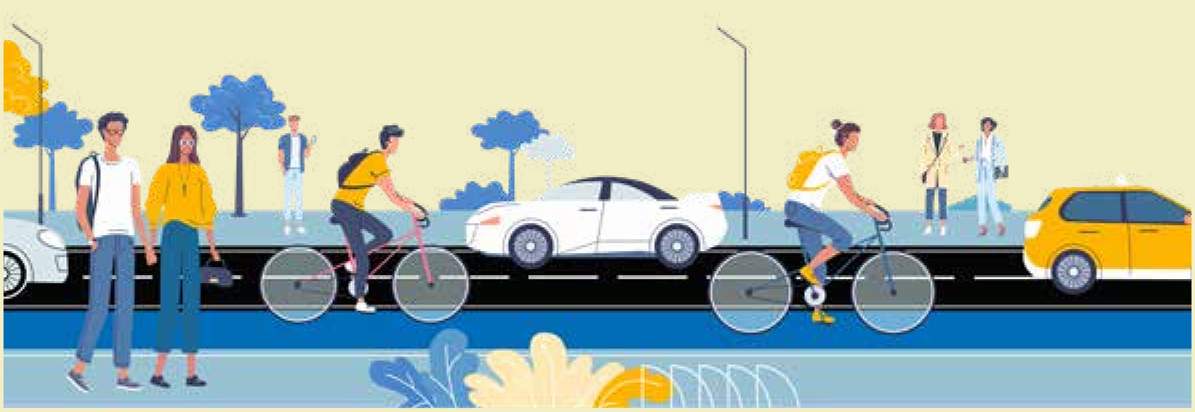
City of Norfolk
NEBRASKA

Norfolk Multimodal Transportation Action Plan

June 2025



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This opinion of probable construction cost was developed by identifying major pay items and establishing approximate quantities to determine a rough order of magnitude cost. Additional pay items have been assigned approximate lump sum prices based on a percentage of the anticipated construction cost. Preliminary cost opinions include a 30% contingency to cover items that are undefined or are typically unknown prior to final design. Unit costs are based on 2025 dollars and were assigned based on historical cost data from NDOT bid histories. Cost opinions do not include easement and right-of-way acquisition; permitting, inspection, or construction management; geotechnical investigation, environmental documentation, special site remediation, escalation, or the cost for ongoing maintenance. A cost range has been assigned to certain general categories; however, these costs can vary widely depending on the exact details and nature of the work. The overall cost opinions are intended to be general and used only for planning purposes. Toole Design Group, LLC makes no guarantees or warranties regarding the cost estimate herein. Construction costs will vary based on the ultimate project scope, actual site conditions and constraints, schedule, and economic conditions at the time of construction.

01

Introduction

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MTAP Purpose

The purpose of the Multimodal Transportation Action Plan (MTAP) is to lay out clear steps to achieve a street network that is **safe**, **accessible**, and **context sensitive**. Achieving these goals requires a paradigm shift in the way Norfolk thinks about transportation and street design (Chapter 2). These goals were established through conversations with the community and data analyses (Chapter 3). The recommended actions (Chapter 4) are based upon community desires and backed by data. The measures for tracking and gaging progress on the three goals are outlined in Chapter 5.

The Action Plan Committee (APC) guided the MTAP planning process and recommendations, which was comprised of community representatives. The APC will also be responsible for implementation and monitoring progress.

Goal #1: Safe

Zero people die and zero people are seriously injured on Norfolk streets.

Between 2016 and 2020, there were 2,260 crashes on the streets in Norfolk. Of these, 676 crashes resulted in a death, serious injury, non-serious injury, or possible injury. While most crashes resulted in minor injuries, 57 resulted in serious injury or death—more than 11 per year.

These losses of life and life-altering injuries are not acceptable. Being involved in a crash changes people's lives physically, mentally, and/or emotionally. The negative impacts of these crashes extend beyond the individuals to their families, friends, neighbors, and to the entire community, including significant impacts on taxpayer spending on emergency response and long-term healthcare[1].

The MTAP identifies action steps to reduce and ultimately eliminate deaths and serious injuries on Norfolk streets and the myriad negative impacts to individuals and the community at large. The City Council established the community's commitment to end these unnecessary tragedies by adopting Resolution No. 2022-36 that states that "the Mayor and Council of the City of Norfolk hereby RESOLVE to establish a Vision Zero initiative with the goal of zero roadway fatalities and serious injuries within the City limits and two mile extra jurisdictional limits by the year 2028."

The Nebraska Department of Transportation has also committed to zero fatalities on Nebraska's roads. The Nebraska Strategic Highway Safety Plan identifies critical emphasis areas (CEAs), seven areas that represent the greatest opportunity for successfully reducing the number of traffic fatalities and serious injuries. These CEAs include increasing seatbelt usage, reducing roadway/lane departure crashes, reducing impaired driving crashes, **reducing intersection crashes**, reducing young driver crashes, reducing older driver crashes, and **reducing non-motorist crashes**. The two bolded CEAs above align very closely with the MTAP.

1 Blincoe, L., Miller, T., Wang, J.-S., Swedler, D., Coughlin, T., Lawrence, B., Guo, F., Klauer, S., & Dingus, T. (2023, February. The economic and societal impact of motor vehicle crashes, 2019 (Revised) (Report No. DOT HS 813 403). National Highway Traffic Safety Administration.

Goal #2: Accessible

People of all ages and abilities can safely, comfortably, and conveniently travel about the community using any mode they choose.

Historically, streets were not often intentionally designed to be accessible by all people using all modes of transportation. This is the case in most cities across the country. Safe and accessible routes for people walking and bicycling are not included on every street, which limits the places that people can safely access via walking and bicycling. Several studies have shown that about 30% of the population cannot or choose not to drive. These members of the community still need to travel about to participate in society—to get to work, school, the grocery store, medical appointments, places of worship, social gatherings, parks and recreation amenities, and otherwise access goods and services. Safe and accessible walking and bicycling routes can provide independence to many in the community—plus, streets that are safer for people walking, biking, and using transit are also statistically safer for people driving due to slower vehicle speeds and separation of users.

People walking and biking are more likely to be killed or injured when involved in a crash, which has led the transportation profession to give people walking and bicycling the label "vulnerable road users" (VRUs). Unlike people in motor vehicles, people walking and bicycling do not have the protection provided by the structure and mass of a motor vehicle. In Norfolk, from 2016 to 2020, 2% of motor vehicle crashes resulted in a fatality or serious injury. For bicyclist-involved crashes, 21% resulted in a fatality or serious injury. For pedestrian-involved crashes, 30% resulted in a fatality or serious injury.

Goal #3: Context Sensitive

Norfolk streets are attractive, resilient, and support adjacent land uses.

Conventional street design practices focus on moving as many motor vehicles as quickly as possible through a space, rather than intentionally supporting the adjacent context - the physical, social, and economic surroundings of the street. These are the neighborhoods, land uses, homes, businesses, and community gathering spaces bounded and crisscrossed by streets. Context also includes the way we interact with and access these surroundings.

As an alternative approach, context sensitive designs focus on better integration of the street and the adjacent uses and places. This concept emphasizes the idea that the places that the street passes through are themselves a place to be, rather than a place to pass through as quickly as possible.

Street design standards are most commonly based on functional classification, such as arterial streets, collector streets, and local streets and are often limited in how much they consider context. Functional classification-based standards often limit the flexibility necessary to modify designs based upon the adjacent context of the street to achieve a street network that is safe and accessible for all people using all modes of transportation. For example, the design standards and characteristics (e.g., design speed, lane width, lane configuration, sidewalk width, landscaping) of an arterial street are generally the same whether it is passing through a residential neighborhood, next to a park or school, through a walkable neighborhood commercial district, through a suburban commercial district.

Norfolk has some notable context sensitive street designs. One prime example is the Norfolk Avenue corridor through downtown. Prior to 2000, this section was similar to other major streets in Norfolk, designed primarily for motor vehicle throughput with two travel lanes in each direction and parallel on-street parking. There was a conscious decision to modify how this street supports the context by slowing down motor vehicle traffic, making the corridor safer and more accessible for pedestrians, and providing a higher degree of streetscaping to make the corridor more visually appealing. This approach—though not the exact design—should be replicated across Norfolk and consideration of context sensitivity should be codified into Norfolk's street design process.

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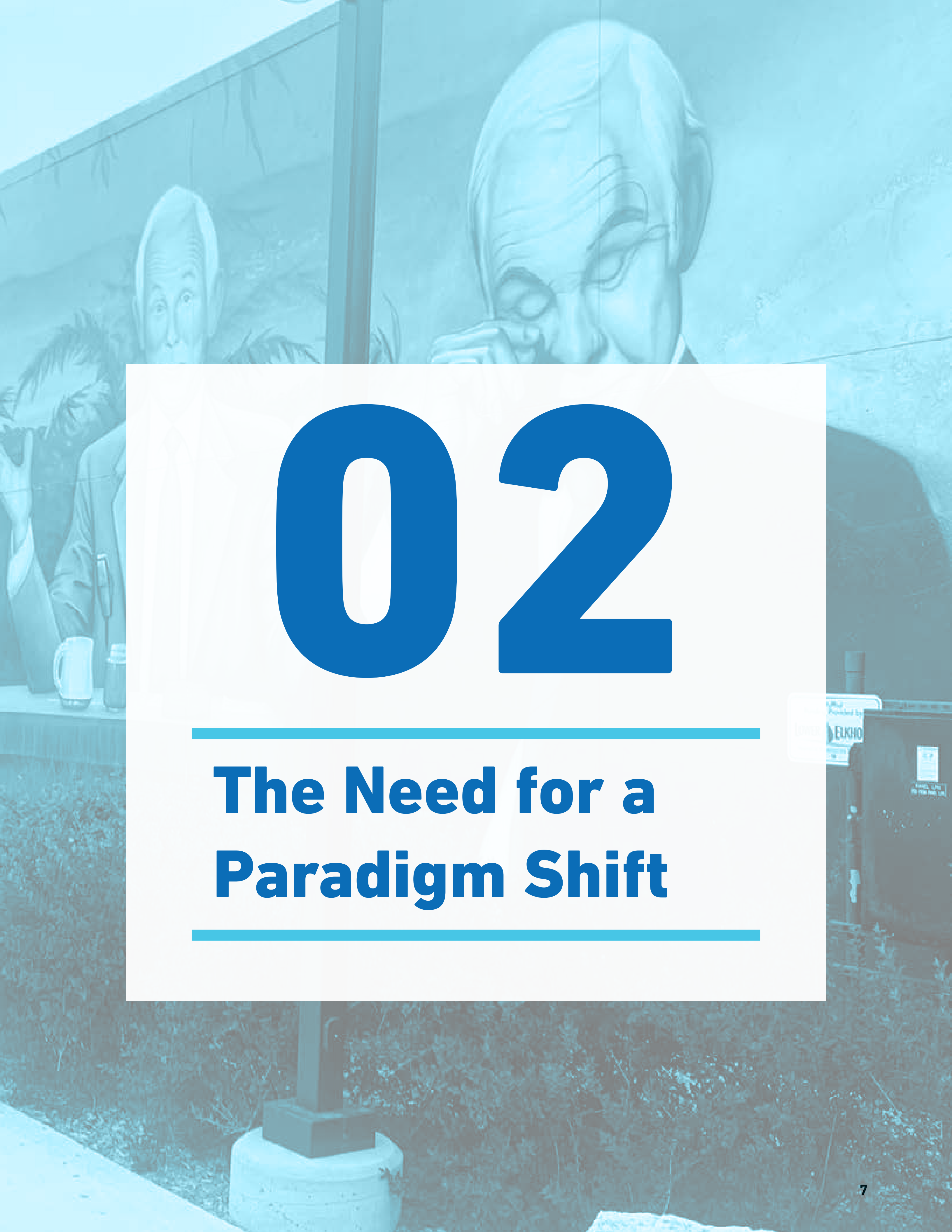

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The Need for a Paradigm Shift

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Paradigm Shift

The foundation of achieving **safe**, **accessible**, and **context sensitive** streets in Norfolk lies in a combination of two approaches to transportation planning and design - the Safe System Approach and Complete Streets Approach. These two concepts represent a paradigm shift from the conventional method of planning and designing our streets. The section below provides a high-level overview of the two approaches and how they combine to create the framework for safe, accessible, and context sensitive streets in Norfolk. Links are provided in the footnotes with much more information about the Safe System Approach and the Complete Streets Approach .

"To eliminate serious crashes, we need redundancies in our transportation system to combat distracted driving"

- Action Plan Committee member

Safe System Approach

For the last hundred years, crashes were considered primarily a result of user error and therefore unavoidable. The Safe System Approach, which has been adopted by the US Department of Transportation, changes the paradigm and is built around six principles and five key objectives, as shown in Figure 1[2].

2 FHWA Safe System Approach

Safe System Approach Principles

- **Death and Serious Injury is Unacceptable**. A Safe System Approach prioritizes the elimination of crashes that result in death and serious injuries.
- **Humans Make Mistakes**. People will inevitably make mistakes and decisions that can lead or contribute to crashes, but the transportation system can be designed and operated to accommodate certain types and levels of human mistakes, and avoid death and serious injuries when a crash occurs.
- **Humans Are Vulnerable**. Human bodies have physical limits for tolerating crash forces before death or serious injury occurs; therefore, it is critical to design and operate a transportation system that is human-centric and accommodates physical human vulnerabilities.
- **Responsibility is Shared**. All stakeholders—including governments, industry, non-profit/advocacy, researchers, and the general public—are vital to preventing fatalities and serious injuries on our roadways.
- **Safety is Proactive**. Proactive tools should be used to identify and address safety issues in the transportation system, rather than waiting for crashes to occur and reacting afterwards.
- **Redundancy is Crucial**. Reducing risks requires all parts of the transportation system be strengthened, so if one part fails, the other parts still protect people.

FIGURE 1 Safe System Approach

Safe System Approach Objectives

The five Safe System Elements describe the methods used to implement the Safe System Approach:

- **Safe Roads**. Design roadway environments to mitigate human mistakes and account for injury tolerances, to encourage safer behaviors, and to facilitate safe travel by the most vulnerable users.
- **Safe Speeds**. Promote safer speeds in all roadway environments through a combination of thoughtful, equitable, context-appropriate roadway design, appropriate speed-limit setting, targeted education, outreach campaigns, and enforcement.
- **Safe Road Users**. Encourage safe, responsible driving and behavior by people who use our roads and create conditions that prioritize their ability to reach their destination unharmed.
- **Safe Vehicles**. Expand the availability of vehicle systems and features that help to prevent crashes and minimize the impact of crashes on both occupants and non-occupants.
- **Post-Crash Care**. Enhance the survivability of crashes through expedient access to emergency medical care, while creating a safe working environment for vital first responders and preventing secondary crashes through robust traffic incident management practices.

Complete Streets Approach

The Complete Streets Approach is a process for planning and designing streets that support the adjacent context of the street and are safe, comfortable, and useful for all people using all modes of transportation. The Complete Streets Approach more consistently, systematically, and equally considers the needs of people walking, biking, driving, using transit, delivering freight, and providing emergency services. The needs of people using non-motorized modes of travel, which are often not a primary consideration during the street planning and design process, are brought into the forefront. This is intended to give people walking, rolling, biking, and taking transit the same access to safe and comfortable streets as those driving motor vehicles, as illustrated in Figure 2.

The Complete Streets Approach allows the streets to complement and support existing and desired land uses surrounding the street. It also ingrains flexibility in street design standards to meet needs of all users and support the context in which the street exists, creating vibrant, safe, and accessible places. Flexibility here refers to the ability of designer to modify street designs based upon context rather than using functional classification.

FIGURE 2 Complete Streets Approach

Shift from the Conventional Approach

Adopting and implementing a Safe System and Complete Streets Approach can move Norfolk towards achieving its goals in a way that the conventional street planning and design approach cannot. Figure 3 shows how the Safe System and Complete Streets Approach differs from the conventional approach.

Norfolk's shift from the conventional approach to an integrated Safe System and Complete Streets Approach is outlined in Chapter 4: Action Steps.

