# Section 3: Safety Considerations

Effective bicycle and pedestrian networks facilitate safe travel for all their users. Cyclists and pedestrians are significantly likelier to be seriously injured or killed in a crash involving an automobile than drivers, and this vulnerability underscores the need for facilities to be planned, designed, and centered around cyclists and pedestrians of all ages and abilities. Safety considerations should not only prioritize areas where crashes involving cyclists and pedestrians have occurred but should also proactively address where these users experience stressful and uncomfortable conditions, such as high-volume streets with high speed limits.

This section outlines safety considerations that are grounded in an All Ages & Abilities framework. To assess bicyclist risk and comfort, it examines vehicular crash rates on the portions of the Village's arterial street network without protected bicycle infrastructure and applies a level of traffic stress calculation to that network. It then describes strategies for improving bicycle and pedestrian safety using the 5 E's of improving safety: engineering, education, encouragement, enforcement, and evaluation.

## 3.1 FRAMING SAFETY CONSIDERATIONS

The safety of a transportation system is one of its fundamental responsibilities. Accordingly, VISION 2050 includes a number of recommendations guided by the objective to create safe and secure travel environments that minimize loss of life, personal injury, and property damage. In the Village of Mount Pleasant, safety is a necessary consideration in planning for a future system. A safe network of bicycle and pedestrian facilities is more likely to be used than one that is unsafe, and a well-utilized network is a community asset.

Key to planning a bicycle and pedestrian network is a recognition of the interrelationship of three bikeway selection factors—safety, comfort, and connectivity (Figure 3.1). This section focuses on these factors by estimating a Village-wide level of a bicyclist's exposure to risk along Mount Pleasant's arterial roadways (safety), then quantifying the level of traffic stress imposed on bicyclists by these roadways (comfort). Improving network connectivity by eliminating or minimizing system gaps can also increase safety and comfort for cyclists and pedestrians.

**Figure 3.1**
**Bikeway Selection Factors**


*Source: FHWA Bikeway Selection Guide (2019)*

These factors are linked, as low-stress bicyclist routes are associated with lower crash injury severities than high-stress routes.[1] The safety and comfort of the Village's cyclist and pedestrian facilities also impact the likelihood that they will be used by the community. When a pedestrian or bicyclist perceives their route to be uncomfortable, most will likely choose a different route or be deterred from walking or bicycling altogether. Confident users—who represent a small percentage of all potential bicyclists and pedestrians—may still travel along high-stress routes. But less confident users who may be open to bicycling or walking, such as beginners, children, or seniors, are likely to travel using another mode. By providing comfortable bicycling and pedestrian facilities the Village of Mount Pleasant can reduce the "barrier to entry" for users, which can result in improved physical safety and greater use by people of all ages and abilities.

Documenting crashes, see Section 2.8, allows for an examination of roadway characteristics that may increase risks to pedestrian and bicyclist safety. Crash analyses are necessary to identify demonstrated risks to these vulnerable roadway users. However, as documented crashes alone may not adequately identify all potential risks for bicyclists and pedestrians, other criteria can be utilized to identify facilities where the risk of unsafe outcomes is high but where crashes have not yet occurred. A common way to consider this potential risk is by estimating the level of traffic stress (LTS) a roadway imposes on its vulnerable users—a measure of how comfortable that roadway is to use.[2] LTS depends on contextual factors including traffic volume, posted speed limit, road width, the presence of a bicycle lane, shoulder, or other refuge, and whether cyclists and pedestrians must interact with vehicles. For example, an average cyclist is likely to feel comfortable on a quiet residential street without dedicated facilities (LTS 1) but uncomfortable on a busy arterial street without a protected bicycle lane (LTS 3 or 4).

