who provided valuable insights from a post-crash care perspective on strategies that could improve VRU safety. They suggested targeting medically underserved communities (areas not close to a hospital with a trauma center) with more first aid training and *Stop the Bleed* campaigns that may improve the likelihood of a seriously injured person surviving until they can be brought to a proper trauma center. First aid training should be added to school curriculums for all Kentucky K – 12 students. Additional funding to increase EMS staff as well as public outreach to encourage people to dial 911 sooner were also identified as post-crash care strategies.

Another key discussion topic was vehicle dynamics. A growing percentage of vehicles on the road today are large trucks, SUVs, and electric vehicles, all of which are heavier than conventional vehicles and carry a high amount of energy into a collision. Even at slower speeds, these vehicle types can cause devastating injuries to VRUs because of their weight. As such, the stakeholders highlighted that automakers should be responsible for incorporating safety features into their vehicles such as radar detection of pedestrians and automatic emergency braking to avoid VRU collisions. Stakeholders also recommended that automakers design vehicles to have less rigidity in front-end impacts, which would transfer less energy to VRUs. Lastly, prioritizing public transit opportunities — either through buses or light rail — is another vehicle-related initiative the Jefferson County stakeholders believe could improve VRU Safety. Increasing public transit opportunities has the dual effect of reducing the number of single-occupancy vehicles on the road and providing VRUs an alternative transportation mode that affords them greater protection from vehicles.

6.2 Fayette County Stakeholder Meeting

Approximately 30 stakeholders participated in the Fayette County meeting, with representatives from the following organizations:

- Lexington Area Metropolitan Planning Organization
- University of Kentucky Civil Engineering Department
- Kentucky Transportation Center
- Kentucky Transportation Cabinet District 7
- Kentucky Transportation Cabinet Central Office: Traffic Safety and Strategic Planning Divisions
- Kentucky Office of Highway Safety
- FHWA Kentucky Office
- Lexington Police Department
- Studio Jesse James Architects Inc.
- Lexington-Fayette Urban County Government Environmental Quality and Public Works
- Lexington City Council
- University of Kentucky Student Government
- University of Kentucky Police Department
- Fayette County Public Schools

One focus of this stakeholder discussion was the public perception of VRUs. Several discussions addressed on the dissonance between how drivers view VRUs and how VRUs view drivers. Concerns of victim-blaming were raised when reviewing the pedestrian factors recorded in crash reports of recent VRU KA crashes in Fayette County. The group noted the use of codes such as *Dark Clothing* and *Walking in Roadway*. These codes may imply that VRUs are to blame for a crash when there is nothing inherently wrong with either action (assuming VRUs are in the road while crossing). A similar victim-blaming concern was raised related to the term *jaywalking*. As a result of these discussions, the group suggested public awareness campaigns to improve public perception of pedestrians and more training for all road users on the safe use of transportation facilities, with an emphasis on strategies for interacting with users of different modes.

Another emphasis of the discussion was redesigning roads that attend to the perspectives of all users, not just motorists, which is how roads have been designed historically. This entails balancing limited space to provide adequate sidewalks, bicycle lanes, transit facilities, and travel lanes based on the anticipated users for a given facility. This sentiment pairs well with Kentucky's recently published *Complete Streets, Roads, and Highways Manual* (see Section 7), which provides guidance on how to design for all roadway users. This manual was issued in August 2022, so many of its principles have not yet been implemented statewide. However, KYTC is working to advance implementation through training and other activities. Stakeholders were directed to this manual for further information.

Speed management was also a concern for stakeholders. Data presented to the group showed that in Fayette County VRU KA crashes occurred on roads with higher speed limits than in the rest of the state. One stakeholder mentioned that Louisville is working to develop a speed management plan for the city and that Lexington could develop its own speed management plan. An FHWA representative indicated that FHWA considers speed management plans to be a proven, low-cost safety countermeasure.

Suggestions from the group on methods to reduce speeds included removing striping in high-density urban areas to force drivers to pay attention, adjusting roadway geometry on ramps/slip lanes to force drivers to reduce speeds, curb extensions, camera-based automated speed enforcement, road diets, speed feedback signs to alert drivers of their speeds, and road designs based on lower target speeds.

6.3 Summary by Category

All strategies, countermeasures, and general feedback from both stakeholder meetings are listed below and organized according to the Safe System Approach: Users, Vehicles, Roads, Speeds, and Post-Crash Care. Another category — Policy — was added due to the call in both stakeholder sessions for statewide guidance on VRU issues.