FIGURE 3 Safe System and Complete Streets Approach compared to Conventional Approach

Conventional Approach	Safe System and Complete Streets Approach
Safety is important, but so is convenience and minimizing costs	Safety is the priority
Some deaths and severe injuries are inevitable	Deaths and severe injuries are entirely preventable
Attempts to reduce or eliminate all crashes rather than focusing on those that lead to death or life altering injuries	Focus on reducing and eliminating fatal and serious injury crashes
Most deaths and severe injuries are caused by human errors that can be corrected through education and enforcement	Street design and other interventions are all important to create a system of redundancy in how we reduce and eliminate severe crash risk
Safety interventions or changes to the streets occur only after crashes have occurred (reactive)	Proactively identifies severe crash risks and implements countermeasures to reduce risks
Eliminating fatal and serious injuries is too expensive or disruptive	Eliminating fatal and severe injuries is worth the effort and investment and does not need to be costly
Street designs and design speeds are primarily based on functional classification	Street designs and design speeds are based on context and focused on safety and comfort for people using all modes of transportation
Street designs lack flexibility to support the adjacent contexts	Street designs are flexible to meet the unique context and needs of each corridor and place
Prioritizes moving motor vehicles rapidly	Prioritizes safety and access for people using all modes of transportation to balance community needs
Will likely not allow Norfolk to achieve the goals	Gives Norfolk the best opportunity to achieve the goals

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Transportation Needs and Opportunities

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Needs & Opportunities

Community input along with several analyses were conducted to identify transportation needs and opportunities specifically related to the MTAP goals of safe, accessible, and context sensitive. This data is integral to defining the targeted interventions recommended in Chapter 4. This section includes key findings from the engagement and analysis results. More detailed reports on community engagement and the analyses are provided in Appendix 1 and Appendix 2, respectively.

Transportation System Overview

Norfolk's transportation system must balance the many functions and needs of the community and greater region. Norfolk strives for a transportation system that facilitates:

- Broad confidence that the transportation system is safe to use without risk of death or serious injury.
- Moving people and goods between places throughout the community.
- Moving people and goods through Norfolk and connecting to areas outside of Norfolk.
- Moving people using all modes of transportation, such as people driving and riding in motor vehicles, walking, using personal mobility devices, riding bicycles and e-bikes, taking transit, and using various other forms such as scooters and e-scooters.
- Creating places that foster community pride, cohesion, and social connections.
- Creating places that foster economic opportunity and activity.

Interpreting Results Considering Data Limitations and Recent Investments

Recently completed street projects and changes to the street network, especially those completed since 2021, may not be reflected in the analysis results. The most current available crash data was from the year 2020. Streets may be identified as having safety challenges, but recent changes to the street may have addressed these issues.

An example of this is Benjamin Avenue between US-81 and 1st Street. This corridor is identified as having safety challenges, but they may have been addressed with the recently completed project. However, the City should monitor to ensure the safety and walking and bicycling issues have been addressed. Community input helped to address the data age issues since community engagement was completed in 2024 for the MTAP planning process, much more current than the crash data. Community input can be used to confirm whether conditions were improved, or identify if challenges remain after a project is completed.

Safety

There were 57 crashes that resulted in a fatality or serious injury from 2016-2020, averaging out to more than 11 per year. This is not consistent with the goal of the MTAP—zero roadway fatalities and serious injuries. Three analyses were completed to facilitate a data-informed planning process to reduce and ultimately eliminate these severe crashes—a descriptive crash analysis, High Injury Network analysis, and High Risk Network analysis. Key takeaways from these analyses are summarized in this section.

Descriptive Crash Analysis

A descriptive crash analysis was completed to identify key data and trends for crashes. This retrospective analysis looked at crashes from 2016-2020. Table 1 shows the number of crashes by severity and mode. The key takeaways from this analysis are shown in Figure 4.

"It is hard to see kids walking and crossing the street when cars are parked along the street."

- Public comment

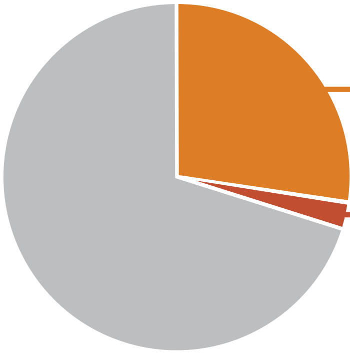
TABLE 1 Crashes by Severity by Mode (2016-2020)

	Fatal	Suspected Serious Injury	Visible Injury	Possible Injury	Property Damage Only	Total
Bicyclist	0	4	9	6	0	19
Pedestrian	4	5	14	7	0	30
Motor Vehicle	6	38	175	408	1,584	2,211
Total	**10**	**47**	**198**	**421**	**1,584**	**2,260**

FIGURE 4 Key Takeaways from Descriptive Crash Analysis

There were **2,260 crashes** over a five-year period

Averaging out to 452 crashes per year



619 crashes resulted in minor injury, averaging out to 124 injury crashes per year or **one every three days**.

A total of **57 crashes resulted in death or life altering injuries** to people in Norfolk, averaging out to 11.4 fatal and serious injury crashes per year or about **one per month**.

Most common locations or factor in fatal and serious injury crashes:

Within 1/4 mile of a school

77% Near a school

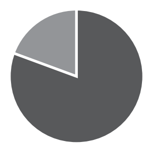
23% Not near a school

Within 1/2 mile of a park*

70% Near a park

30% Not near a park

Location



81% Intersection

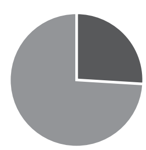
19% Non-intersection

Crash type

37% Angle crashes

63% Others combined

Driver contributing circumstance



26% Disregarding traffic signs & signals

74% Others combined

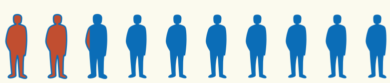
Crash behavior

35% Young drivers

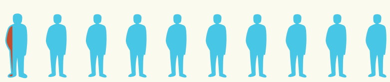
65% Others combined

30% of **pedestrian**-involved crashes resulted in death or serious injury

21% of **bicyclist**-involved crashes resulted in death or serious injury



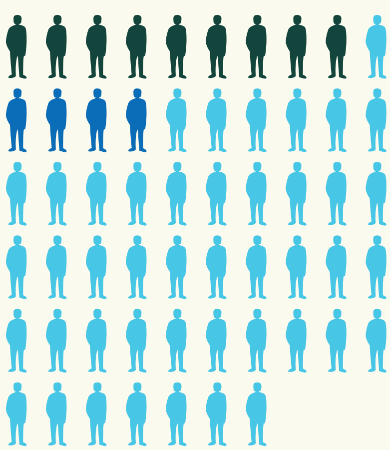
2% of **vehicle-only** crashes resulted in death or serious injury



Of all 57 fatal and serious injury crashes:

16% involved a **pedestrian**

7% involved a **bicyclist**



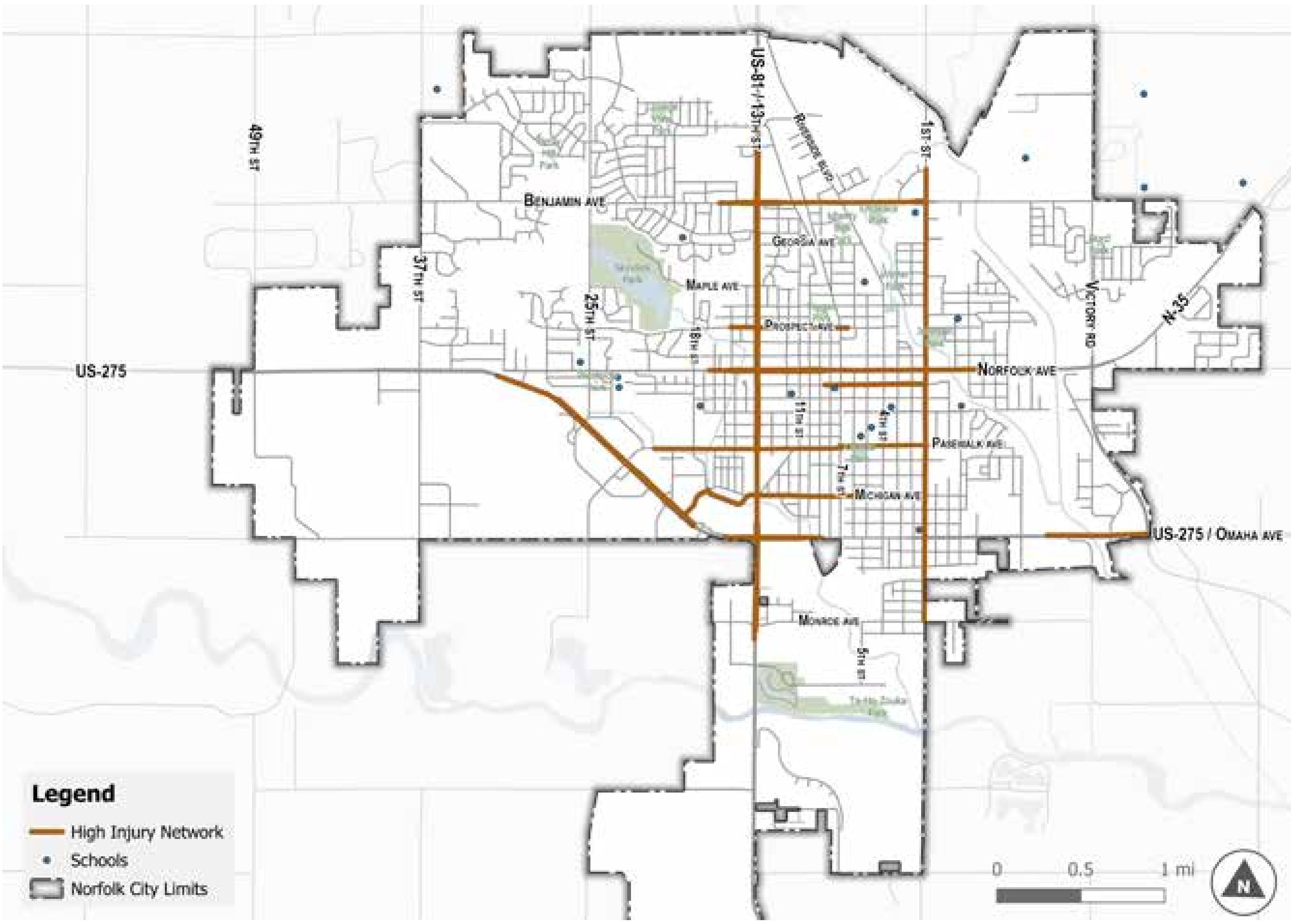
Crashes involving pedestrians and bicyclists are **more likely to result in death or serious injury.**

All pedestrian-involved fatal and serious injury crashes occurred within ½ mile of a park

High Injury Network Analysis

An analysis was completed to identify streets with higher densities of crashes with added weight for fatal and serious injury crashes. The result of this analysis is called the High Injury Network (HIN). The HIN is a small percentage of streets in Norfolk where crashes are more common, especially severe crashes. Map 1 shows the streets on Norfolk's HIN. Key takeaways from the HIN are that most corridors are along major streets in Norfolk and most are east/west corridors. The HIN accounts for 12% of the street network in Norfolk and 63% of the fatal and serious injury crashes occurred on HIN streets.

MAP 1 High Injury Network



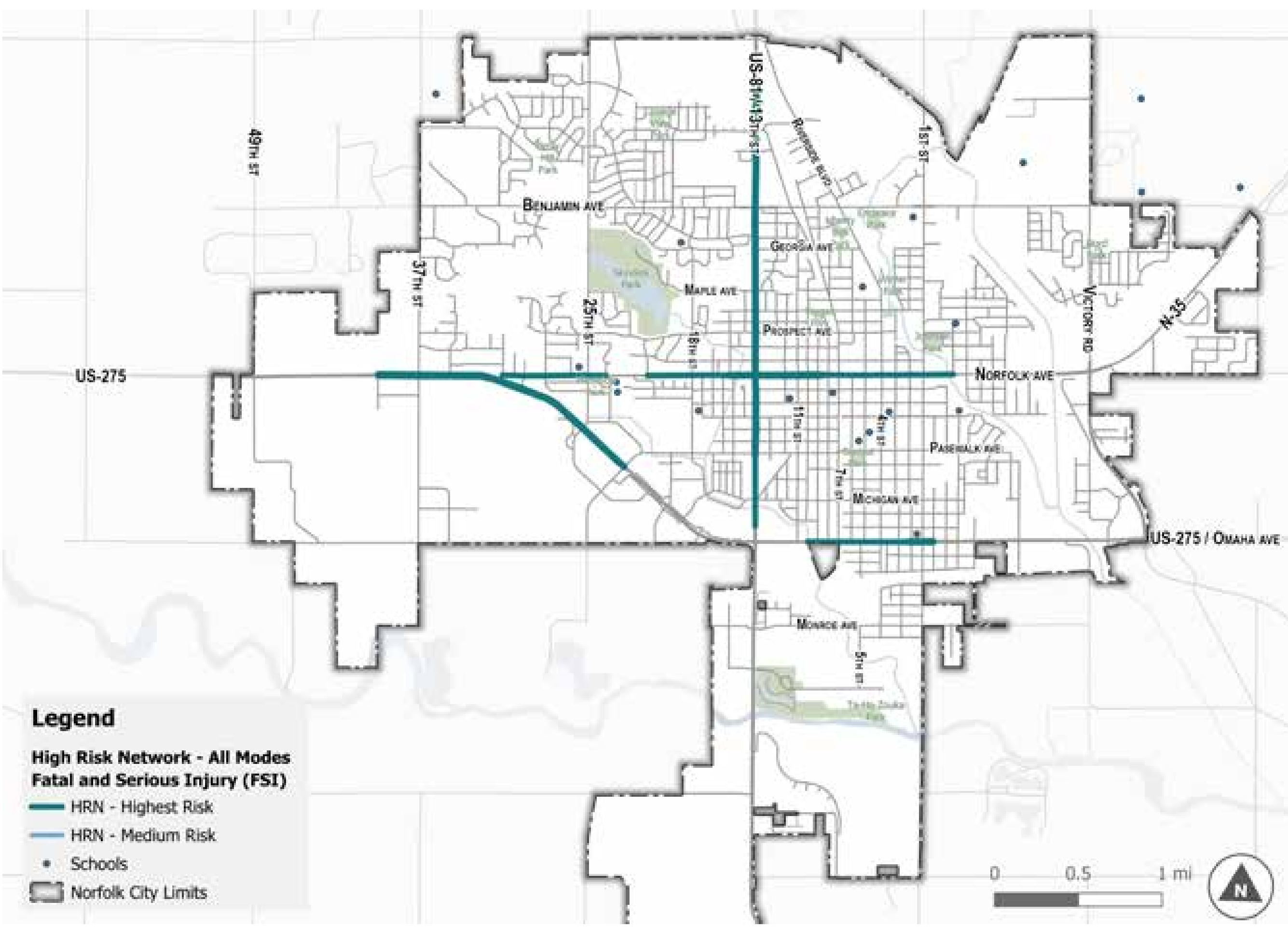
High Risk Network Analysis

A systemic safety analysis was conducted to identify street corridors with heightened risk of injury and fatal crashes. This analysis identified key street attributes (e.g., traffic volumes, speed limits) and context characteristics (e.g., population of young people and older adults in adjacent census blocks) associated with the 2016-2020 fatal and injury crashes. It then identified individual and combinations of attributes and characteristics that were strongly correlated with elevated fatal and injury crash frequencies. These attributes and characteristics were then identified on the entire network to identify streets with the attributes and characteristics that pose greater risk.