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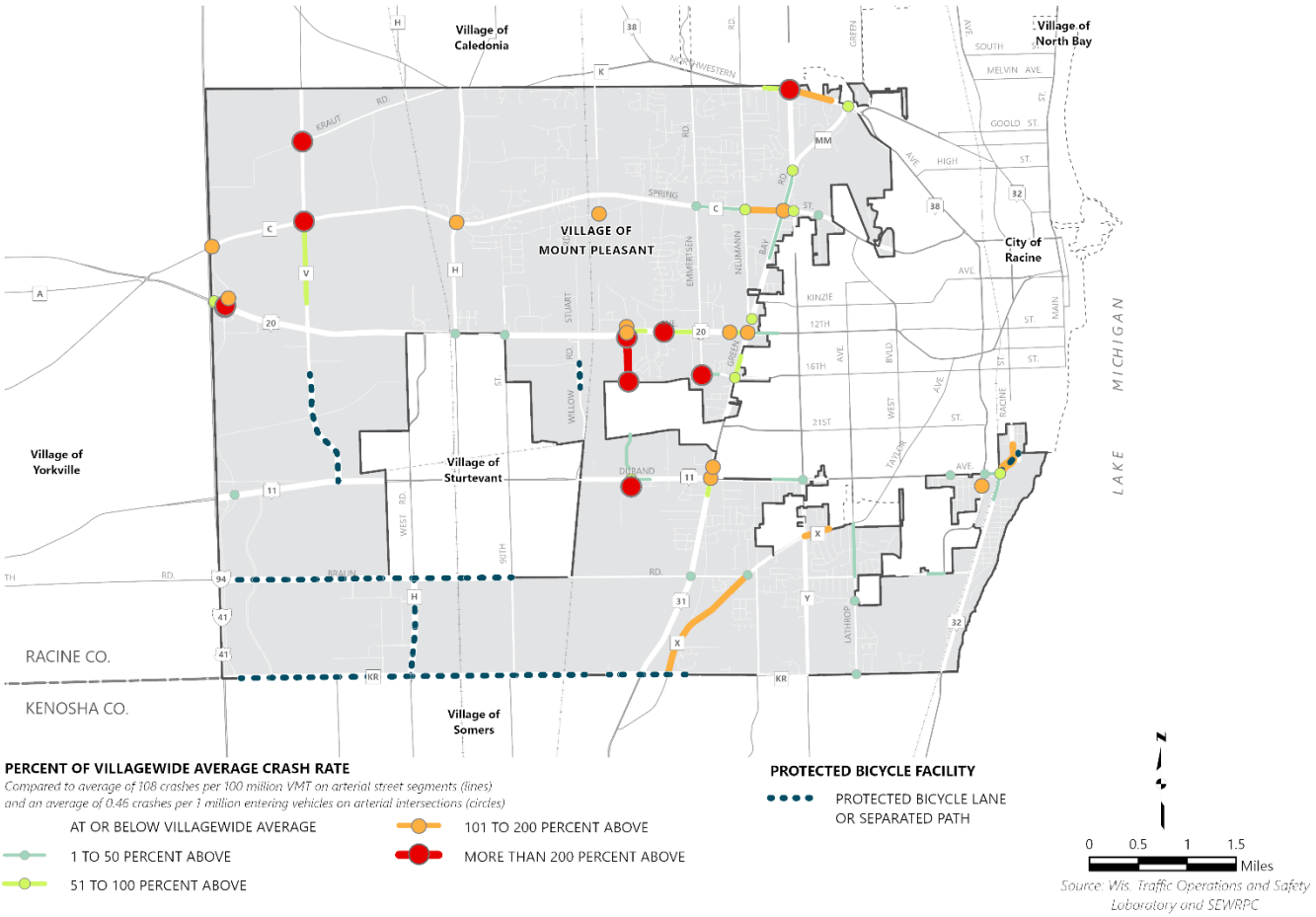
[1] *Liu et al. (2017). "How bicycle level of traffic stress correlate with reported cyclist accidents injury severities: a geospatial and mixed logit analysis,"* Accident Analysis & Prevention*, 108, pp. 234-244.*