Policy

- Adjust standard widths for sidewalks and shared use paths based on roadway functional class.
- Append statewide policy changes to limit roadway widening (with possible exceptions).
- State and local agencies should explore data sources that provide an indication of pedestrian and cyclist usage and volumes. This data can help identify areas with a need for VRU facilities.
- Enact statewide or local policies to address speed management. Current policies prioritize moving vehicles efficiently with a focus on safety for roadway users.
- Build policies to maintain pedestrian/cyclist facility connectivity in work zones.
- Diversify representation in safety advocacy groups to better serve the population.
- Consider legislative changes that allow for automated speed enforcement.

- Adjust roadway project prioritization methods to place a greater emphasis on VRU safety.
- Include VRU safety considerations during roadway resurfacing projects.
- Include disadvantaged area demographics as a consideration when prioritizing transportation projects.
- Provide statewide policy and guidance on lighting warrants and standards. Guidance is also needed on the use of solar lighting versus hardwired lighting.
- Legislate a helmet policy for cyclists.
- Leverage resurfacing projects to implement road diets and reassign right of way to sidewalks, lighting, and bike lanes.
- Utilize Kentucky's *Complete Streets, Roads, and Highways Manual* and the *Highway Design Guide*. Both documents are currently being updated and will provide further considerations for VRU safety.
- Reframe pedestrian factors in crash reporting to move toward phrasing that can help identify solutions. For example, changing *dark clothing* as a pedestrian crash factor to *non-reflective clothing* to indicate reflectivity would make a pedestrian more visible in low-light conditions.

Users

- Educate the public about VRU safety. Currently, the KOHS VRU safety group is developing VRU safety education programs to add to school curriculums. These materials are being developed for K–12 students and will be delivered in health classes. This initiative will start VRU safety training early on so that students form good VRU safety habits. A secondary goal is for children to take this information home and encourage their parents/guardians to engage in safe VRU behaviors as well.
- Regulate or establish education programs for e-scooters. These users move faster than pedestrians and are harder for drivers to see when they approach intersections.
- Consider enforcement and/or education programs for impaired pedestrians.
- Campaigns to encourage cyclists, e-scooter riders, and runners/walkers to wear high-visibility clothing to improve their visibility to drivers.
- Utilize public involvement to identify where VRUs feel unsafe. Pair this with VRU hotspot location data to prioritize projects.
- Support safety in homeless and low-income communities. Many members of these communities use bikes to get around. Provide free helmets and high visibility gear to these groups along with educational campaigns about VRU safety.
- Raise awareness by holding biking and walking rallies — shut down roads and give access to VRUs to highlight their presence.
- Use public art to bring awareness to VRUs.
- Set up marketing campaigns to change public perception of VRUs to enhance empathy and reduce tension between users of different transportation modes.

Vehicles

- Consider supplemental safety efforts directed toward trucks and SUVs. Their height and tinted windows make it more difficult for drivers to see VRUs (especially children).
- Heavier vehicles generate more kinetic energy and therefore present a higher risk to VRUs. Introduce a weight-based vehicle tax for heavy vehicles to help fund VRU safety initiatives.
- Require electric/automated vehicles to have pedestrian radar detection.
- Design vehicles to have a lower point of impact and less rigidity in the front to reduce energy transfer to VRUs in the event of a crash. The automotive industry should be responsible for proper design and weight of vehicles, particularly with the emergence of electric vehicles that are much heavier than standard gas passenger cars.
- Build a light rail line for Louisville (especially in the West End to provide transportation to more economic opportunities).
- Improve public transit opportunities to reduce the number of single-occupancy vehicles on the road network and provide another mode of transportation for VRUs. For example, focusing on bus rapid transit may encourage more people to select transit as a transportation mode.

Roads

- Begin conversations about "disconnecting" highways (interstates/freeways) from urban areas.
- Incorporate short-term, low-cost projects into statewide transportation planning instead of relying only on large, expansive transportation projects.
- Consider infrastructure updates that small, rural towns may need. Many lack pedestrian and bicycle facilities. It is possible that there was not a need for VRU infrastructure when they were designed, but growing populations may have changed this. This need should be considered in conjunction with location prioritization for retrofitting facilities to Complete Streets standards.
- Move away from sharrows and toward dedicated bike lanes. Sharrows are painted markings on the roadway to

indicate that bicyclists and motorists must share the road. While this could help raise awareness of bicyclists using the roadway, the safer option is to separate bike and vehicle traffic.