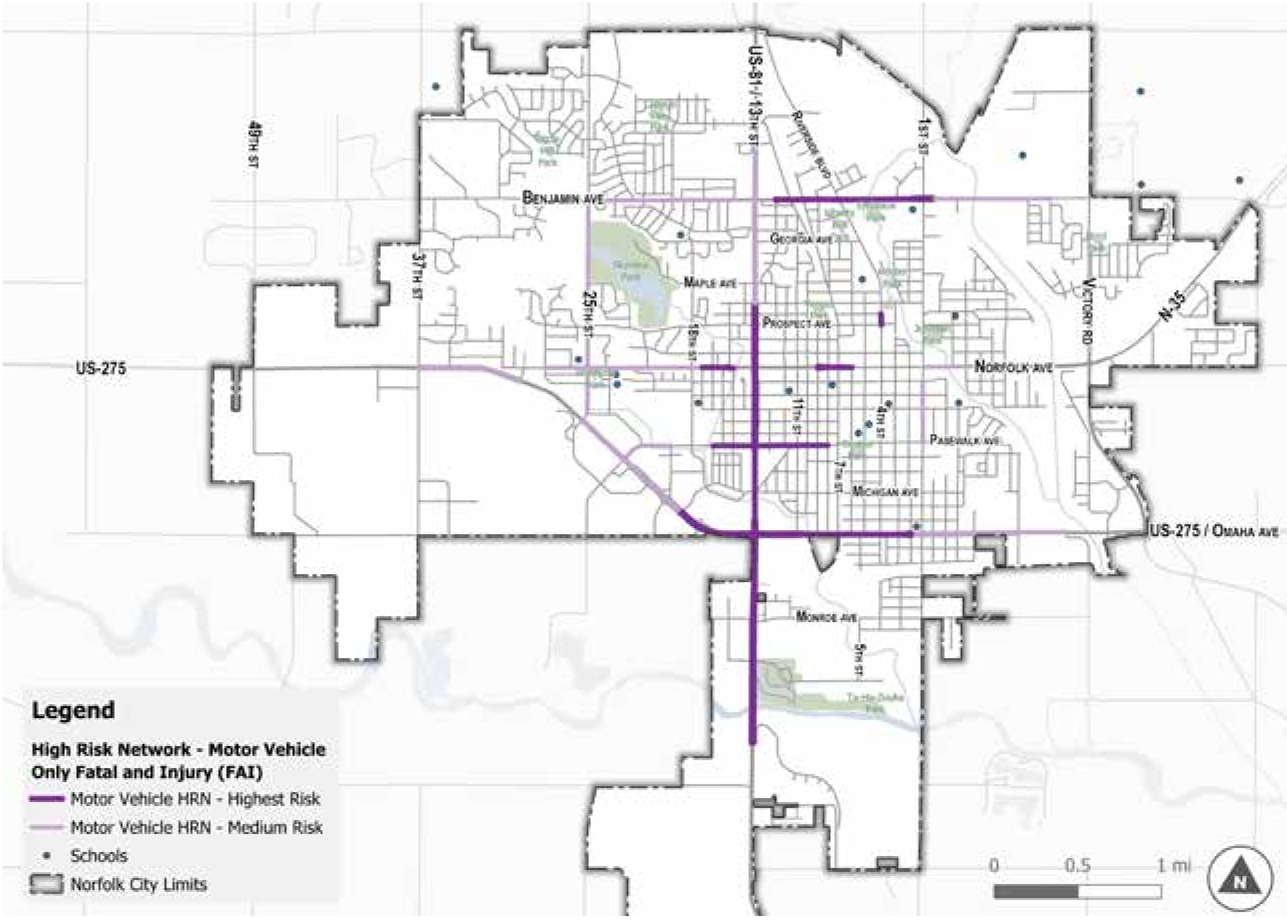
The results of this analysis is the identification of three High Risk Networks (HRN): an all modes HRN, a motor vehicle-only HRN, and a vulnerable road user (VRU) HRN. The all modes HRN is based on fatal and serious injury crashes and the other two are based on fatal and all injury crashes. These HRNs identify streets with the greatest potential for safety concerns, and therefore the greatest potential need for safety improvements. The list below describes key takeaways from each of the HRNs, which are shown in Map 2, Map 3, and Map 4.

- All modes HRN: Streets with the greatest risk for all modes are major streets in areas with a higher percentage of young residents (arterial and collector streets in areas with over 25% of the population being age 25 or younger). Streets with these characteristics make up 7% of the street network but had 40.4% of fatal and serious injury crashes.
- Motor vehicle-only HRN: Streets with the greatest risk for people using motor vehicles are higher volume streets in areas with a smaller percentage of older residents (more than 5,000 vehicles per day and in areas with less than or equal to 15% senior population). Streets with these characteristics make up 5.4% of the street network but had 25.5% of motor vehicle-only fatal and injury crashes.
- VRU HRN: Streets with the greatest risk for people walking or bicycling are in areas with a higher percentage of young residents and nearby a liquor store (areas with over 25% of the population being age 25 or younger and within 500 feet of a liquor store). Streets with these characteristics make up 12.1% of the street network but had 46.9% of VRU fatal and injury crashes. The proximity to liquor stores may be correlated with location near commercial developments rather than liquor stores specifically.

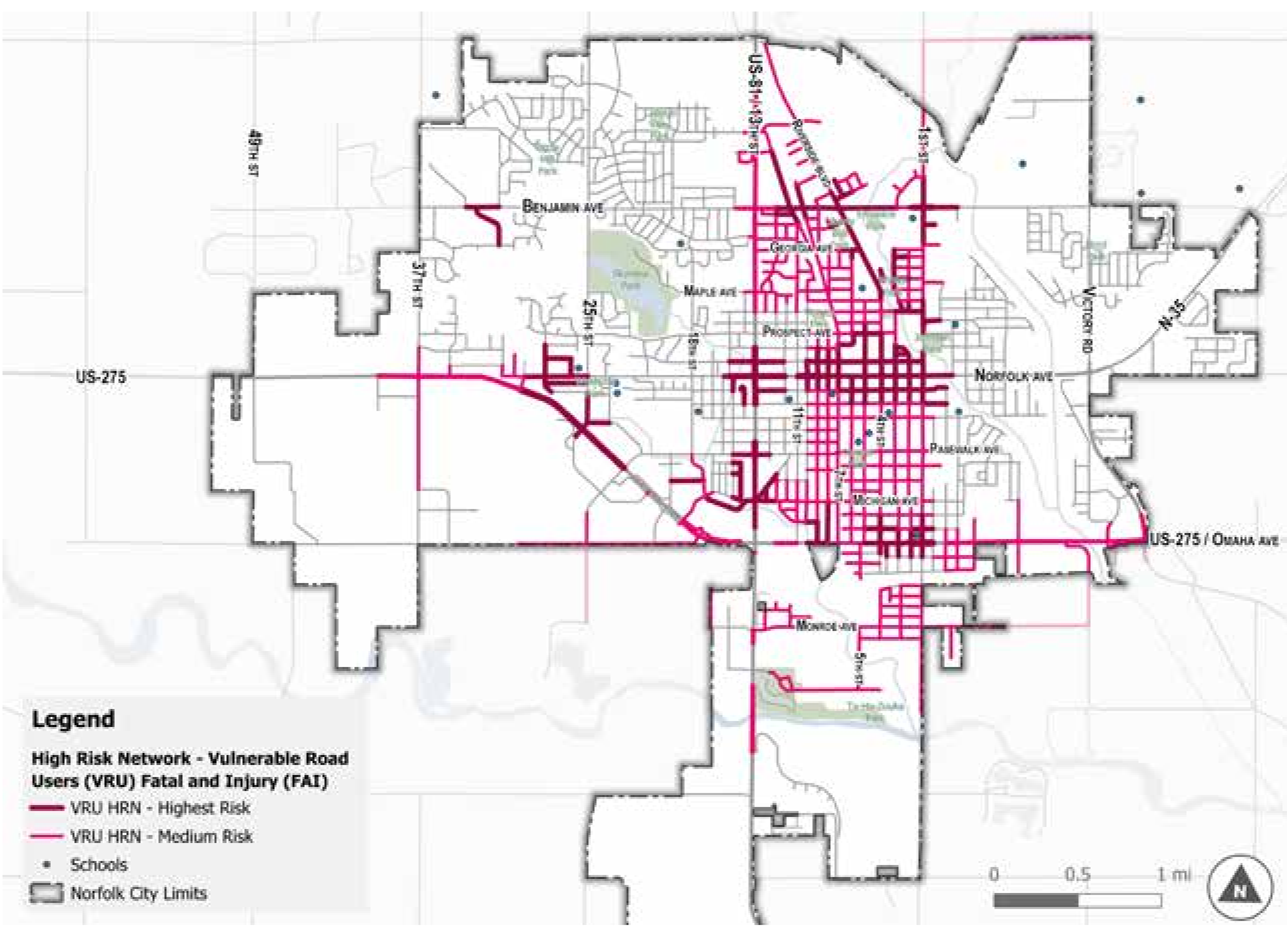
MAP 2 High Risk Network - All Modes



MAP 3 High Risk Network - Motor Vehicles



MAP 4 High Risk Network - Vulnerable Road Users



Complete Streets

As described in Chapter 1: Introduction, Complete Streets is a process for planning and designing streets that support the adjacent context of the street and are safe, comfortable, and useful for people using all modes of transportation. Every street in Norfolk allows car traffic, but not every street accommodates walking and biking. Analyzing needs and opportunities for walking and bicycling shows key corridors and locations that would greatly benefit from Complete Streets interventions that focus on creating an environment that is safe, comfortable, and useful for active transportation.

Complete Streets Analysis

The Complete Streets analysis identified active transportation needs and opportunities based upon several factors including:

- Vulnerable road user crash history and risk
- Active transportation network gaps and problem areas identified by the public
- Demographics that indicate greater amounts of walking and biking
- Modeled active transportation trips and short-distance motor vehicle trips that indicate potential for converting to active transportation modes
- Excess roadway capacity
- Corridors included in Norfolk's planned bicycling and walking network

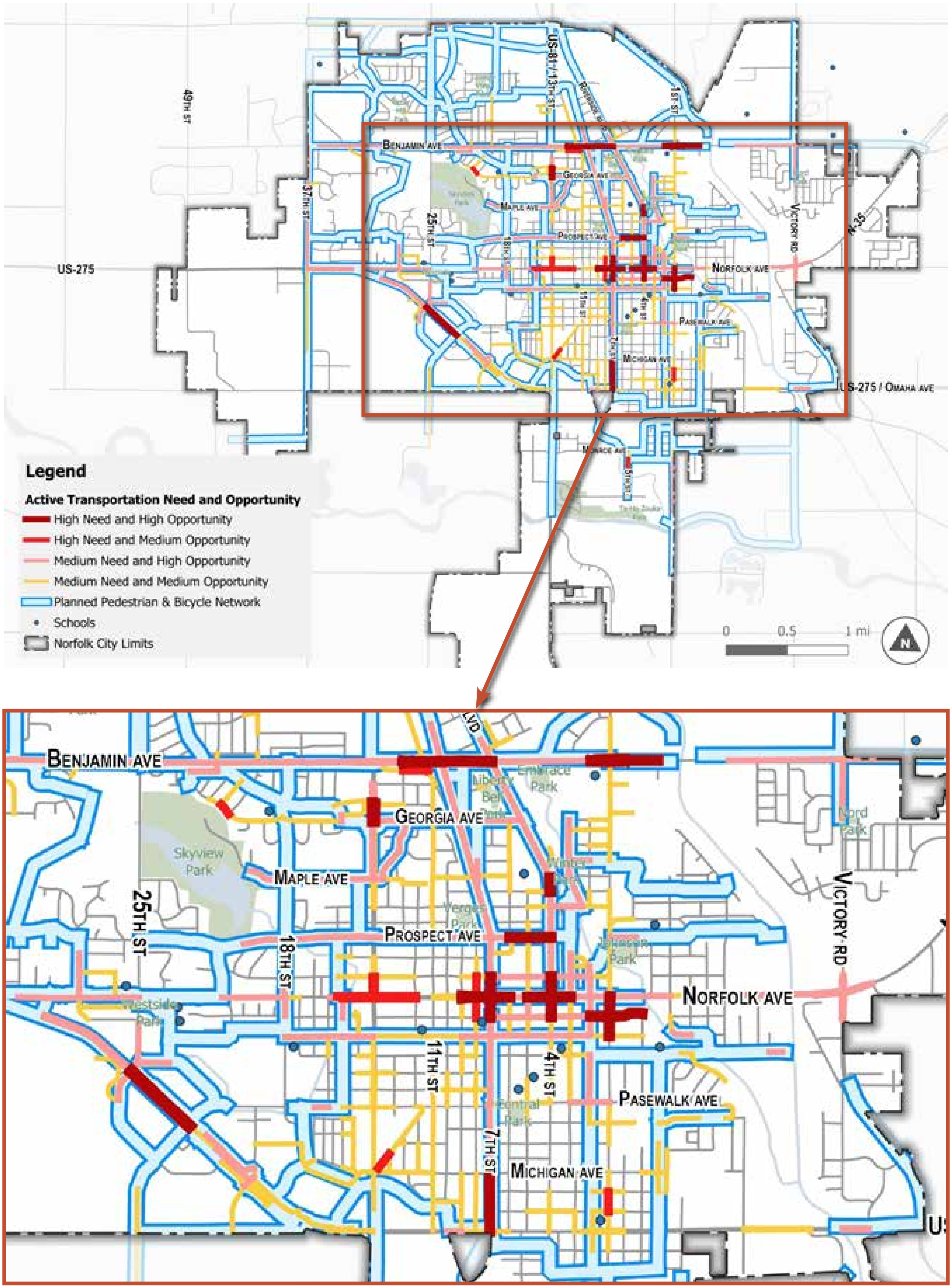
These factors were scored and weighted to identify corridors of greater need and opportunity for active transportation, as illustrated in Map 5. Corridors with high active transportation need and/or opportunity are primarily in the central area of Norfolk and extending outward primarily along arterial and collector streets.

Map 5 also shows Norfolk's Planned Pedestrian and Bicycle Network from the 2020 Norfolk Bicycling & Walking Network Plan. Analyzing active transportation need and opportunity for the MTAP is intended to supplement the planned network. Locations with greater active transportation needs and opportunities that overlap the planned network could indicate a priority location for active transportation infrastructure. Map 5 can also show where additional active transportation facilities are likely desired that are not on the planned network.

What is Active Transportation?

Human-powered transportation including walking, bicycling, and using personal mobility devices.

MAP 5 Active Transportation Needs and Opportunities



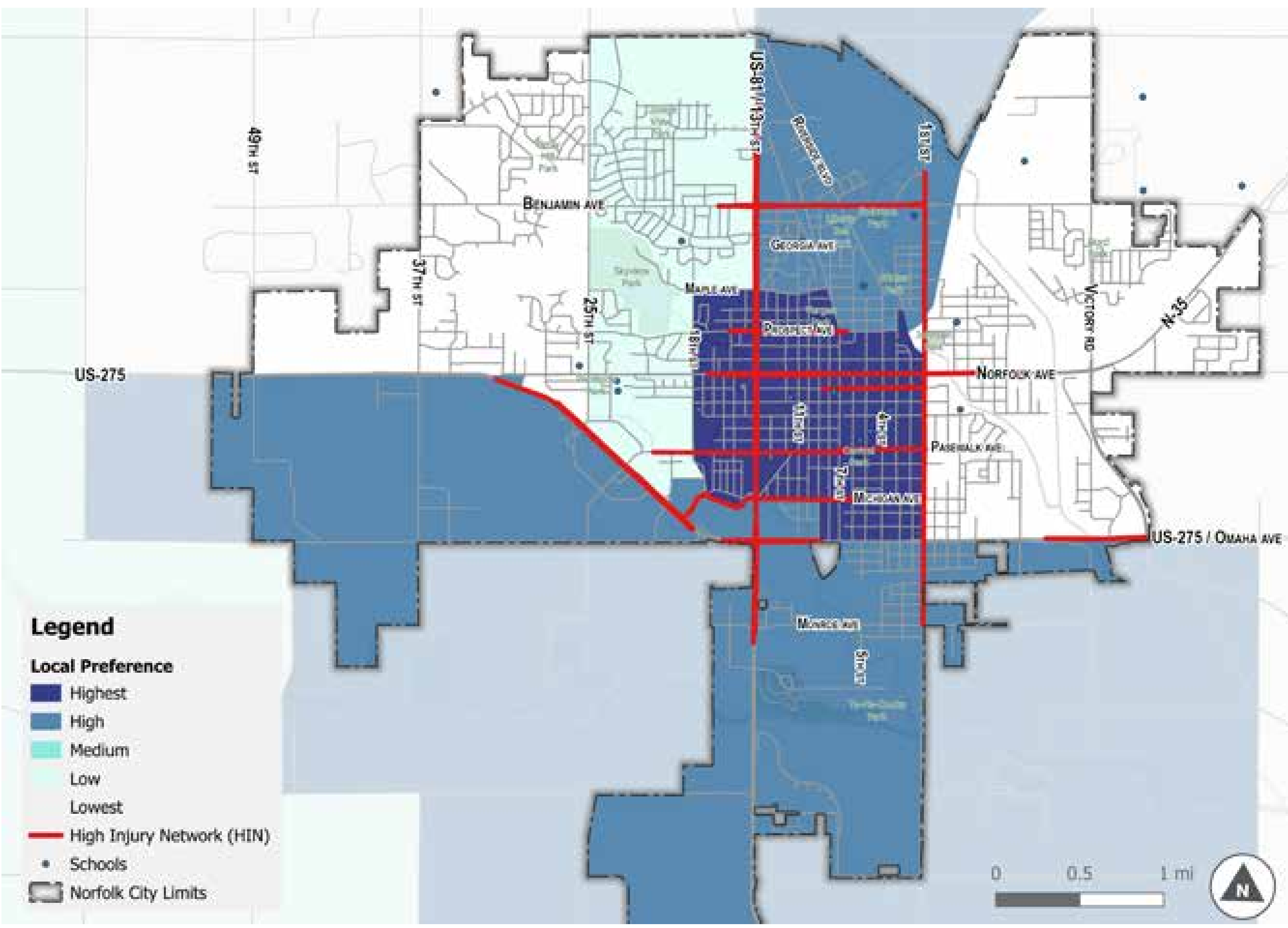
Local Preference

A local preference analysis was conducted to assess safety and active transportation impacts on populations that experience transportation disadvantage. The results of the analysis reveal demographic patterns in safety and multimodal access outcomes and provide valuable information for incorporating local needs and preferences into the prioritization of investments.