[2] *The level of traffic stress (LTS) measure was developed by the Mineta Transportation Institute (MTI) in 2012 and published in MTI Report 11-19, "Low-Stress Bicycling and Network Connectivity". The LTS measure estimates the level of comfort cyclists may experience while bicycling within a roadway and classifies road segments into four levels of traffic stress ranging from LTS 1 (low-stress environments that are comfortable for cyclists of all ages and abilities) to LTS 4 (generally uncomfortable for most adults). The American Association of State Highway and Transportation Officials (AASHTO) has incorporated LTS into its Guide for Development of Bicycle Facilities 5th Edition. A number of transportation agencies have applied LTS to their networks since the measure is easily comprehensible and uses readily available bicycle facility and traffic data.*

## 3.2 SAFETY: BICYCLIST RISK EXPOSURE

**Map 3.1**
**Vehicular Crash Rates on Intersections and Arterial Segments in the Village of Mount Pleasant: 2017-2022**

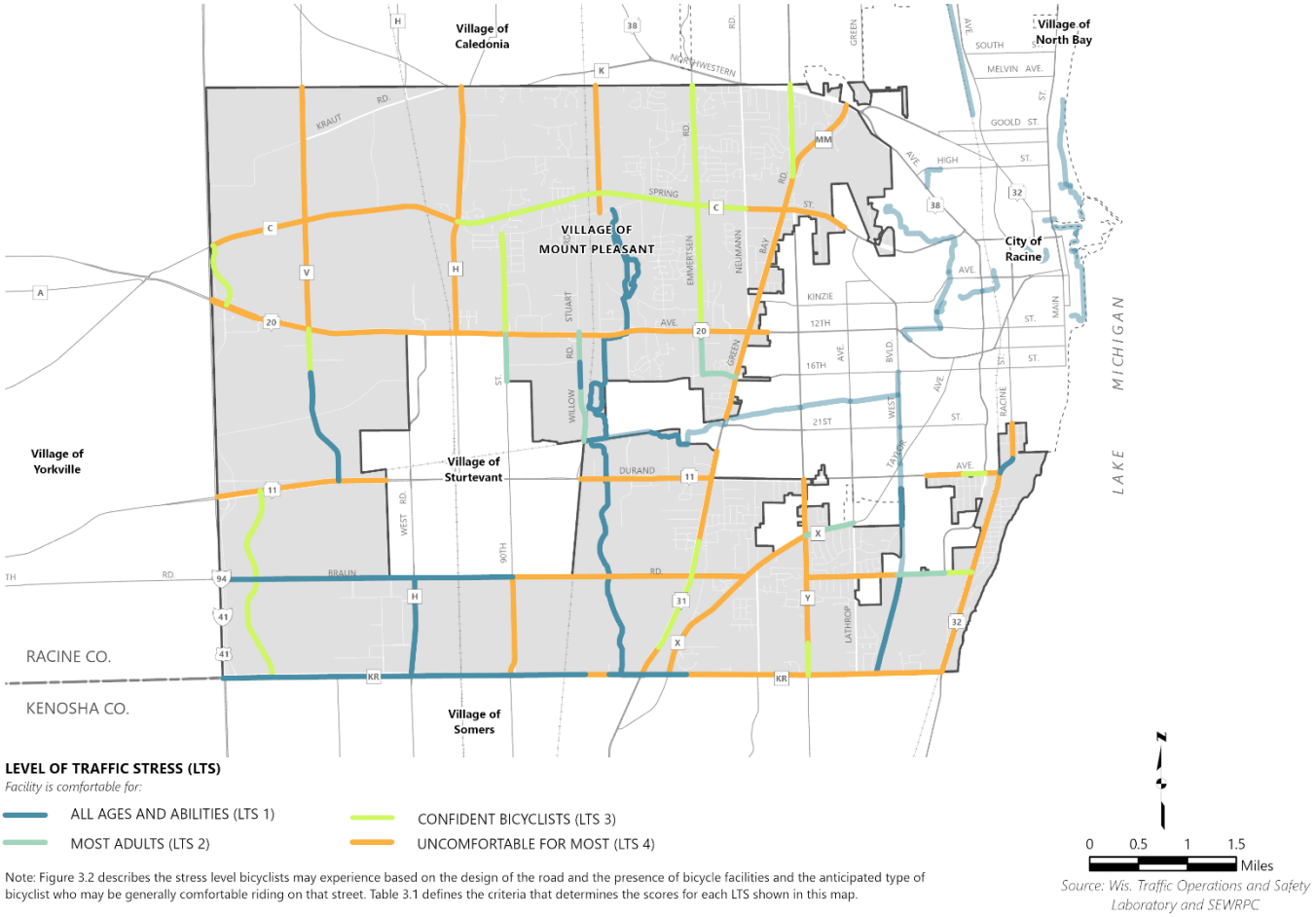



To assess bicycle risk exposure, Map 3.1 shows vehicular crash rates on intersections and segments of the Village's arterial street system. The small number of bicycle and pedestrian crashes limits the ability to draw Village-wide conclusions from rates calculated using these data (see Section 2.8). Because of this limitation, vehicular crash rates were used to assess the level of risk exposure for cyclists. These rates use the average number of crashes per year between 2017-2022 to minimize random yearly variations. On roadways without protected bicycle facilities (as identified on Map 3.1), cyclists must share road space with vehicles. Therefore, on arterial segments with no protected facilities and high vehicular crash rates, it