- Add more crosswalks to suburban corridors that have few crossing locations.
- Improve crosswalk visibility for all users.
- Add raised medians along center turn lanes so that drivers do not use them as passing lanes.
- Consider the number of curb cuts in a given area. Businesses are entitled to curb cuts that provide access to their business and parking lot, but an abundance of driveway entrances create additional conflict points for VRUs.
- Improve intersection and corridor lighting so VRUs are more visible at night. Also consider using more LED lighting as it can more uniformly illuminate VRUs.
- Add more speed limit signs on rural roads to remind drivers of the speed limit.
- Improve the consistency of roadway markings (e.g., crosswalks, roadway striping) and use materials that improve visibility during low-light and wet conditions.
- Drivers tend to look in the direction of potential vehicle conflicts rather than potential pedestrian/cyclist conflicts, so find solutions to help drivers notice potential VRU conflict spots as well.
- Transit stops should be connected to bicycle or pedestrian facilities to establish more seamless flow for transit users.
- Use fencing in medians to discourage pedestrians from crossing mid-block outside of a dedicated crosswalk. Ensure the fencing is forgiving if a car were to crash into it.
- Enhance landscaping to improve the appeal/comfort of VRU spaces, such as along sidewalks or multi-use paths. However, avoid planting trees and landscaping that prevent drivers from detecting VRUs. Be strategic with landscaping and proactive with landscape maintenance.
- Find equitable solutions for sidewalk maintenance. Maintenance and repair of neighborhood sidewalks are often the responsibility of homeowners. More affluent neighborhoods can afford higher quality sidewalks, which widens the safety gap between disadvantaged and non-disadvantaged communities. Lack of sidewalk repair due to lack of funding also creates potential issues with ADA compliance.

Speeds

- Apply traffic calming strategies such as reducing lane widths, curb extensions, and speed humps, where applicable.
- Implement camera-based automated speed enforcement in work zones, schools, and areas with a high volume of VRUs.
- Implement variable speed limits in high-volume VRU areas.
- Install speed feedback signs in neighborhoods to make drivers aware of their speed.
- Utilize delineators at crosswalks to encourage drivers to slow down.
- Consider linking the cost of a speeding ticket to the offender's annual income. This supports equity, may increase the severity of speed-related ticketing, and can help discourage repeat offenses.
- Develop a speed management plan at the city level.
- Shift roadway design toward a focus on target speed — not design speed — to encourage motorists to drive the target speed or slower.

Post-Crash Care

- Target first aid training in medically underserved communities. *Stop the Bleed* campaigns can train more civilians on prompt and efficient first aid techniques, which can extend the time VRUs can survive as they are being transported to a trauma center equipped to handle their injuries.
- Increase funding for EMS in order to hire more staff and improve response times.
- Include first aid training in middle and high school curriculums.
- Build public outreach campaigns that encourage people to call 911 sooner when they see an incident occur.

Section 7 Kentucky's Progress Toward Improving VRU Safety

Kentucky has many initiatives focused on improving the safety of VRUs. These can support the progress toward meeting VRU safety performance targets. The following sections describe these activities.

7.1 Complete Streets, Roads, and Highways Manual

Published in 2022, the *Complete Streets, Roads, and Highways Manual* is a "guide to implementing safe and equitable transportation strategies for facilities in rural and urban Kentucky." The manual defines complete streets as "an evolution of the way streets, roads, and highways address the transportation needs of the communities they serve, shifting from a motor vehicle-centric transportation system to a new, holistic approach for building a network that supports the needs of all users." It emphasizes the Safe System Approach from the National Roadway Safety Strategy (NRSS) and "offers guidance, recommendations, and resources for the implementation of Complete Streets in all transportation projects as a tool to promote safety for all users as part of an equitable, accessible, and sustainable transportation network." It identifies and supports a variety of users on Kentucky streets and highways, including motorists, bicyclists, pedestrians, scooter riders, transit riders, and freight carriers. The manual touches on several project types, including new construction, reconstruction, and modernization. Specific guidance for urban curbside management and rural and small communities with higher concentrations of farming, equestrians, and horse-powered vehicles operating on or near Kentucky's streets and highways is also discussed. The manual is a living document that recognizes that "user types, multimodal guidance, and transportation best practices will continue to evolve." Kentucky's *Complete Streets, Roads, and Highways Manual* was honored with the American Council of Engineering Companies (ACEC) *Grand Award* in 2023.[8] As of October 31, 2023, there have been 11 Complete Streets training sessions across Kentucky, with over 400 participants in attendance. Additional training sessions are planned for 2024.