The analysis identified the prevalence of certain characteristics in areas of the community that increase transportation disadvantage, vulnerability, insecurity, and burden. Each US Census Block Group was assigned a score based upon a combination of these factors. The results of the safety and Complete Streets analyses were overlaid on the local preference areas to show potential geographic inequities. Key takeaways from the local preference analysis are summarized below and the detailed analysis and maps are available in Appendix 2. Map 6 shows the local preference areas and the High Injury Network.

- High Injury Network (HIN) and High Risk Network (HRN) streets are primarily within or bordering areas with greater local preference.
- Corridors with high active transportation need and opportunity are generally concentrated in areas with greater local preference.

MAP 6 Local Preference Areas and the High Injury Network



Community Input

This section represents the voices of more than 400 Norfolk community members that participated in MTAP public engagement activities including online and printed surveys, open house, committee meetings, stakeholder meetings, and workshops. It identifies systemic as well as location-specific opportunities to improve safety, accessibility, and context sensitivity desired by the community. Adding community input and the data analyses provides a more complete picture of transportation safety, accessibility, and context sensitivity. More details on the engagement process, methods, and feedback are provided in Appendix 1.

Systemic Opportunities

Listed below are the frequently voiced safety and active transportation concerns, priorities, and areas of opportunity from community engagement.

More Multimodal Transportation Options: The community highly values the existing trails and sidewalks and repeatedly stressed the need for better and safer connections to the active transportation network throughout Norfolk. Residents would like safe and comfortable space to walk, bicycle, and take transit to work, school, and daily destinations. Residents want an expanded active transportation network, gaps filled in the existing network, and better maintained sidewalks. Affordable and reliable transit is particularly important for students and low-income residents.

Enhance Pedestrian and Bicyclist Safety: The community recognizes the challenge of crossing streets for people walking and bicycling. Residents expressed crossing safety, enhanced visibility of pedestrians and bicyclists, and reduced conflicts between drivers and other modes of transportation as high priorities. Safety of pedestrians in school zones, residential areas, high-traffic locations, and residents with disabilities/ impairments were primary concerns.

Improve Driver Behavior: Drivers speeding, distracted driving, and drivers failing to yield were among the top comments by the public. Residents would like to see strategies to improve driving behavior implemented, including better enforcement of traffic laws and removing distractions to drivers.

Shift to a Culture of Traffic Safety: Transportation safety is important to the community, and they would like to be proactive to create safer streets. Residents see an opportunity to improve safety by educating the public about transportation safety and traffic laws, encouraging people to walk and bicycle through events and outreach, and improving relationships with the public through continued engagement.

> *" Vehicles need to slow down during drop off and pick up hours from school. Lots of near misses of vehicles hitting NMS staff and students at the crosswalk, usually cars wanting to turn while staff and students are crossing in the crosswalk."*
>
> \- Public comment

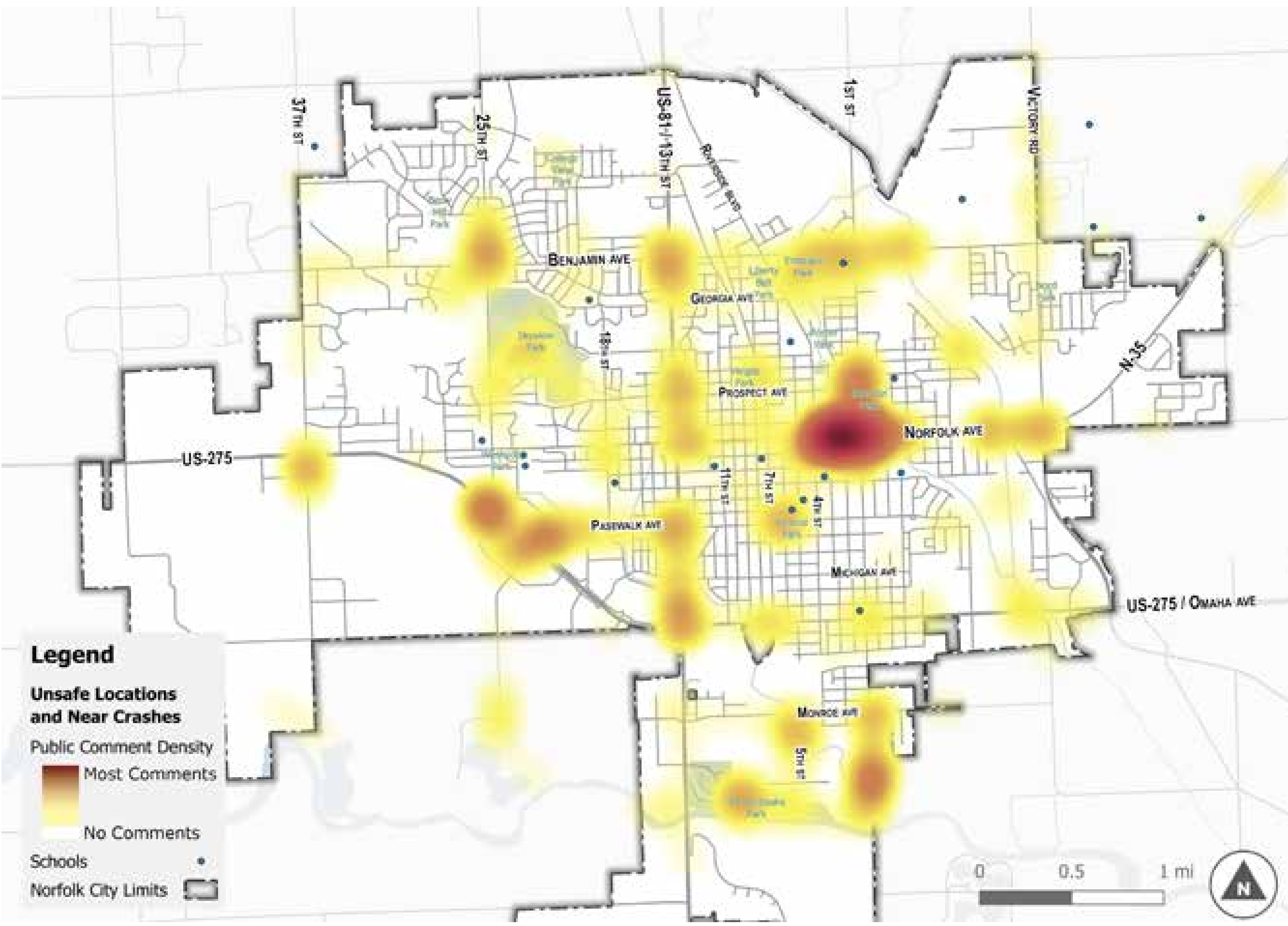
Locations and Areas of Opportunity

There are many locations throughout the city that were identified by the public as unsafe or where they were nearly involved a crash. This section outlines some specific locations frequently identified through the engagement process as well as insights from community members about the factors influencing transportation safety at these locations. People identified unsafe and near crash locations throughout the city, especially on arterial and collector street corridors and intersections, as shown in Map 7.

[Benjamin Ave] The sidewalks are narrow and have curbs at the driveways so they are not good for bicycles. Also because the road goes east/west there is glare in drivers' eyes which makes additional hazard in the mornings and evenings. This is a direct school route to Norfolk Catholic, but I never felt comfortable letting my kids bike to school because of traffic hazards."

- Public comment

MAP 7 Unsafe Locations and Near Crashes Identified by the Public



Downtown Norfolk: By far the most prevalent location identified was Downtown Norfolk including Norfolk Avenue from 4th Street to Cottonwood Street, 1st Street from Elm Avenue to Phillip Avenue, and Madison Ave from 4th Street to 1st Street. The issues identified vary greatly, but common themes included:

- Drivers not paying attention
- Drivers do not yield to pedestrians or bicyclists
- Street is too wide for pedestrian crossings
- There are no safe spaces for bicyclists
- Signage is confusing or lacking
- Visibility is poor
- People drive too fast
- Lack of separation between motor vehicle traffic and pedestrians and bicyclists
- Vehicles parked too close to sidewalk and intersections, impeding sight lines
- There were many comments that did not support the change from traffic lights to stop signs. Common themes as to why include:
  - I feel less safe with the stop signs (as a pedestrian with children)
  - Drivers cannot get out of parking spots
  - Drivers don't like to stop at every intersection
  - Stop signs slow down car traffic
  - Drivers roll through the stop signs
  - Drivers don't yield to people in crosswalk
  - Removal of stop lights has distracted drivers because of the lack of traffic flow
  - Stop signs cause too much commotion

" The vegetation and trees separating the traffic lanes make the downtown area more welcoming. I appreciate all of the efforts to make the river walk/downtown area more walkable and pedestrian and community oriented."

- Public comment

"[US-275] Sidewalks are old and too narrow. The area between the sidewalk and street is ugly and dangerous. We could improve our community if we could clean this area up for the people who need to or choose to walk or ride a bike."

- Public comment

US-275 near 25th Street and Pasewalk Avenue Intersections:

- Lack of safe bicycle and pedestrian crossing of US-275 to access Cowboy Trail
- People drive too fast
- Drivers fail to yield to pedestrians and bicyclists

Pasewalk Avenue between US-275 and 18th Street:

- Lack of pedestrian route continuity
- Lack of maintenance of pedestrian route
- Dangerous for pedestrians to cross Pasewalk Avenue

1st Street near Cowboy Trail East Trailhead:

- No safe place for bicyclists and pedestrians to access the Cowboy Trail from the north

U**S-81 between US-275 and Pasewalk Avenue**:

- Drivers do not pay attention
- Drivers do not yield to pedestrians or bicyclists
- Roadway is too wide for pedestrian crossings
- Drivers struggle to find a gap in traffic to turn onto Pasewalk Avenue

" The flashing pedestrian crossing light [at Norfolk Ave and Pine St] actually makes cars notice and stop for pedestrians."

- Public comment

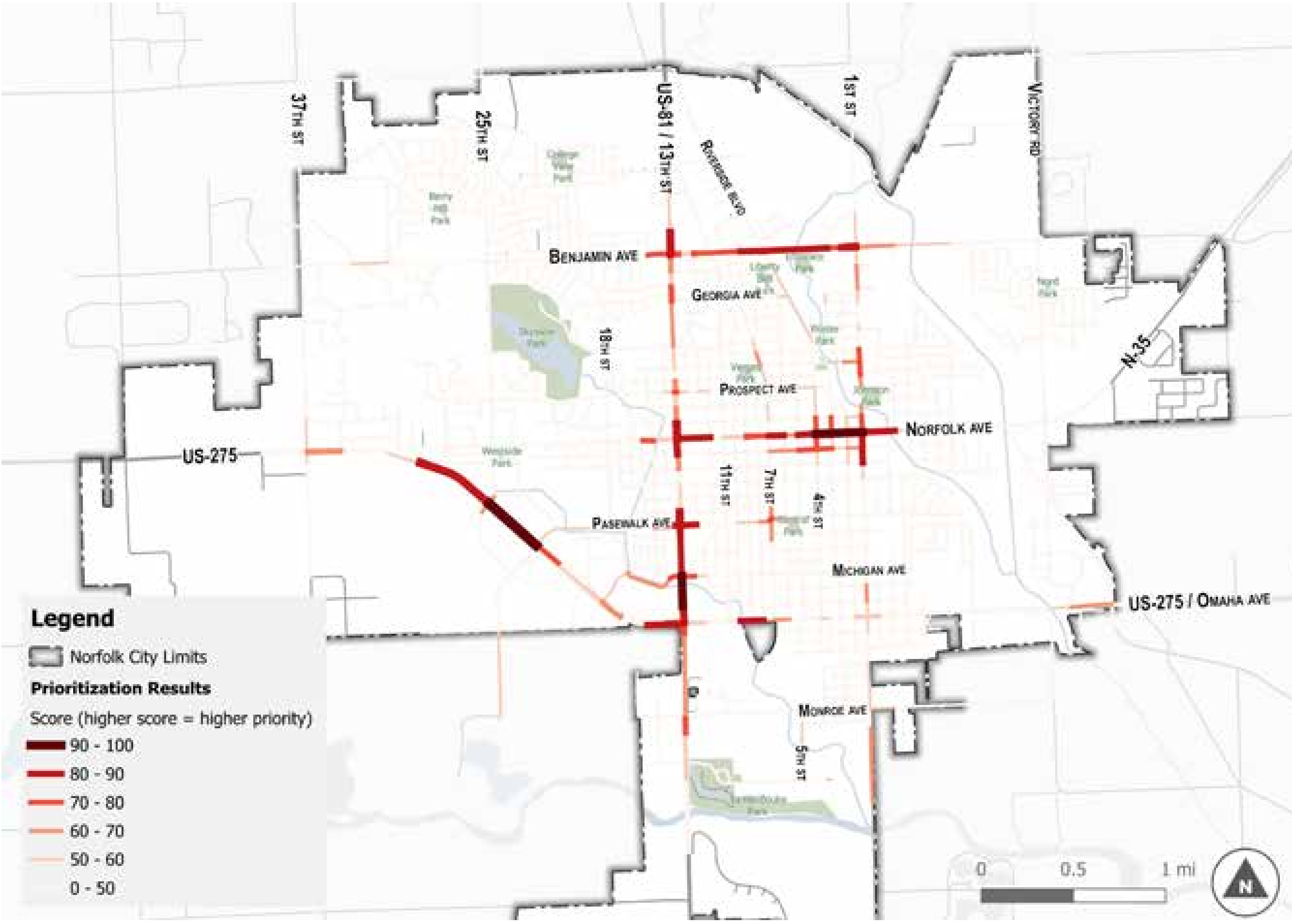
Prioritization of Locations for Interventions

Using the community input and analysis results, prioritization criteria and weighting were established based upon MTAP goals. The purpose of this prioritization process is to provide Norfolk with a basis for where to start with interventions to improve safety, accessibility, and context sensitivity. The higher priority locations are likely have the greatest opportunity for safety and active transportation interventions. The criteria and weighting are provided in Table 2 and the results are illustrated in Map 8.