is likely that a cyclist's risk exposure is higher. Most of the Village's protected facilities are on roadways with crash rates at or below average. The only protected facility along a roadway with an elevated crash rate is along STH 32 from STH 11 (Durand Ave) to 25th Street.

Many high crash rate intersections and segments are concentrated in the more developed eastern portion of the Village (Map 3.1). However, in rural western areas of the Village, elevated crash rates occur at the intersections of arterial streets, such as where CTH C (Spring St) intersects with CTHs V and H, and in areas near the entrance/exit ramps to IH 94, such as at STH 20 and East Frontage Road. The substantial business and commercial activity along STH 20 east of Oakes Road and on STH 31 between STH 20 and STH 11 likely contributes to the high intersection crash rate in this corridor. The high crash rate on Oakes Road south of STH 20 may be caused by this facility's proximity to the Village's high school and by heavy truck traffic accessing nearby industrial facilities. CTH X from CTH KR to Braun Road is a two-lane rural road with 35-45 mph speed limits and a high level of land access to residential driveways and intersections with local roads, which may contribute to its elevated crash rate.

## 3.3 COMFORT: LEVEL OF TRAFFIC STRESS

**Map 3.2**
**Level of Traffic Stress on Arterials and Off-Street Facilities, Village of Mount Pleasant**



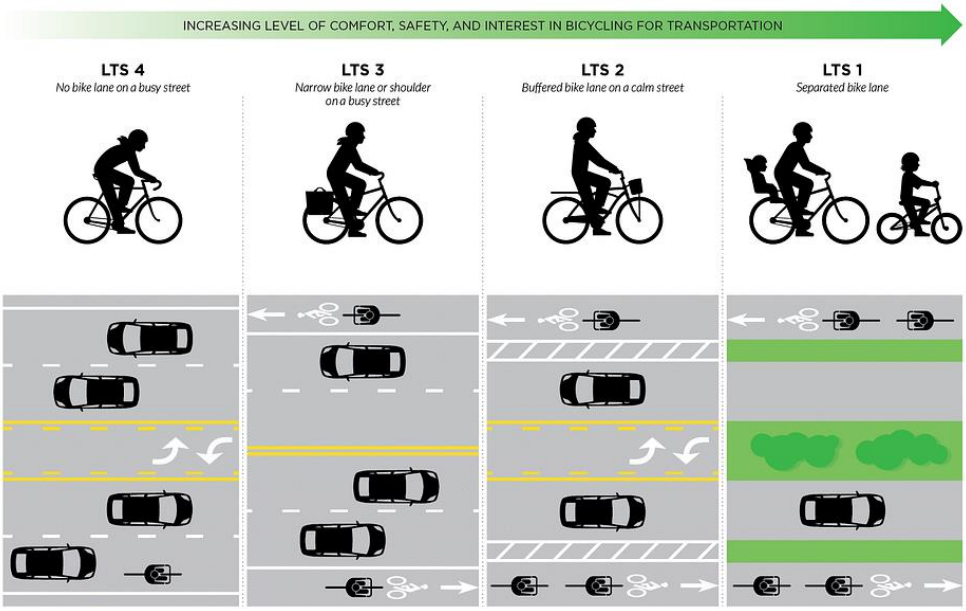

Note: Figure 3.2 describes the stress level bicyclists may experience based on the design of the road and the presence of bicycle facilities and the anticipated type of bicyclist who may be generally comfortable riding on that street. Table 3.1 defines the criteria that determines the scores for each LTS shown in this map.