7.2 Kentucky Pedestrian and Bicyclist Safety Program Assessment

In March 2022 following issuance of the Uniform Guidelines for State Highway Safety Programs which are required by Congress, Kentucky conducted a Pedestrian and Bicycle Safety Program Technical Assessment. The assessment was facilitated by the National Highway Traffic Safety Administration (NHTSA) and conducted by a team of national experts, including an expert on equity. It posed 86 questions about the status of the state's bicyclist and pedestrian safety programs in the areas of program management, education, enforcement, engineering, and emergency medical services. Responses included *current practice*, *in development*, *under consideration*, or *not at this time*. The assessment report included overall priority recommendations in each question category (program management and the 4 Es) as well as longer summaries and recommendations for each area.[9]

7.3 Statewide Bicycle and Pedestrian Master Plan

In November 2022, with support from QK4 Inc., KYTC published its *Statewide Bicycle and Pedestrian Master Plan* (BPMP). The purpose of this plan is to "inventory Kentucky's current bicycle and pedestrian networks, to identify current policies, programs, and tools available, both within KYTC and by other partners supporting active transportation and to establish a framework to advance bike/ped planning within local, regional, and agency jurisdictions over the next few years." The plan includes sections on (1) the benefits of active transportation and the KYTC planning process and related plans, (2) existing conditions (including heat maps, infrastructure, routes and policies, funding, and partners), (3) a futures framework (including trends and goals related to safety, connectivity, equity, health/environment, and thriving communities), and (4) recommendations (action items). The BPMP refers to and integrates with other plans (e.g., SHSP, *Complete Streets, Roads, and Highways Manual*, Bike/Ped Safety Assessment, ADA Transition Plan, and SHIFT).[10]

7.4 KYTC Americans with Disabilities Act Transition Plan

U.S. Department of Justice (USDOJ) regulations require that state and local governments perform a self-evaluation of their services, programs, policies, and practices to verify compliance with the Americans with Disabilities Act (ADA). In 2021, KYTC published the *Americans with Disabilities Act Transition Plan 2021*. The plan details KYTC's "dedication to meeting and exceeding accessibility needs in new highway projects." The plan describes KYTC's process for conducting a self-evaluation to identify barriers associated with sidewalks, transit stops, and intersections (curb ramps, detectable warnings, crosswalks, and pedestrian signals) adjacent to state-maintained roadways. An estimated project schedule is outlined to analyze data and prioritize essential accessibility enhancement projects. The *ADA Transition Plan* includes descriptions of ADA roles and responsibilities for relevant offices, districts, and divisions of KYTC as well as sections on grievances, coordination with other plans, communications, training, and public outreach. Finally, the plan lists KYTC's actions for achieving ADA compliance, including a list of barriers to

compliance and estimated budget needs for eliminating these barriers. The plan is a living document intended to be revised each year.[11]

7.5 Vision Zero Louisville Safety Plan

On April 13, 2021, the City of Louisville/Jefferson County published the *Vision Zero Louisville Safety Report* with the goal of eliminating "all traffic related fatalities and serious injury crashes by taking a proactive, preventive approach rather than a reactive approach to address safety challenges." The report characterizes safety using crash data by severity for vehicle occupants/riders, pedestrians, and bicyclists, and then outlines the principles for achieving goals. These principles include keeping a focus on people, being data informed and action oriented, maintaining equity, ensuring accountability and continuous improvement, and taking a Safe System Approach. The report describes trends using charts and maps and estimates the costs of crashes to the community. Areas of opportunity are identified, similar to the SHSP's emphasis areas. Each area is described in detail and countermeasures are suggested for each. Four implementation strategies and actions are presented:

- Improve Multi-Modal Safety
- Improve Roadway Network
- Improve Environmental Justice
- Improve Human Behavior

The Louisville Metro Department of Public Works and Assets received a Special Achievement in GIS (SAG) Award for maps and visualizations that appeared in *Vision Zero Louisville*. The award was presented by Esri President, Jack Dangermond, during the 2023 Esri International User Conference.[12]

7.6 Lexington Safety Action Plan

The City of Lexington published its *Safety Action Plan* on June 30, 2023. Similar to Louisville's *Vision Zero Safety Report*, Lexington's *Safety Action Plan* has as its goal zero road fatalities by 2050. The Plan includes sections on leadership, commitment and goal setting, planning structure, safety analysis (including trends), engagement and collaboration, equity considerations, policy and process changes (including related plans and activities), strategy and project selections (including reactive and systemic improvements), and progress and transparency.[13]