TABLE 2 Prioritization Criteria and Weighting

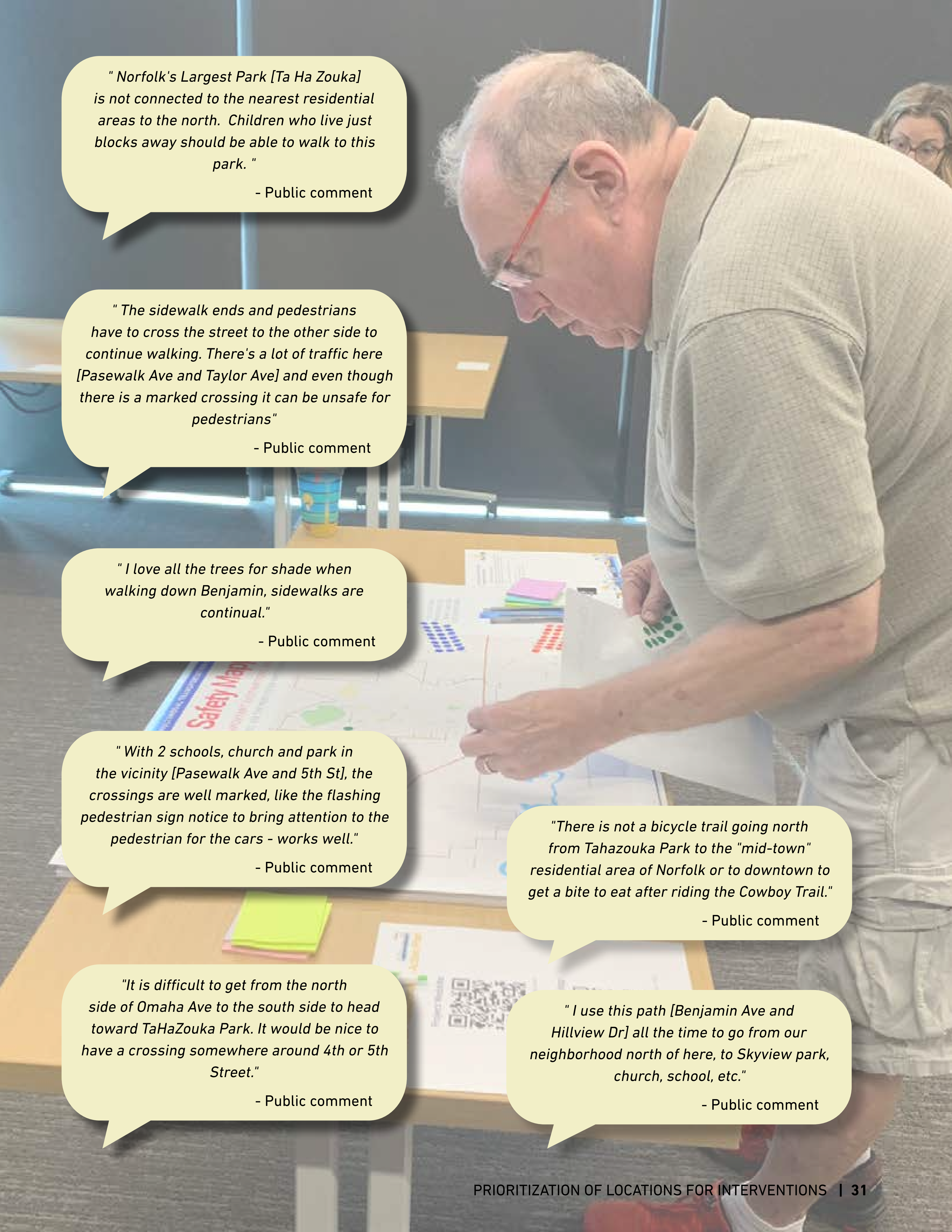
Criteria	Weighting
Community Input 25 points possible	• 3 or more comments for unsafe locations or near crashes (25 pts) • 2 comments for unsafe locations or near crashes (20 pts) • 1 comment for unsafe locations or near crashes (10 pts)
Vulnerable Road User High Risk Network 20 points possible	• High on Vulnerable Road User High Risk Network (20 pts) • Medium on Vulnerable Road User High Risk Network (10 pts) • Low on Vulnerable Road User High Risk Network (5 pts)
Motor Vehicle High Risk Network 15 points possible	• High on Motor Vehicle High Risk Network (15 points) • Medium on Motor Vehicle High Risk Network (10 points) • Low on Motor Vehicle High Risk Network (5 points)
High Injury Network 15 points possible	• On High Injury Network (15 pts)
Active Transportation Need and Opportunity 15 points possible	• On Planned Pedestrian and Bicycle Network (15 pts) • High Need and High Opportunity (12 pts) • High Need and Medium Opportunity (9 pts) • Medium Need and High Opportunity (6 pts) • Medium Need and Medium Opportunity (3 pts)
Local Preference 10 points possible	• Located within or bordering area of Highest Local Preference (10 pts) • Located within or bordering area of High Local Preference (7 pts) • Located within or bordering area of Medium Local Preference (4 pts) • Located within or bordering area of Low Local Preference (1 pt)

MAP 8 Priority Locations for Interventions



Street corridors, segments, and intersections with the highest prioritization scores are listed below, which include those receiving at least 50 out of 100 points. These are not in priority order.

- 37th Street near US-275
- 25th Street near US-275
- 25th Street south of Omaha Avenue
- US-81 from Sheridan Drive to Ta-Ha-Zouka Park (except a few short segments)
- 7th Street near Pasewalk Avenue
- 7th Street / Queen City Boulevard from Maple Avenue to Koenigstein Avenue
- 5th Street from Jackson Avenue to Ta-Ha-Zouka Park
- 4th Street from Prospect Avenue to Phillip Avenue
- Riverside Boulevard from Isabella Avenue to Walnut Avenue
- 3rd Street from Braasch Avenue to Madison Avenue and from Georgia Avenue to Sycamore Avenue
- 2nd Street from Braasch Avenue to Madison Avenue
- 1st Street from Andrews Drive to Park Avenue (except a few short segments) and Prairie Avenue to the Elkhorn River (except a few short segments)
- Benjamin Avenue from 14th Street to McIntosh Road and from Eldorado Road to 30th Street
- Georgia Avenue near Riverside Boulevard
- Elm Street from 3rd Street to 1st Street
- Prospect Avenue from Magnet Street to 4th Street (except a few short segments)
- Braasch Avenue from 2nd Street to 1st Street
- Norfolk Avenue from 15th Street to Pine Street (except one short segment)
- Madison Avenue from 7th Street to 1st St
- Pasewalk Avenue from US-275 to 4th Street (except a few short segments)
- Michigan Avenue / Center Drive from
- US-275 from 37th Street to Pierce (except a few segments) and from Victory Road to N-35
- Monroe Avenue near 1st Street



" Norfolk's Largest Park [Ta Ha Zouka] is not connected to the nearest residential areas to the north. Children who live just blocks away should be able to walk to this park. "

- Public comment

" The sidewalk ends and pedestrians have to cross the street to the other side to continue walking. There's a lot of traffic here [Pasewalk Ave and Taylor Ave] and even though there is a marked crossing it can be unsafe for pedestrians"

- Public comment

" I love all the trees for shade when walking down Benjamin, sidewalks are continual."

- Public comment

" With 2 schools, church and park in the vicinity [Pasewalk Ave and 5th St], the crossings are well marked, like the flashing pedestrian sign notice to bring attention to the pedestrian for the cars - works well."

- Public comment

"There is not a bicycle trail going north from Tahazouka Park to the "mid-town" residential area of Norfolk or to downtown to get a bite to eat after riding the Cowboy Trail."

- Public comment

"It is difficult to get from the north side of Omaha Ave to the south side to head toward TaHaZouka Park. It would be nice to have a crossing somewhere around 4th or 5th Street."

- Public comment

" I use this path [Benjamin Ave and Hillview Dr] all the time to go from our neighborhood north of here, to Skyview park, church, school, etc."

- Public comment

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Action Steps

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Recommended Actions

The action steps recommended in this chapter focus on changes to citywide policies and practices that will facilitate creating a physical environment that is safe, accessible, and context sensitive. These citywide actions are complemented by location-specific recommendations presented in Appendix 6 and Appendix 7.

The action steps are intended to address the objectives of the Safe System Approach - safe roads, safe speeds, safe road users, safe vehicles, and post-crash care. The analysis and community input (Chapter 3) emphasize the need to physically modify streets, and countermeasures proven to improve safety and accessibility offer viable opportunities to improve streets. Table 3 includes of summary of recommended action steps included in this chapter.

TABLE 3 Summary of Action Steps

Action Step	Implementation Timeframe
Promote a Safety Culture	Ongoing
Adopt a Safe and Complete System Policy	By 2026
Adopt Street Design Guidelines	By 2027
Proactively Implement Toolbox Countermeasures	Immediate and ongoing
Update City Policies and Plans	Policies - by 2030 Plans - Ongoing

"Zero is the only acceptable number of fatalities on Nebraska roads."

Nebraska Strategic Highway Safety Plan

Promote a Safety Culture

The public showed strong support for creating a shift to a culture of traffic safety (see Appendix 1). Common themes voiced by the public included educating the public about transportation safety and traffic laws, encouraging people to walk and bicycle through events and outreach, and improving relationships with the public through continued engagement.

Establishing a culture of street safety should be a cornerstone of Norfolk's communicated values and should influence all decisions. These values should inform educational campaigns and other strategies to prevent fatalities and serious injuries on the street network. A street safety culture starts with City leadership and staff.

Decision-Making Framework

The Action Plan Committee (APC) led the development of the Multimodal Transportation Action Plan (MTAP) and will help implement recommendations and monitor outcomes. The APC (or similar committee / subcommittee) should advise City Council on transportation safety-related issues. Additional responsibilities are identified in the "Adopt a Safe and Complete System Policy" section in this Chapter and in Chapter 5.

A post-crash analysis team should be established and used to assess serious injury and fatal crashes. This should be a multidisciplinary team comprised of experts and community members that analyze the multiple factors that caused the crash and identify opportunities to reduce the frequency and severity of future crashes.

City Staff Culture and Practices

The city should establish policies that encourage/require staff to follow traffic safety rules and use best practices when traveling and working within street right-of-way. Safety trainings should be provided and staff leadership should lead by example.

The Safe System Approach recognizes that police, fire, and emergency response professionals play important roles in reducing and eliminating fatal and serious crashes—providing lifesaving care and transport,

encouraging safe behaviors, deterring unsafe behaviors, education, outreach.

Post-crash care enhancements can lead to better crash outcomes. For instance, first responders could have access to whole blood, providing a life saving resource in the field. Coordinating with trauma centers can also lead to a more comprehensive strategy to improve crash outcomes. Supporting victims of traffic violence can also mitigate negative impacts of traffic violence in the community.

Law enforcement should focus on encouraging safe behaviors as well as deterring behaviors that are causing heightened risk of fatal and serious injury crashes as identified in Chapter 3 (e.g., drivers speeding, distracted driving, and failing to yield to pedestrians and bicyclists). Norfolk's enforcement practices should recognize the need to ensure practices are consistent, fair, unbiased, and just.

Additional strategies for city staff to foster a culture of traffic safety include building and maintaining relationships with the community, consistent outreach to the public, and demonstrating that feedback from the community is valued and taken into consideration.

City Equipment and Technology

The city should ensure municipal fleet vehicles are equipped with the appropriate safety equipment such as truck side guards, intelligent speed assist, upgraded mirrors, and blind spot detection / cameras. An assessment of the city's fleet could help identify opportunities for improved safety and integrate best practices.

Additional technology can help city staff address transportation safety challenges. One example is the issue of red light running on US-81 brought up by several members of the public. New technologies can be used to mitigate this issue including feedback such as distracted driving detection and feedback signs. Other similar technologies can mitigate existing safety issues such as speeding detection and feedback.

The city should investigate or pilot vehicle to infrastructure technologies, such as traffic signal preemption for emergency response vehicles, which can improve response times and create a safer streets.

Messaging and Framing

The City should use and promote proper narratives around crashes. Changing how we talk about safety is a prime example of creating a culture of safety. For example, using the term crashes, instead of accidents, is an important component of messaging. Accident implies that crashes cannot be reasonably anticipated or avoided. Traffic crashes—when two or more objects collide—are often predictable and typically preventable occurrences. Using correct terms is important, including in reporting crashes and media coverage of crashes, to avoid victim blaming and to shift public perception.

Traffic Safety Campaigns and Events

The City should work to facilitate a culture that acknowledges that we all have a sense of responsibility, both personally and as a society, to prevent serious crashes. This includes developing, supporting, and regularly participating in traffic safety educational campaigns.

The city should lead, support, and/or participate in public events to promote traffic safety such as open streets, bike buses, ciclovia events, bike / walk to work / school day, and many more.

Agency Partnerships

The City should use existing external resources and participate in safety campaigns. The Nebraska Department of Transportation has resources available online for various topics including safety educational events and resources, responder training, law enforcement training, workshops, and conferences[1]. The National Highway Traffic Safety Administration (NHTSA) has a comprehensive list of resources including facts, media and marketing resources, campaigns, and other general resources for specific safety topics such as distracted driving, impaired driving, bicycle safety, teen driver safety, and many more[2]. Norfolk should also build awareness of, and support for, the countermeasures in the Toolbox in Appendix 5. Norfolk should also partner with local non-profits and advocacy organizations to help develop and deploy safety campaigns.

Additional Planning

The MTAP provides detailed analysis for four corridors and provides conceptual drawing for several challenging locations (see Appendix 6 and 7). Detailed analysis, planning, and concept development should be done on additional corridors or intersections especially those identified on the map showing Priority Locations for Interventions (see Map 8 in Chapter 3). In addition, a comprehensive Safe Routes to School Plan for all schools in Norfolk should be developed.

1 https://dot.nebraska.gov/safety/hso/

2 https://www.trafficsafetymarketing.gov/safety-topics

Adopt a Safe and Complete System Policy

As outlined in Chapter 2, the conventional approach to planning and designing streets will not achieve the safe, accessible, and context sensitive goals set for in the of the MTAP. Achieving these goals will require a paradigm shift, created by establishing a new approach to how Norfolk plans and designs streets.

The MTAP was created by blending the key elements and concepts of the Complete Streets approach with the Safe System approach. As a result, the MTAP consolidates and simplifies how Norfolk can apply national and international best practices in Complete Streets and transportation safety to its planning and design practices to build a safe, multimodal, context-sensitive system that works for everyone.

To begin implementing the MTAP, Norfolk should formally adopt a Safe and Complete System Policy (Policy) through a codification, resolution, or similar instrument. This will show meaningful commitment for action on, and institutionalization of, the foundational goals of safety, access, and context sensitivity. The Policy should be based upon the recommendations of this Plan and include the following elements. Sample language for Norfolk's Policy is also provided. If adopted following these guidelines, the Policy will serve as a comprehensive Complete Streets policy with added safety emphasis.

Purpose and Principles: Clearly state the purpose and guiding principles of the Safe and Complete System Policy and clearly identify any areas of emphasis, especially those that differ from the current approach.

Applicability: Document who is required to follow the Policy, where the Policy applies, and specific and limited exceptions to the Policy.

Flexibility: Explicitly allow design flexibility and ensure a process for documenting design decisions.

Resources: Document the latest resources and best practices for implementing designs that support the Policy.

Performance Measures: Document the measures and/or desired outcomes that will be used to assess the effectiveness of the Policy and implementation steps. These should be based on data that is accessible and regularly available or can be collected by the City. It is recommended that the Policy not explicitly establish the measures, but that a committee will establish them, and allow flexibility for modifying them as more data becomes available. Consider measures such as crash data, non-motorized use data, access to non-motorized routes, and actions and projects carried out by the city.

Implementation: Describe how the policy will be implemented, including the establishment of a group that will oversee the Policy.

Example Language

Below is language developed for Norfolk that can be used as the Safe and Complete System Policy or be modified as deemed appropriate.

Purpose and Principles

The City of Norfolk will plan, design, construct, reconstruct, maintain, and operate public streets to create safe and accessible environments for all people in a manner that supports existing and future land uses and surrounding neighborhoods and streets. Public streets will reflect the needs of all users, regardless of age, ability, income, or ethnicity. All users include pedestrians, bicyclists, users of public transit, motorists, freight providers, emergency responders, and people accessing adjacent parcels and buildings.

The City of Norfolk will integrate transportation and land use decisions to ensure public streets reflect the character of the surrounding environment in a manner that creates a safe and accessible environment for all people. The Safe and Complete System considers the surrounding character of the built and natural environment, the transportation functions of the street, and input from the people that use the transportation system.