*Source: Wis. Traffic Operations and Safety Laboratory and SEWRPC*

The level of traffic stress (LTS) is an objective methodology for quantifying the level of comfort that people may experience when bicycling with traffic. Although the analysis focuses on bicycle LTS, pedestrians also experience varying levels of stress that are most pronounced on busy roads with no sidewalks. For assessing level of traffic stress on the Village roadways, numeric stress levels were assigned from low to high stress based on the following criteria: number of travel lanes, traffic volumes, speed limits, presence of a bicycle facility, and presence of parking. Figure 3.2 provides a description of each stress level and the anticipated type of bicyclist who would generally be comfortable riding on that street.

Map 3.2 displays the estimated level of traffic stress for the Village roadways. Table 3.1 provides the criteria that determine each LTS for Map 3.2. All roads with a separate path in the road right-of-way were assigned an All Ages and Abilities score (LTS 1) as users would be separated from vehicular traffic. Similarly, all off-street paths were also given a LTS 1 score as trails utilize their own corridors. There are 10.6 miles of arterial streets and 8.9 miles of off-street paths with LTS 1 in the Village. There are 3.1 miles of arterials with a Comfortable for Most Adults score (LTS 2) generally located on streets in the central parts of the Village with bicycle facilities, low speed limits and low traffic volumes. The majority of state and county highways, due to their large traffic volumes and moderate to high speed limits, have Comfortable for Confident Bicyclists (LTS 3) or Uncomfortable for Most Users (LTS 4) scores. There are 13.4 miles of arterials with a LTS 3 score and 36.8 miles of arterials with a LTS 4 score in the Village.

**Figure 3.2**
**Level of Traffic Stress**




*Source: Alta Planning and FHWA Bikeway Selection Guide (2019)*

**Table 3.1**
**Level of Traffic Stress Criteria**

| | | | Level of Traffic Stress | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Road Segment | Number of Lanes (by direction) | Traffic Volumes (ADT) | <20 mph | 25 mph | 30 mph | 35 mph | 40 mph | 45 mph | 50+ mph |
| No bicycle facility or shoulder | 1 (no centerline) | <750 | 1 | 1 | 2 | 2 | 3 | 3 | 3 |
| | | 751-1500 | 1 | 1 | 2 | 3 | 3 | 3 | 4 |
| | | 1501-3000 | 2 | 2 | 2 | 3 | 4 | 4 | 4 |
| | | >3000 | 2 | 3 | 3 | 3 | 4 | 4 | 4 |
| | 1 (with centerline) | <750 | 1 | 1 | 2 | 2 | 3 | 3 | 3 |
| | | 751-1500 | 2 | 2 | 2 | 3 | 3 | 3 | 4 |
| | | 1501-3000 | 2 | 3 | 3 | 3 | 4 | 4 | 4 |
| | | >3000 | 3 | 3 | 3 | 4 | 4 | 4 | 4 |
| | 2 | <8000 | 3 | 3 | 3 | 3 | 4 | 4 | 4 |
| | | >8000 | 3 | 3 | 4 | 4 | 4 | 4 | 4 |
| | 3 | All | 3 | 3 | 4 | 4 | 4 | 4 | 4 |