7.7 Lexington Complete Streets Policy

The City of Lexington has a *Complete Streets Policy* which advances a vision to "provide an equitable, balanced, safe and efficient transportation system that supports a sustainable and healthy community with thriving people, neighborhoods, cultural life and businesses." The policy recognizes diverse users, equity, and a "commitment to complete streets in the design, construction, maintenance and operation of transportation networks" require clear and accountable exceptions to the policy. It reviews jurisdictional issues, design guidance, complete streets and land use context, project prioritization and selection criteria, policy implementation, and performance measures.[14]

7.8 SHIFT Scoring Component for Pedestrian and Bicycle Improvements

The *Strategic Highway Investment Formula for Tomorrow* (SHIFT) is KYTC's data-driven, objective approach for comparing capital improvement projects and prioritizing limited transportation funds. For the SHIFT 2024 evaluation of projects, a systematic process has been developed and included as a SHIFT scoring component to evaluate each project's potential benefits to non-motorized VRUs. This effort focused on examining the SHIFT 2022 projects and developing an approach that could be used to score pedestrian and bicycle improvements. The approach included the selection of projects that were identified as having a pedestrian and/or bicycle components as part of the project, a systematic review of each project to determine existing conditions, the possible pedestrian and/or bicycle improvement(s) that could be implemented, the potential for pedestrian and/or bicycle improvements, and an assessment of the surrounding area to define the context of the project and identify possible trip generators for pedestrian and/or bicycle activity. The Pedestrian and Bicycle component score is calculated as an equally weighted measure of bicycle and pedestrian facilities proposed as compared to existing facilities.[15]

7.9 Kentucky VRU Dashboard

KOHS hosts a public-facing, interactive dashboard for VRU crash data. The dashboard allows users to filter statewide VRU crash data from 2010 to the present. Data are filterable by VRU crash type (including motorcycle crashes), time, location, injury severity, and several crash-related factors. The dashboard has mapping capabilities and provides an aggregated breakdown of environmental factors, human factors, and demographics for selected crashes. This tool is a useful resource for agencies and individuals across Kentucky that want to develop a better understanding of VRU safety performance both statewide and at a local level.[16]

7.10 Jefferson County VRU Taskforce

KOHS has partnered with KYTC's District 5 Chief Engineer to organize a multidisciplinary taskforce to develop a process for conducting VRU-specific road safety assessments (RSAs) that can be applied statewide. With Jefferson County having the highest overall VRU risk, the taskforce chose this county to test the development of the VRU RSA process. The team, co-led by KYTC and Louisville Metro, with support by engineers from Gresham Smith, drafted an assessment template that includes a pre-field review roadway data analysis page, a list of prompts to consider while conducting the field assessment, a summary of the crash history at the target location, and a page to take notes on during the field assessment.[13]

The taskforce conducts biweekly VRU RSAs at the location of every fatal and serious injury VRU crash that has occurred in Jefferson County since the beginning of 2023 (62 sites as of October 31, 2023). The objective of these RSAs are twofold: to achieve more individualized understanding of recent VRU crashes and to refine the VRU RSA process before implementing it on a larger scale. Many systemic risk factors and solutions have been identified through these assessments. The following list provides examples of short-, mid-, and long-term action items that address systemic risk factors identified from the road safety assessments.

Short-Term Action Items	Medium-Term Action Items	Long-Term Action Items
Reflective signal backplates	Access management	Capital investment projects (corridor-wide)
Refresh pavement markings	Speed management	Interchange investments
Lighting audits	Coordination with public transit	Hardscape pedestrian refuges
Vegetation trimming or removal	Adding or enhancing pedestrian crossings	Sidewalk infill in suburban areas
Enhance midblock crossings	Traffic calming	

Several of the short-term action items have already been implemented on KYTC-maintained corridors where VRU RSAs have been completed. The taskforce is working to combine several mid- and long-term action items into corridor-wide projects and is seeking funding sources to implement larger VRU countermeasures. Solutions proposed based on the VRU RSAs will be implemented via KYTC's planning, guidance, and standard drawing documents. The RSA process developed by the VRU taskforce can be adopted by state and local agencies throughout Kentucky to increase VRU safety statewide.

Section 8 Strategies And Countermeasures

The assessment team compiled VRU strategies and countermeasures sourced from Kentucky's bicycle and pedestrian initiatives and guidance documents (see Section 7), as well as external sources, such as FHWA proven safety countermeasures, to serve as a unifying list to guide designers and practitioners toward meaningful methods of improving VRU safety.

The list categorizes each strategy or countermeasure according to the Safe System Approach focus area it affects, allowing users to filter the list by targeting specific Safe System elements. This list is housed on the KOHS website and is linked to on the state's interactive VRU dashboard. The hosting locations for this list provide convenient access to effective VRU safety countermeasures to those actively seeking VRU safety data.

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