The foundational principles of the Safe and Complete System Policy are to:

- Proactively address safety risks for people using the street network.
- Prioritize safety for all users, and do not trade the safety of one mode for the convenience of another.
- Serve all users and modes, including pedestrians, bicyclists, users of public transit, motorists, freight providers, emergency responders, and adjacent land users, regardless of age, ability, income, or ethnicity.
- Form connected multimodal networks that provide safe, convenient access to neighborhoods and destinations for all modes. All modes are not likely to receive the same type of accommodation or amount of space on every street, but that the street network should allow everyone to safely and conveniently travel across the community.
- Create context-sensitive streets that are designed to support the current and future local land use and development context while considering impacts to surrounding streets and neighborhoods. Similarly, land use and development plans should support interconnected multimodal networks that are safe and accessible by all people.

Applicability

The Safe and Complete System Policy applies to all transportation infrastructure projects carried out on public streets under the jurisdiction of the City of Norfolk including the City's jurisdiction within the 2-mile extra jurisdictional limits. The Nebraska Department of Transportation (NDOT) and Madison County are also encouraged to follow this Policy within Norfolk City Limits and within its extra jurisdictional limits. This Policy is meant to guide the decisions of the City of Norfolk and its partners.

The Safe and Complete System Policy applies to:

- All existing and future public streets under the jurisdiction of the City of Norfolk, and
- All transportation infrastructure projects, regardless of funding source, including the following project phases:
  - Project identification and planning,
  - Project scoping,
  - Project design approvals,
  - Construction and reconstruction,
  - Repaving and rehabilitation, and
  - Operations and maintenance.

The Safe and Complete System Policy also applies to the following. However, increased flexibility, including potentially not accommodating all modes, may be provided in the following situations:

- Streets where specific modes and/or users are prohibited by law,
- Streets perpetually owned by an agency other than the City of Norfolk, and
- Projects where cost or impacts of following the Safe and Complete Streets Policy are excessively disproportionate to the existing and future need and probable use and sufficient documentation is provided.

The Safe and Complete System Policy does not apply to:

- Emergency street reconstruction and repairs, and
- Minor maintenance activities such as mowing, cleaning, sweeping, crack sealing, and patching.

Exceptions to the Safe and Complete System Policy shall be documented, publicly available, and approved by [City Engineer, Safe and Complete System Action Committee, subcommittee, or governing body].

Flexibility

The Safe and Complete System Policy allows flexibility to accommodate different types of streets and users and to promote design solutions that fit within the context(s) of the community. In some cases, the most appropriate design solutions may not be feasible due to right-of-way or budgetary constraints. In such cases, alternative design solutions will be considered. The City Engineer shall document and explicitly explain, or cause to document and explicitly explain, how the alternative solutions adequately accommodate all anticipated users of the street in a safe, accessible, and context-sensitive manner.

Resources

The latest design guidance, standards, and recommendations available will be used in the implementation of the Safe and Complete System Policy, including, but not limited to:

- City documents, plans, and resources
- Designing Walkable Urban Thoroughfares: A Context Sensitive Approach: An ITE Recommended Practice

(Institute of Transportation Engineers)
- Guide for the Planning, Design, and Operation of Pedestrian Facilities (American Association of State Highway and Transportation Officials)
- Guide for the Development of Bicycle Facilities (American Association of State Highway and Transportation Officials)
- Urban Street Design Guide (National Association of City Transportation Officials)
- Urban Bikeway Design Guide (National Association of City Transportation Officials)
- A Policy on Geometric Design of Highways and Streets (American Association of State Highway and Transportation Officials)
- Manual on Uniform Traffic Control Devices (Federal Highway Administration)

Performance Measures

The City of Norfolk will measure the effectiveness of the Safe and Complete System Policy and associated implementation steps by establishing performance measures and producing an annual report. These measures will be established by the [City Engineer, Safe and Complete System Advisory Committee, or subcommittee] and should focus on the desired outcomes of safety, access, and context-sensitivity.

Implementation

The Safe and Complete System Policy will be cooperatively implemented among all departments within the City of Norfolk, and to the greatest extent possible, among private developers and county, state, regional, and federal agencies.

The City of Norfolk will take specific steps to implement the Safe and Complete System Policy, including:

- Implement the Multimodal Transportation Action Plan, which includes identified needs and priorities along with a process, procedures, classifications, and design guidance for a Safe and Complete System.
- Establish or designate a Safe and Complete System Advisory Committee or subcommittee. City staff will be assigned to the committee / subcommittee and will report the committee's input to City Council regularly. The Safe and Complete System Advisory Committee will:
  - Meet at least annually and up to quarterly,
  - Review individual street projects pre- and post-construction (including projects excepted from this Policy along with justifying documentation) for conformance with the Safe and Complete System Policy, the Multimodal Transportation Action Plan and other City plans and objectives,
  - Assist in setting performance measures and targets along with completing an annual Safe and Complete System review,
  - Recommend projects to be implemented and identify opportunities to integrate Multimodal Transportation Action Plan recommendations into projects, and
  - Suggest policy and procedure revisions.
- Develop a template for an annual Safe and Complete System review, including identifying key reporting metrics, and then populate the review each year to document compliance with the policy, report on performance measures, and generally assess the Policy and action steps.
- Restructure or revise related procedures, plans, regulations, and other processes to conform to and support the Safe and Complete System Policy and guidance contained within the Multimodal Transportation Action Plan.
- Develop internal procedures to institutionalize the Safe and Complete System Policy. This may include staff training, checklists for project scoping and design, or updated standard details.
- Offer opportunities for City staff, community leaders, and the general public to learn about the Safe and Complete System Policy and participate in the implementation process.

Adopt Street Design Guidelines

Norfolk should adopt the street design guidelines provided in Appendix 3. Street design guidelines provide a broad policy and consistent approach to allocating space for, and the design of, specific elements within public street right-of-way.

The proposed guidelines for Norfolk are based upon the Safe and Complete System Policy, best practices in Complete Streets and safety, and customized for Norfolk. The guidelines include the following elements:

- Definitions of Street Zones
- Development of a Street Typology
- Street Type Design Guidance
- Additional Design Clarifications for Roadway Zone, Pedestrian Zone, Bikeways, and Intersections

The guidelines discuss the space allocation and design parameters for each zone and area comprising the entire street right-of-way for the various street types and contexts, as shown in Figure 5.

These street design guidelines can be supplemented by the City of Norfolk with new standard details, cross section drawings, etc.

In addition, the City should work with the Nebraska Board of Public Roads Classifications and Standards to promote more design flexibility, especially related to travel lane widths, in support of improved safety and accessibility.

FIGURE 5 Example of the Street Zones and Areas from the Street Design Guidelines

Proactively Implement Toolbox Countermeasures

The Safe and Complete System Toolbox, provided in Appendix 5, includes a list of countermeasures to change the physical environment to enhance safety, access, and context-sensitivity. These countermeasures were compiled from national guidance and best practices and customized for Norfolk. Many of the countermeasures can and should be implemented in tandem with other countermeasures to create a safe system with redundancies.

There are two primary means for Norfolk to implement countermeasures in the Toolbox. The first is to integrate these countermeasures into planned roadway projects. The second is to proactively implement countermeasures as standalone retrofit projects. Some examples of countermeasures in the Toolbox are shown in Figure 6.

Whether integrated into larger roadway projects or strategically retrofitted, countermeasure implementation should be incorporated into the City's Capital Improvement Program (CIP) and/or annual budget. As Norfolk's annual CIP is being developed, the City should identify opportunities to incorporate countermeasures into CIP projects in the pipeline, include new retrofit project funding, and also prioritize projects located on the Priority Locations for Interventions map in Chapter 3. All transportation projects should be shaped by, or consider, countermeasures identified in the Toolbox. The City should also coordinate with the Nebraska Department of Transportation and promote the integration of appropriate Toolbox countermeasures for projects on the State-owned streets in Norfolk.

Efforts to create or modify infrastructure to reduce and ultimately eliminate fatal and serious injury crashes should focus on vulnerable road users (VRU) and intersections. The data analysis and community input summarized in Chapter 3 support emphasis on these two areas.

> "The term vulnerable road user (VRU) 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."
>
> National Safety Council

The majority of the countermeasures in the Toolbox target safety and access improvements for people walking and bicycling. A few examples include corner radius reductions, curb extensions / bulb-outs, high-visibility crosswalks, separated bike lanes, and road diets.

Many countermeasures in the Toolbox focus on intersections and crossings. A few examples include backplates with retroreflective borders, dedicated right and left turn lanes, leading bicycle and leading pedestrian intervals, mini-roundabouts, and no turn on red.

Update City Policies and Plans

Existing City policies and plans were reviewed as part of the MTAP development process. A summary memo is available in Appendix 4. The memo identifies opportunities for modifying or adding elements to policies and plans, such as adding more transportation safety focus in the Transportation Plan and strictly limiting exceptions to the City's sidewalk requirements for subdivisions. The City should proactively address the policy recommendations. For plans, the City should evaluate each plan when it is being updated to seek opportunities to incorporate the recommended changes identified in Appendix 4. Any new plans or policies should be consistent with the MTAP and promote the Safe and Complete System Approach.

FIGURE 6 Example Countermeasures

Crossing Islands, also referred to as pedestrian refuge islands, are center medians with a cut-out area for pedestrian and bicyclist refuge that enhance crossing safety.

Curb Extensions / Bulb Outs extend a section of sidewalk into the roadway at intersections and other pedestrian crossing locations to reduce crossing distance and improve visibility.

High-Visibility Crosswalks use parallel markings that motorists see more easily compared with traditional crosswalk markings located perpendicular to the motor vehicle path of travel.

School Zones use speed limit signage to reduce vehicle speeds near schools for enhanced safety and access for children.

Separated Bike Lanes provide physical separation between bicyclists and vehicle traffic to increase safety and comfort for people bicycling and appeal to more potential bicyclists.

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Monitoring Outcomes

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Measuring Progress

The Multimodal Transportation Action Plan (MTAP) includes action steps, strategies, and projects that will enhance the safety, accessibility, and context-sensitivity of Norfolk streets. It is vital to track and report on the progress of implementing the recommended action steps and ensuring the goals (safe, accessible, and context-sensitive) and desired outcomes are achieved.

To institutionalize these goals and promote their consideration in decision-making, the City will produce an annual report that will be posted on their website and publicized through its main communication channels. At a minimum, the annual report should include the Core Performance Measures. These measures are intended to be a starting point as the City begins to collect, analyze, and publish data that reflect street improvements in Norfolk. As the City improves available data and resources, Supplemental Performance Measures will provide a more detailed view of the progress the City is making, especially in response to pressing transportation safety issues identified in this Plan.

Core Performance Measures

- **Total number of fatal and serious injury crashes.**
  - A goal of the MTAP is to reduce the number of fatal and serious injury crashes and ultimately eliminate them.
  - Source: Crash data from NDOT or local law enforcement.
- **Number of fatal and serious injury crashes occurring at intersections.**
  - With 81% of fatal and serious injury crashes occurring at intersections, focusing on these locations can greatly reduce the overall fatal and serious injury crashes.
  - Generally, intersection crashes are within 150 feet of an intersection.
  - Source: Crash data from NDOT or local law enforcement.
- **Number of pedestrian crossings enhanced.**
  - The desire is to increase the number of safe and accessible crossings by enhancing existing pedestrian crossings and providing new crossings.
  - Source: City to track the number of crossings enhanced that are consistent with the Toolbox in Appendix 5.

Supplemental Performance Measures

- **Percent of street centerline miles that are operating under 30 miles per hour.**
  - Crashes involving faster-moving motor vehicles are more likely to result in fatalities or serious injuries. The desire is to increase the percent of Norfolk's street network that is operating at slower speeds.
  - Source: City to conduct a regular traffic speed study
- **Percent of streets with complete sidewalk network.**
  - The desire is to have a complete system of pedestrian connections to enhance pedestrian safety and accessibility.
  - The proposed measure would report on the percent of streets with sidewalks on both sides of the street, one side of the street, and none.
  - Source: City GIS data and City to track sidewalk projects.
- **Percent of transportation projects that comply with the Safe and Complete System Policy.**
  - The Safe and Complete System Policy in Chapter 4 includes guidance on ensuring street projects are focused on the safety and accessibility of all users and designed in a context-sensitive manner. Exceptions can be granted, but the desire is to limit the exceptions.
  - Source: City to track projects that meet the policy and those that are given exceptions.

Moving Forward

It is recommended that the Action Plan Committee (APC) be charged with ensuring MTAP implementation as well as monitoring progress on actions and outcomes. The APC should work with City staff to identify performance targets for each measure and identify gaps in data availability.

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Community Engagement Summary

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Summary

Over 400 Norfolk community members participated in activities across the various engagement events for the Norfolk Multimodal Transportation Action Plan (MTAP) in the Summer 2024. Thematic findings about the overall transportation system and specific areas of concern in Norfolk are outlined in this memo. These findings will be used to identify locations for interventions as well as systematic changes to the transportation system to enhance safety and accessibility for people of all ages and abilities, no matter the mode of travel chosen.

Systemic Opportunities

Listed below are the general safety and non-motorized (active) transportation concerns, priorities, and areas of opportunity outlined by the public and stakeholders through the engagement process.

More Multimodal Transportation Options: The community highly values the existing trails and sidewalks and repeatedly stressed the need for better and safer connections to the active transportation network through Norfolk. Residents would like safe and comfortable space to walk, bicycle, and take transit to work, school, and daily destinations. Residents want an expanded active transportation network, gaps filled in the existing network, and better maintained sidewalks. Affordable and reliable transit is particularly important for students and low-income residents.

Enhance Pedestrian and Bicyclist Safety: The community recognizes the challenge of crossing streets for people walking and bicycling. Residents expressed crossing safety, enhanced visibility of pedestrians and bicyclists, and reduced conflicts between drivers and other modes of transportation as high priorities. Safety of pedestrians in school zones, residential areas, high-traffic locations, and residents with disabilities/ impairments were primary concerns.

Improve Driver Behavior: Drivers speeding, distracted driving, and drivers failing to yield were amongst the top comments by the public. Residents would like to see strategies to improve driving behavior, including better enforcement of traffic laws and removing distractions to drivers.

Shift to a Culture of Traffic Safety: Transportation safety is important to the community and they would like to be proactive to create safer streets. Residents see an opportunity to improve safety by educating the public about transportation safety and traffic laws, encouraging people to walk and bicycle through events and outreach, and improving relationships with the public through continued engagement.

Integrate Complete Streets Approach: Transportation safety and access for people using all modes of transportation and people with all types of mobility needs are important to the community. Taking a holistic, proactive approach to street design would address systemic opportunities identified through engagement, such as multimodal safety, connectivity, driving speeds and behavior.

Locations and Areas of Opportunity

This section highlights common locations identified by the public and stakeholders through the engagement process. Community members provided insight into the factors influencing transportation safety at these locations, which were used to identify the opportunities listed below.

1. Downtown (Norfolk Ave - 4th St to Cottonwood St and 1st St - Braasch Ave to Phillip Ave)
   - Reconsider intersection treatments; explore options outside of four-way stops.
   - Reduce points of conflict for pedestrians/bicyclists and vehicles.
   - Maintain vegetation at intersections and crossings.
2. East Norfolk Ave
   - Provide safe spaces for pedestrians and bicyclists to access the Cowboy Trail from Downtown.
   - Improve roadway signage and traffic law enforcement.
   - Address lighting and personal safety issues.
   - Improve the gateway into Downtown.
3. East Benjamin Ave
   - Address infrastructure accessibility issues.
   - Provide safe crossings, continuous sidewalks, and trees/shade.
   - Enhance access and crosswalks for pedestrians and address pick up/drop off congestion around schools.
4. North 25th Ave
   - Improve crosswalk visibility, lighting, and pedestrian crossing safety.
   - Improve pedestrian access at Prospect Ave.
   - Address congestion, yielding and visibility issues, and high vehicle speeds, particularly at the Benjamin Ave intersection.
5. US-81/13th St
   - Expand connections to Cowboy Trail and Skyview Park and promote the use of these trails to the community.
   - Address crossing safety, accessibility, and sidewalk gaps to improve pedestrian mobility.
   - Consolidate commercial property driveways.
   - Address turning issues at Pasewalk and US-81/13th St.
6. Residential Areas
   - Provide more neighborhood sidewalks and street trees/vegetation.
   - Provide safe connections to parks, destinations, and existing trails.
   - Improve sense of community and identity.
   - Prioritize safety for pedestrians in school zones.