| | | | Level of Traffic Stress | | | | | |
|---|---|---|---|---|---|---|---|---|
| Road Segment | Number of Lanes (by direction) | Facility Width | 25 mph | 30 mph | 35 mph | 40 mph | 45 mph | 50+ mph |
| With bicycle lane or shoulder | 1 | 6′+ | 1 | 2 | 2 | 3 | 3 | 3 |
| | | 4′-5′ | 2 | 2 | 2 | 3 | 3 | 4 |
| | 2 | 6′+ | 2 | 2 | 2 | 3 | 3 | 3 |
| | | 4′-5′ | 2 | 2 | 2 | 3 | 3 | 4 |
| | 3 | All | 3 | 3 | 3 | 4 | 4 | 4 |
| With separate path in road right-of-way[a] | Any | -- | 1 | 1 | 1 | 1 | 1 | 1 |

| | | | Level of Traffic Stress | | |
|---|---|---|---|---|---|
| Road Segment | Number of Lanes (by direction) | Bike Lane/ Park Lane Width | 25 mph | 30 mph | 35 mph |
| Bicycle lane with parking lane | 1 | 15′+ | 1 | 2 | 3 |
| | | 12′-14′ | 2 | 2 | 3 |

Note: Roadways having a level of traffic stress (LTS) score of 1 would be suitable for bicyclists of all ages and abilities, having a score of 2 would be suitable for most adults, having a score of 3 would be suitable for only confident bicyclists, and having a score of 4 would not be suitable for most bicyclists. Figure 3.2 illustrates each stress level based on road design and presence of bicycle facilities and the type of bicyclist who might be comfortable riding on that street. Map 3.2 shows the application of these criteria on the street and highway network in the Village.

[a] *LTS 1 also includes off-street paths*

*Source: Maryland Department of Transportation*

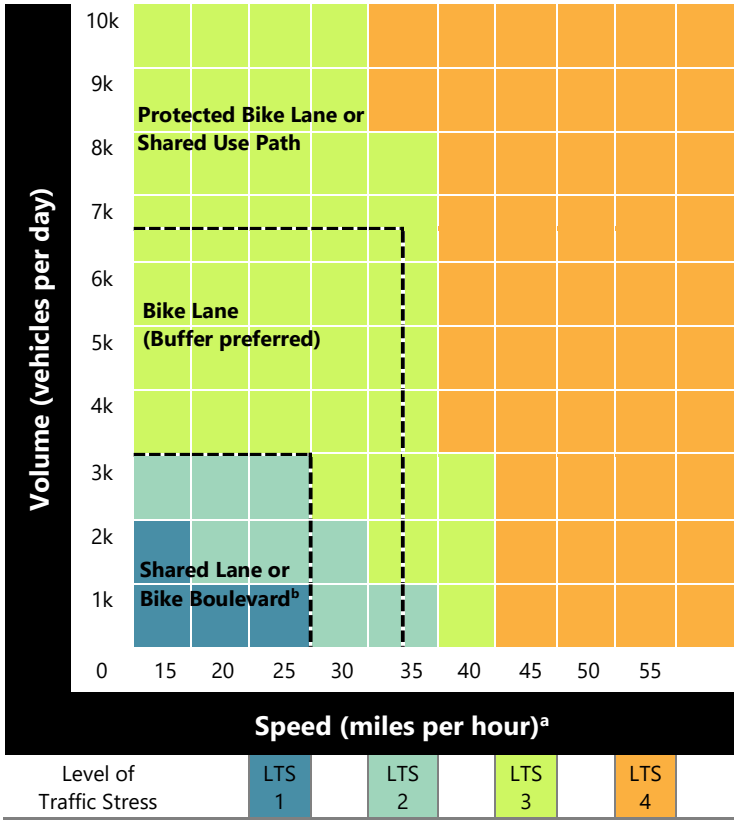
## 3.4 STRATEGIES TO ADDRESS SAFETY CONCERNS

A comprehensive approach to addressing bicyclist and pedestrian safety concerns in the Village should be framed within the context of the 5 E's of improving safety: engineering, education, encouragement, enforcement, and evaluation.