Engagement Process Overview

This section summarizes the methods used to engage the public and stakeholders during the summer of 2024. The intent of this engagement was to get feedback on overall transportation safety, specific safety concerns and locations, active transportation access and safety concerns and locations, safety and active transportation access strategies, and inequities in the transportation system.

Methods Used to Engage

The project team used a range of engagement techniques, both virtual and in-person, intended to reach a wide variety of Norfolk residents including individuals that may not live in Norfolk, but spend a significant amount of time in Norfolk, such as students, employees, and business owners.

Survey

The project team administered a survey with interactive mapping exercise. This was hosted on the project website with translation services available, serving as the primary virtual engagement option. There were also hard copies available in English and Spanish. The survey was open to the public from July 10, 2024 to August 28, 2024. Feedback was provided by 282 individuals through participation in all, or portions of, the survey. Over 270 comments were made via the interactive mapping exercise.

Open House

The project team facilitated a public open house on July 30, 2024 from 5-7pm at the Norfolk Library for the public to learn about the project and provide feedback. There were eight people that signed-in to the open house, with each person participating in the engagement activities and providing multiple comments. In addition, the project team was able to gather input from an additional 10 people who wouldn't have otherwise participated by encouraging library patrons to participate in an interactive activity.

Pop-Ups

The project team engaged community members at five public events around the community utilizing two or more activities to engage quickly and interactively. The team attended the events below and engaged with over 100 individuals.

- July 19th, Stringbeans Concert at the Library, 10-noon. Participants were primarily parents of small children.
- July 20th, Farmers Market Downtown, 9-noon. Participants ranged in demographics and provided perspective from a wide range of residents and out-of-town visitors.
- July 25th, Music in the Park at Skyview Park, 6-8pm. Participants ranged in demographics, with some coming from outside the Norfolk region.
- August 6th, National Night out at Central Park, 5-7pm. Participants ranged in demographics. This was the event with the most participants.
- August 16th, Arcoiris, 5-7:30pm. Participants were primarily Hispanic with much of the focus being on children.

Stakeholder Engagement

The project team facilitated eight stakeholder group interviews and an Action Plan Committee meeting, which are summarized in the Stakeholder Interviews section and the Action Plan Committee section, respectively.

Promotions

Engagement opportunities were promoted via city of Norfolk website and social media channels, Norfolk Daily News (online, print, social media channels, and email distribution list), press releases, flyers distributed to businesses and bulletin boards around town, post-cards around town, the MTAP project website, and word of mouth.

Figure 7 shows examples of promotions used, in order from top to bottom, 1) city of Norfolk video promotion of survey, 2) city of Norfolk promotion of survey, 3) city of Norfolk promotion of open house, and 4) Norfolk Daily News article on open house (Source: Norfolk Daily News).

Questions and Activities

The project team developed a common set of questions to be used to engage with the public across all engagement methods. Interactive activities were then developed to facilitate participation and elicit feedback. The survey and open house included all questions and activities. The pop-up events included two or three questions and activities. Not all questions and activities were used for pop-up events since time with participants was limited.

Questions included how members of the community feel about the safety of the current transportation system, safety and access for different modes of transportation, locations that are seen as safe and those seen as unsafe, various safety strategies, and where their priorities lie in working towards a safe multimodal transportation system. Activities included placing dots on a map, ranking options, placing pom poms in jars, as well as survey questions.

Equitable Engagement

Community engagement with a diverse population and set of stakeholders offers insights into often overlooked transportation needs and challenges. There was a concerted effort to reach out to Black, Indigenous, and People of Color (BIPOC) residents, low-income households, people with disabilities, limited English, and other historically disadvantaged groups who are traditionally underrepresented in transportation planning. These individuals and representatives were invited to participate in the stakeholder interviews, invited to serve on the Action Plan Committee, and targeted to participate in the survey. The survey was extended an extra two weeks to allow the Hispanic Business Council to promote survey participation.

Additional engagement opportunities were implemented via two walk audits to garner more input from traditionally underrepre-sented communities, which are summarized later in this appendix.

FIGURE 7 Engagement Promotions

Public Engagement

This section summarizes information obtained from the general public from the survey and activities at the open house and pop-up events.

Key Findings: Public Engagement

From the conversations with members of the public, completed surveys, and input into the activities, the project team was able to gather insight about common transportation issues, areas of concern in Norfolk, and factors contributing to transportations safety issues/locations.

Systemic Opportunities

The list below are key themes from the public input about overall transportation safety and active transportation access. Table 4 provides a summary of the feedback provided that informed these key takeaways.

Pedestrian and Bicyclist Safety: Addressing gaps in the existing sidewalk network, improving crossing safety, and improving the visibility of pedestrians and bicyclists were expressed as high priorities. Many participants mentioned concerns about accessibility for themselves as well as other residents.

Trail and Sidewalk Connectivity: Participants expressed their appreciation for existing trails and repeatedly mentioned the desire for these trails to be expanded and better connected throughout Norfolk. Residents enjoy being able to bicycle to work, school, and daily destinations. Areas without sidewalks or with interrupted trail/sidewalk networks is a point of frustration for the community. Residents would also like better trail and sidewalk connections to surrounding areas.

Traffic Speed and Behavior: Community members would like to see driving speeds, distracted driving, and issues with drivers yielding addressed and mentioned that enforcement of traffic laws is important.

Multimodal Transportation Options: The community enjoys biking for recreation, but they would like the option to commute and travel by bicycle. Residents mentioned the lack of access to transit and they would like to see service expanded and transit be more affordable.

Culture: The community places high value on transportation safety and supports changes necessary to achieve a safe multimodal transportation system. Education, training, and community outreach methods around safe driving behavior should be explored and a shift from driving to walking, biking, and taking public transit should be encouraged.

Locations and Areas of Opportunity

The online and in-person engagement methods provided the public with the opportunity to identify safe and unsafe locations around Norfolk. Participants were able to elaborate on what is impacting their feeling of safety at specific locations and provide suggestions for improvement. Table 5 summarizes the common locations, issues, and needs outlined by the community. Map 9, Map 10, and Map 11 indicate that unsafe locations and crashes/near misses are concentrated in Downtown Norfolk and along North 1st St, US-81/13th St, 25th St N, Benjamin Ave, West Pasewalk Ave, and South 1st St (south of City limits).

TABLE 4 Common Themes - Public Engagement

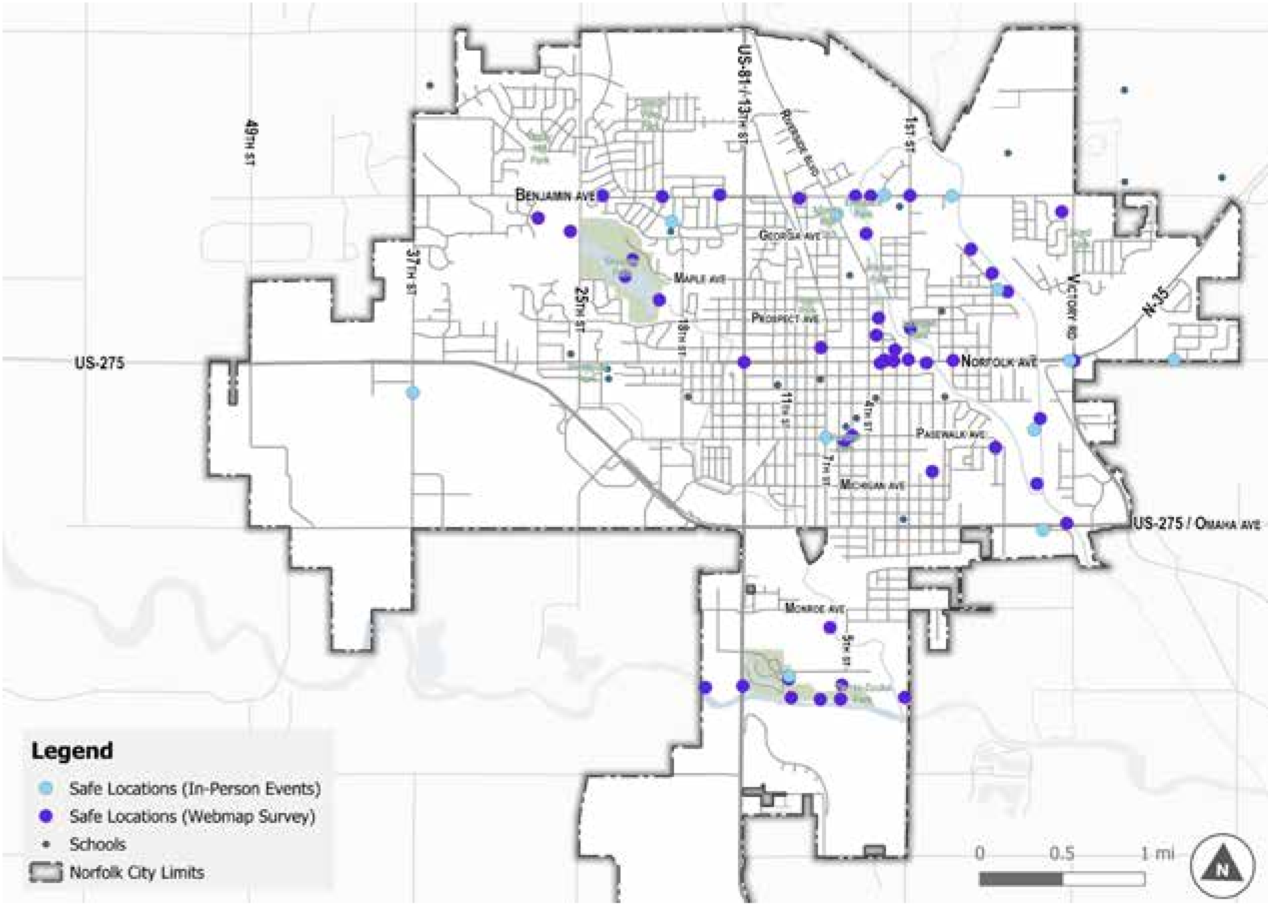
Category	Common Theme	Insight
Safety as a priority for the community	• Most agreed that reducing serious crashes and fatalities should be prioritized over minimizing travel time and would change their behavior to do so. • People lean towards street being centered around people rather than cars, but there are many that feel streets should focus on drivers.	• The community greatly values safety and supports transportations safety efforts. • Residents are open to changing personal behavior to help create a safety transportation system. • Car mobility is important in Norfolk.
Feeling of Safety	• Most people drive and walk, but many would walk, bike, or drive more if it felt safer. • Most feel that driving is safe and accessible and many feel that walking and transit are as well. • Some feel that transit is safe but not accessible. • Many others feel that walking and biking/scooters are accessible but not safe.	• Driving feels the safest in Norfolk. • While there are options to walk and bike, they are not accessible or safe for users of all abilities. • Transit is safe but lacks accessibility for some users.
Transportation Safety Ranking	• People would like to see safer crossings, reduced conflicts between modes of travel, improved walking/biking routes, and better visibility of pedestrians and bicyclists. • Enforcement of road safety rules and lighting along routes are the top factors that impact feelings of safety, followed by road maintenance, reduced driving speeds, and more sidewalks and trails.	• Drivers and pedestrians/bicyclists alike would like to see improvements to make it easier and safer to share the road. • Driver speeds and behavior have a significant impact on safety. • Lighting should be improved for all modes of travel. • More dedicated places to walk and bike safely are needed.
Additional Comments	• People expressed the importance of connections to existing trails, particularly the Cowboy Trail. • Stop signs replacing traffic lights is presenting a safety issue for pedestrians and drivers alike. • Drivers yielding and visibility of pedestrians/bicyclists is a safety issue. • People expressed interest in expanding transit services.	• Gaps and connections to the existing trail network should be prioritized. • Crossing safety is a significant issue. • Lighting and visibility impact drivers and pedestrians/ bicyclists. • Transit accessibility and services should be explored through this project.

TABLE 5 Common Themes for Locations - Public Engagement

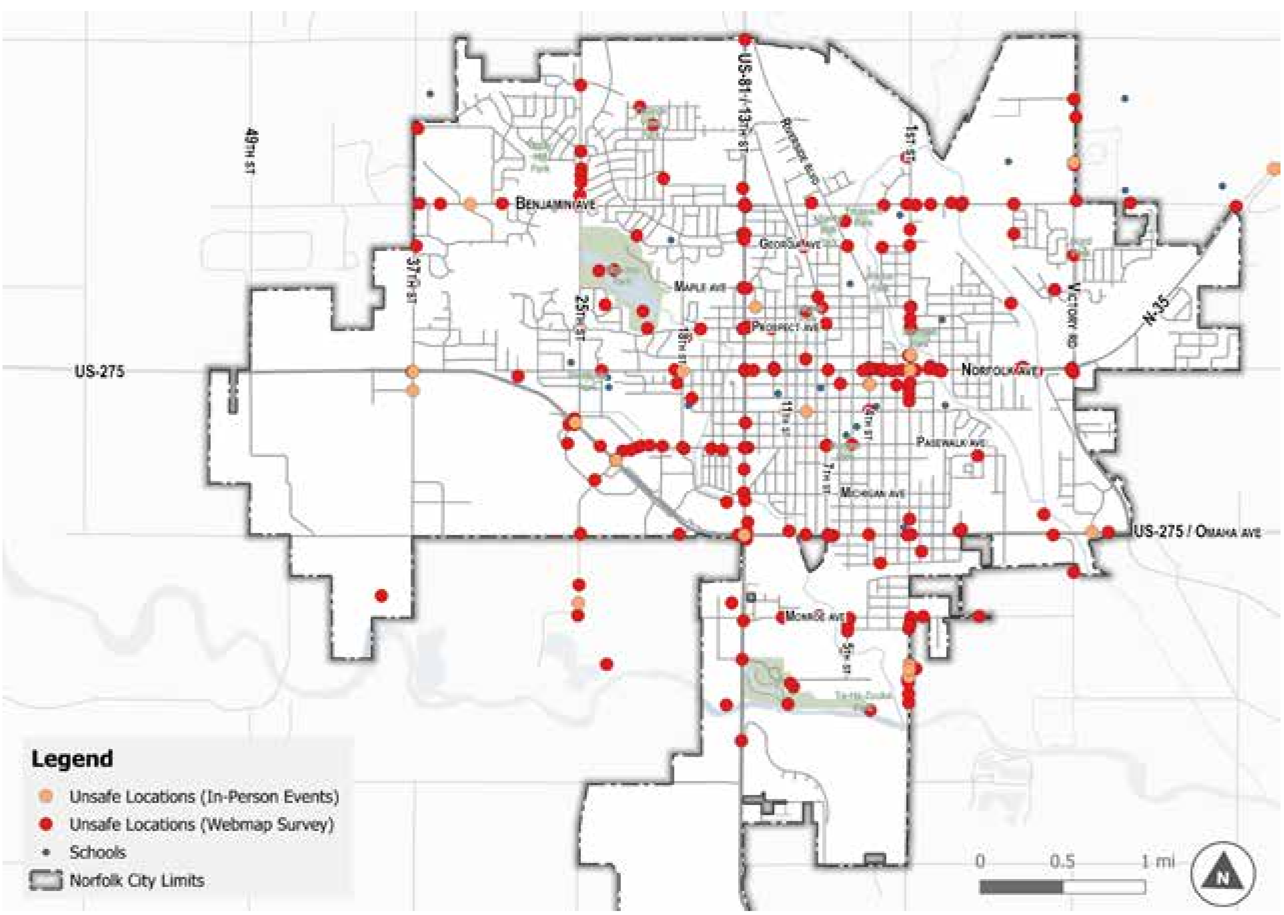
Location	Unsafe Attributes	Safe Attributes
Downtown (Norfolk Ave: 4th St to Cottonwood St and 1st St: Braasch Ave to Phillip Ave)	• Drivers are distracted and do not yield to pedestrians. • Visibility of pedestrians is challenging and there are vehicle/pedestrian conflicts at signalized intersections. • Four-way stop signs. • Inadequate maintenance of vegetation impact safety and traffic. • 17 out of the 25 survey points in this area reported a crash or near miss.	• Grade separated trail crossing of a road. • Library greenspace and playground are welcoming, accessible, and safe. • Vegetation and street trees make downtown welcoming and enhance community identity. • Rectangular Rapid Flashing Beacons (RRFB) are effective. • Community members look forward to trail expansion projects.
East Norfolk Ave	• High speeds and distracted driving are common. • Road signage is confusing to users. • Access to flood control pathway and connection to Cowboy Trail need improvement. • Lack of lighting and personal safety/ harassment issues prevent usage. • Gateway into town is not welcoming. • 6 of the 7 survey points on this route reported a crash or near miss.	• Residents appreciate the improvements to the trail under the bridge crossing. • Biking the trails has become safer.
Benjamin Ave	• Lack of sidewalks, safe crossings, accessible infrastructure as well as sidewalk gaps. • Student/staff pedestrian safety is a concern around the schools. • Drivers fail to see pedestrians/bicyclists and do not yield. • Participants reported personal safety issues.	• Trees and shade are continuous on west side. • Residents appreciate continuous sidewalks. • Pedestrian and bicycle access to Skyview Park paths and daily destinations are important for the community.