- Engineering

- To improve the level of safety and comfort for bicyclists and pedestrians in urban and suburban portions of the Village, especially on streets with scores of LTS 3 and 4, consider constructing separate paths or enhanced bicycle facilities (e.g., protected or buffered bicycle lanes) that either physically separate cyclists from traffic or provide additional space between the bicycle lane and traffic lane. Figure 3.3 provides guidance on the selection of bicycle facility type based on traffic volumes and speed.
- To improve the level of safety and comfort for bicyclists and pedestrians in rural portions of the Village, consider constructing shoulders on roadways or separate paths when arterials have higher speeds and volumes to provide space or separation from traffic. Figure 3.4 provides guidance on shoulder width based on traffic volume and speed and thresholds for when separate paths should be considered.

**Figure 3.3**
**Preferred Bikeway Types in Urban, Suburban, and Rural Town Contexts**



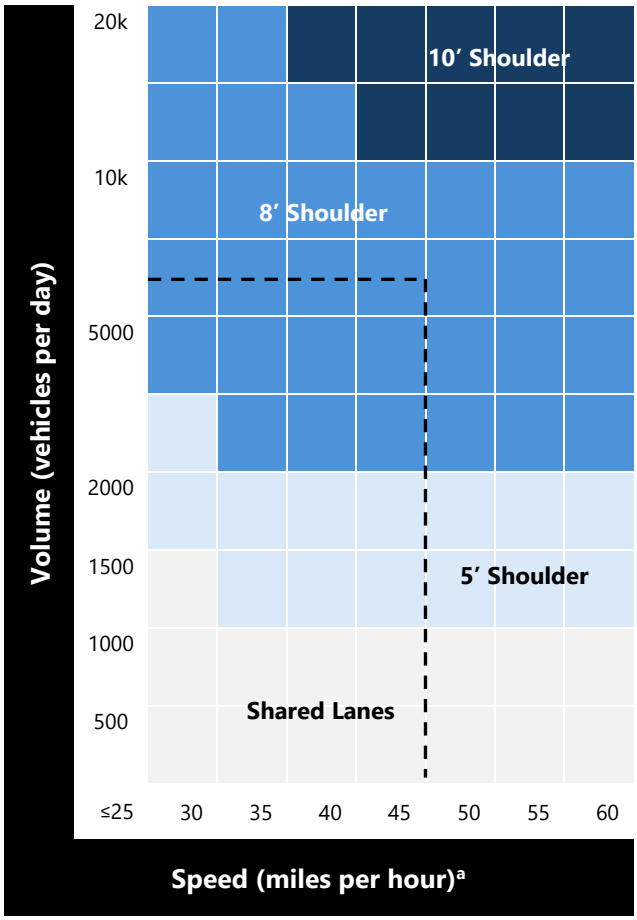

Note: The colors represent the Level of Traffic Stress (LTS) on roadways without bicycle facilities as shown in Table 3.1. Implementation of recommended bicycle facilities (such as bicycle lanes or paved shoulders) would reduce LTS scores to the scores shown in the table for road segments with a bicycle facility.

Refer to the FHWA Bikeway Selection Guide for alternatives if preferred bicycle facility is not feasible (page 32).

[a] *Operating speeds are assumed to be similar to posted speeds. If they differ, use operating speeds rather than posted speed.*

*Source: SEWRPC and FHWA Bikeway Selection Guide (2019)*

**Figure 3.4**
**Preferred Shoulder Widths for Rural Roadways**




Note: This guidance is for shoulders as part of reconstruction and retrofit projects. For new projects, follow guidance for recommended shoulder widths in the AASHTO Green Book.

Rural shoulders are typically designed for the recreational bicyclist, who often are confident bicyclists that are comfortable riding with traffic at moderate to high speeds and volumes. Should a broader level of users be desired, separate paths should be considered for roadways with speeds over 45mph and traffic volumes above 6,000 vehicles per day. However, implementation of a separate path may not necessarily preclude the providing of a paved shoulder, which may be desired for other road design purposes.

If heavy vehicle traffic is greater than 5 percent, consider providing a wider shoulder or a separate path.

[a] *Operating speeds are assumed to be similar to posted speeds. If they differ, use operating speeds rather than posted speed.*

*Source: SEWRPC, AASHTO Guide for the Development of Bicycle Facilities (2024), and FHWA Bikeway Selection Guide (2019)*

- Engineering, continued
    - Prioritize bicycle facility improvements to segments of arterials with high levels of stress that serve as connections between other arterials with low stress levels. Implementing these bicycle facilities can further connect residential neighborhoods to businesses, schools, and other public destinations through an expanded low stress network.
    - Ensure safe travel between neighborhood streets to the off-street network "spine." Prioritize facility improvements to create local "spur" routes on road segments with high level of stress scores that connect residential neighborhoods to the existing off-street network (Figure 3.5).
    - Construct intersection improvements or consider strategies for grade separation at high-traffic intersections to safely accommodate ridership growth, especially at locations where spine routes cross high-volume arterial streets.[3]

**Figure 3.5**
**Spine and Spur Network**

**Overview:**
A high-comfort spine corridor (green) supports longer-distance trips. Spurs (purple) provide connections to local destinations. Spines are often off-street trails. Spurs are often dedicated on-street facilities connecting to a trail spine.

**Trips Accommodated:**
Recreational trips along the spine, access to the spine for all trip types using spurs, and utilitarian trips using spurs.

*Source: Fort Worth Active Transportation Plan (2019), NACTO Urban Bikeway Design Guide (2025)*

    - To improve safety at busy intersections, especially those identified in Section 2.8 with high crash rates, consider designs that allow for cyclists and pedestrians to have clear priority over right-turning vehicles, reduce the approach and turn speed of motor vehicles, and increase the visibility of people walking, biking, and driving.[4]
    - To improve safety around bus stops in the Village, accessible paths should be constructed to and from all stops, gaps in the bicycle and pedestrian network between the stops and nearby businesses should be filled, and adjacent intersections should have clearly marked crosswalks.
    - To facilitate safe routes to school, ensure schools are connected to the bicycle and pedestrian network by minimizing gaps and providing low-stress routes.
- Education
    - Develop bicyclist 'rules of the road' informational materials for drivers and cyclists to better understand the rights of each group when traveling on the road.
    - Consider the implementation of Safe Routes to School programs to educate children on how to safely walk and bike to and from school.
    - Work with the Wisconsin Bike Fed to hold bike rodeos or other bicycle education programs at local schools to learn safe riding tips and increase confidence with bicycling.
- Encouragement
    - Develop an interactive map where the public can share safety concerns (e.g., intersections improvements, maintenance needs) for the Village to evaluate and address.

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[3] *For additional information on best practices for grade-separated crossings, please refer to Chapter 5: "Designing Pedestrian Facilities" in the* Wisconsin Guide to Pedestrian Best Practices *(2010), Wisconsin Department of Transportation.*

[4] *For detailed design guidance related to intersection improvements, please refer to the Third Edition of the* Urban Bikeway Design Guide *by the National Association of City Transportation Officials (NACTO), released in 2025.*

    - Update the level of traffic stress map to show improvements as bicycle-pedestrian facilities are implemented.
    - Participate in Bike to Work week events to encourage commuters to ride to work and increase the presence of cyclists in the Village.
    - Work with local bicycle clubs or create walking groups to reach out to more people who may be interested in walking and biking but are reluctant to participate in these activities due to safety concerns.
- Enforcement
    - Increase police presence at intersections or trail crossings where it is determined that a significant number of drivers are placing cyclists and pedestrians at risk by not complying with traffic controls.
    - Train police in law enforcement specific to bicycle safety through courses offered by the Wisconsin Bike Fed and education material provided by the Wisconsin Department of Transportation.
    - Law enforcement should continue to target driver behaviors that put the safety of vulnerable road users at risk, particularly reckless driving, excessive speeding, and failure to follow traffic laws.
- Evaluation
    - Conduct safety audits of intersections to determine needed bicycle and pedestrian safety improvements
    - Continue to periodically document and map bicycle and pedestrian crashes to identify and analyze areas of concern.
    - Use the crash location maps as a resource for prioritizing facility improvements and for directing enforcement

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