Location	Unsafe Attributes	Safe Attributes
25th Ave	• Driving at high speeds and not yielding. • Sidewalks on both sides are desired. • Sidewalks gaps, barriers for pedestrians and bicyclists, visible crosswalks, and lighting and visibility. • Prospect Park Ave intersection lacks pedestrian connections. • Traffic issues at Benjamin Ave.	• N/A
US-81/13th St	• Traffic congestion and driver behavior. • Lack of safe crossings, accessibility issues, and sidewalk gaps prevent walkability. • Lack of connection to Skyview Park trail. • Commercial property driveway consolidation needed. • Many near misses and crashes reported. • Turning issues at Pasewalk and Highway 81.	• Residents favor the Cowboy trail and regional connection and would like to see the trail expanded and promoted more as an asset to the community.
NW Norfolk (North of Norfolk Ave and West of 13th St)	• Residents desire more recreational spaces and facilities. • Lack of shade, vegetation, and sidewalks in neighborhoods. • Roadway maintenance issues. • Need for wider sidewalks and better lighting around Skyview Lake. • Drivers fail to yield at crosswalks. • Norfolk Ave and 17th St grade changes and pedestrian crossings.	• The Skyview Park trail is heavily used and enjoyed by residents.
NE Norfolk (North of Norfolk Ave and East of 13th St)	• Lack of sidewalks, safe crossings, accessibility, and trees/shade. • Pedestrians do not yield or pay attention. • Residents express personal safety issues. • Queen City Blvd needs improvements and pedestrian/bicycle connections to Georgia Ave. • US-81/13th St and Elm Ave was identified as a dangerous intersection.	• Residents appreciate the levee trail and would like to see the trail network expanded. • Residents enjoy being able to bike to work.
SW Norfolk (South of Norfolk Ave and West of 13th St)	• High speeds, driver behavior, and traffic congestion. • Lack of sidewalks, safe spaces to bicycle, safe crossings, and accessible infrastructure. • Lacks a sense of community identity. • Need better connections to existing parks and trails. • Safety issues for teens accessing plaza. • Highway 275 intersection at 37th St and 25th St are problematic.	• N/A
SE Norfolk (South of Norfolk Ave and East of 13th St)	• High speeds, driver behavior, confusing roadways signage, issues with roundabouts, and traffic congestion. • Wide crossings, sidewalk conditions, poor visibility, and lack of vegetation, shade, and benches for pedestrians. • Crossing safety issues for students. • Conflicts with pedestrians and bicyclists along trail. • Lack of connections to existing trails.	• Residents enjoy the parks and would like to see improvements to benches, restrooms, trash receptacles, and other amenities. • Residents appreciate well-marked crosswalks and RRFBs. • Participants expressed desire for enhancement to community identity.

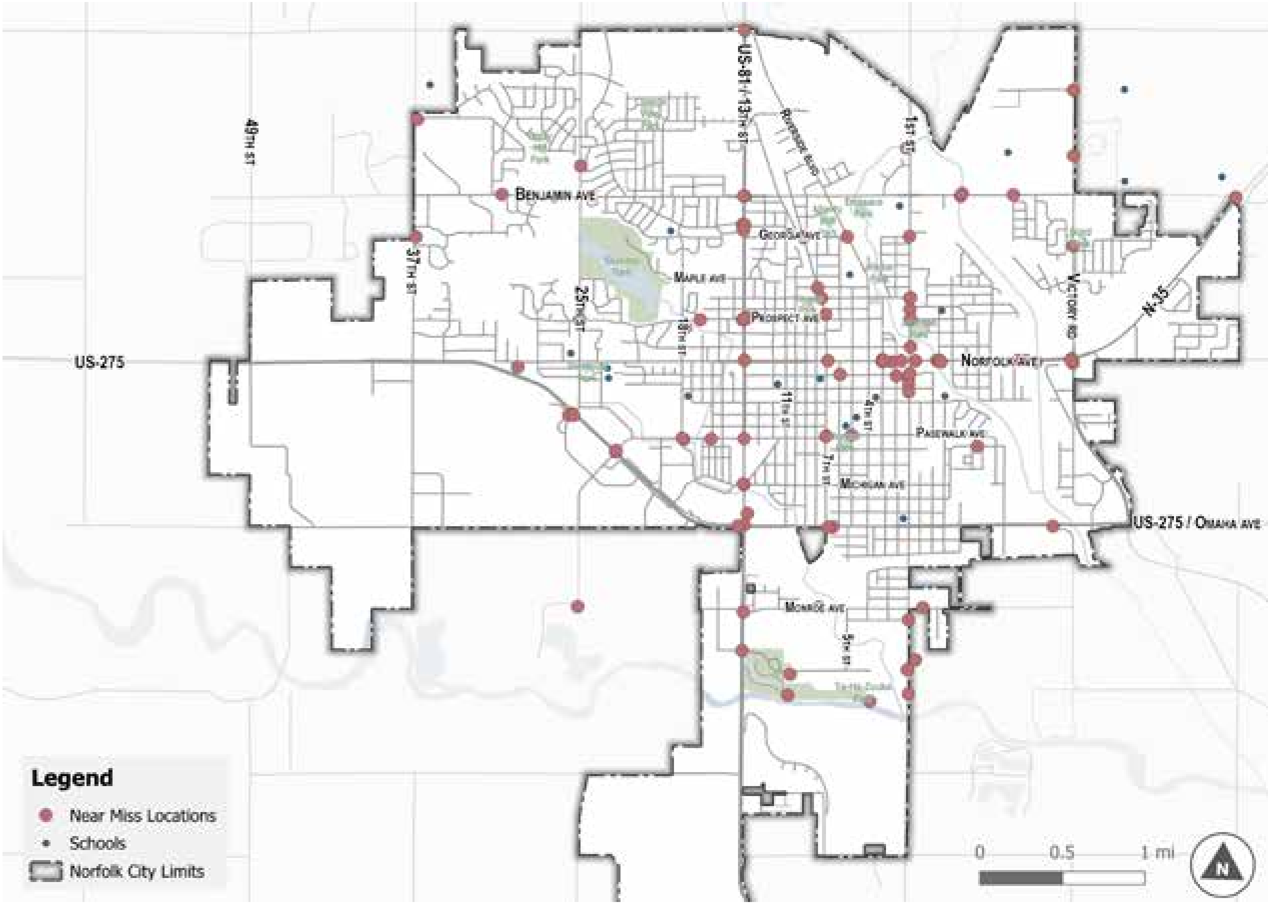
MAP 9 Safe Locations - Public Engagement



MAP 10 Unsafe Locations - Public Engagement



MAP 11 Crash and Near Miss Locations - Public Engagement



Stakeholder Interviews

Stakeholder interviews were used to supplement the broader community engagement by targeting specific organizations and community groups to provide input into the planning process. Talking with targeted stakeholders helps to create a well-rounded understanding of the diverse community experiences and needs related to transportation in Norfolk. The diverse perspectives provide insights from various groups that are often underrepresented in the transportation planning process, such as people of color, seniors, people with low-income, and people with disabilities.

Eight (8) stakeholder groups were invited to participate in the hour-long stakeholder interviews that focused on diving deeper into several topics from the public survey. Of the 68 people invited, 32 attended and/or provided input. Stakeholders were identified by city staff, Action Plan Committee (APC) members, City Council members, and others. Individuals from the following groups, organizations, and agencies were invited to participate:

Public Agencies: This group included public officials, city and county staff, as well as Department of Transportation employees. They offer insights on identifying current projects, enhancing construction methods, selecting projects, and providing cross-agency support.

South Norfolk, Non-English Speaking: This group included the lower-income areas of Norfolk, limited English speakers who are at risk and vulnerable, and other historically underrepresented communities. Community members that were invited did not respond to the invitations, so this stakeholder interview was not held.

Northeast Community College: This group focused on Northeast Community College. Representatives from Resident and Student Life, as well as student outreach, offered insights into how college students integrate into the city. Participants included the Director of Residence Life and Residence Life staff and the NECC College Engagement Coordinator.

Veterans, Seniors, Mental and Physical Disabilities: This group concentrated on seniors, residents with limited mobility, or individuals with disabilities. It also included representatives for those with low vision and hearing impairments. Participants included a resident with visual and auditory impairment, a member of the Norfolk Senior Center, and representatives from the Northeast Nebraska Area Agency on Aging, the Arc of Norfolk, and the League of Human Dignity.

Walking and Biking Focus and Advocates: This group focused on advocates for walking and biking infrastructure and residents who walk or bike to work as well as for recreation. Participants included a bike advocate, bike business owner, library staff, and a Nebraska Game and Parks representative.

Chamber, Business Owners, Visit Norfolk, and Developers/Builders: This group consisted of individuals focused on business and tourism. It also included local developers who had views regarding regulations or other codes. Participants included Norfolk Economic Development, Norfolk Vehicle Parking District, Norfolk Area Visitor's Bureau, Norfolk Sports Council, Norfolk Area Transit, Norfolk Homebuilders Association, Norfolk Chamber of Commerce representatives, as well as a local housing developer.

Community Organizations: This group included various Norfolk-specific entities, from after school activity centers to the Elkhorn Logan Valley Public Health Department. One participant, an Elkhorn Logan Valley Public Health representative, responded and attended.

Parents, Grade School Representatives, and Day Care: This group focused on children of grade school age, their parents, and grade school representatives. Participants that responded and attended include representatives from Norfolk Public Schools and The Well.

Key Findings: Stakeholder Interviews

From the conversations with stakeholders, the project team was able to gather insights about common transportation issues, areas of concern in Norfolk, and factors contributing to transportations safety issues/ locations.

Systemic Opportunities

The participants discussed the common factors that cause safety, accessibility, and connectivity issues in the multimodal transportation system across Norfolk.

Pedestrian Safety: Across all meetings, the safety of pedestrians, especially in school zones, residential areas, and high-traffic locations, was a primary concern.

Trail and Sidewalk Connectivity: Participants consistently emphasized the need for better-connected trails and sidewalks to facilitate safe, non-motorized travel across the city, particularly students, bicyclists, and residents of lower-income neighborhoods.

Traffic Speed and Behavior: Concerns about speeding, aggressive driving, and distracted driving were common, with suggestions for traffic calming measures and stricter enforcement.

Public Transportation Accessibility: There were many comments about the availability and reliability of public transportation, particularly for students and low-income residents, with a strong desire for the reinstatement of free bus services.

Infrastructure Maintenance and Design: Issues related to poorly maintained sidewalks, the need for wider sidewalks, and improved street designs to accommodate all users were frequently raised.

Education and Awareness: The importance of public education on traffic safety, proper use of roundabouts, and the need for mutual respect among all road users were frequently raised.

Locations and Areas of Opportunity

Stakeholders discussed specific areas where there are gaps and safety issues in the multimodal transportation network around Norfolk. Through the in-depth conversations of the stakeholder meetings, the participants had the opportunity to express what they feel is causing the issues at problem areas and offer suggestions to improve safety and accessibility at these locations. Table 6 summarizes the issues and needs for identified locations.

TABLE 6 Common Themes for Locations - Stakeholder Meetings

Location	Issue	Need
Norfolk Ave and Downtown	• Pedestrian safety. • Traffic flow. • Need for infrastructure improvements (e.g., better crossings and sidewalk maintenance).	• Infrastructure improvements: • Better crossings. • Sidewalk maintenance.
Riverside and Georgia	• Safer pedestrian crossing. • Access to safe active transportation facilities.	• Protected pedestrian crossings. • Better trail connectivity.
1st St	• Safety concerns. • Vehicular speeding.	• Roundabouts to improve traffic flow.
Elementary and Middle School Areas	• Parent and child safety.	• Crossing treatments (RRFBs and Pedestrian Hybrid Beacons (PHBs)). • Traffic calming measures.

Action Plan Committee

The Action Plan Committee (APC) is a group of stakeholders who are interested in making Norfolk's streets safer and more accessible for everybody. The committee convened for the first of four meetings on July 16, 2024. Members from the following agencies attended the first meeting:

- City of Norfolk (Public Works, Engineering, Planning, Fire, Parks, Library, Streets, Communications, Emergency Management, City Council)
- Parks and Recreation Board
- North Fork Area Transit
- Nebraska Department of Transportation
- Norfolk Public Schools
- Elkhorn Logan Valley Public Health Department
- Norfolk Area Homebuilders Association
- Norfolk Senior Citizens Center
- Community Member

Key Findings: Action Plan Committee

The conversation at the APC meeting was broad reaching and included discussions about why roadway safety is important, what safety challenges exist, what multimodal access challenges exist, and what can be done to address the challenges. Below are some common themes about why roadway safety and multimodal access is important to the Norfolk community.

We Value People: Members were concerned about safety of their children, families, and community members.

People Need Safe Access: Members want safe roads for all people (and children specifically) no matter which mode of travel they chose or rely on, especially since children often rely on walking and cycling. People need safe access to destinations around Norfolk.

Public Health: Many members have been the victim of traffic violence, have witnessed crashes, or been negatively impacted by crashes. Negative physical and mental effects from crashes impact the community. Having safe walking and biking facilities can help improve public health, which is very important.

Systemic Opportunities

Below are some key takeaways from the APC related to systemic changes to our roadways.

Proactive Approach: Members recognize the safety issues and support a proactive approach to mitigating and eliminating crash risks.

Improve Driver Behavior: Poor driver behaviors such as speeding, distracted driving, red-light running, and aggressive driving as well as a lack of education and unfamiliar infrastructure designs was often cited as a real challenge to roadway safety, especially as it negatively impacted safety, comfort, and access of people walking and biking. It is understood that drivers are going to make mistakes, but it will be challenging to eliminate or minimize the potential for serious injuries or fatalities resulting from those mistakes. APC members want more driver, cyclist, and pedestrian education.

Busy Street Crossings and Intersections: It is unsafe for kids (and others) to cross busy streets and these unsafe streets create major barriers to walking and cycling. Existing intersections are challenging for people walking and cycling, even at intersections with signalized crossings for pedestrians. Access for people with visual and/or hearing impairments is limited due to disjointed and inconsistent infrastructure. Right-turning vehicles at intersections create major pedestrian safety challenges. Also, uncontrolled intersections create challenges due to unclear right-of-way.

Wide Trails: Wide multiuse trails are desired due to the variety of users, space requirements, and travel speeds (e.g., people walking, dogs on leashes, bicycles, scooters and other similar devices, and ebikes).

Locations and Areas of Opportunity

Although many safety and access issues were discussed, the primary challenging locations identified were Prospect Ave, US-81/13th St, and Norfolk Ave. They also identified most arterial or busy road intersections were unsafe for people walking and cycling.

Lessons Learned: Engagement Summer 2024

This section summarizes the demographics of participants, analyzes the success of the outreach conducted, and provides recommendations to improve engagement through this process and in future planning processes performed by the City of Norfolk, particularly for multimodal transportation projects. This project intentionally incorporated a variety of engagement strategies to reach as wide of a cross section of the community as achievable. This includes traditional engagement strategies, such as open houses and surveys, but considers that these strategies are historically more accessible to limited demographics. To address this, strategies such as stakeholder interviews with targeted community members and pop-ups at various community events and locations were also part of this engagement process.

However, successful engagement is part of a larger process. It requires building and maintaining relationships with the community, consistent outreach to the public, and demonstrating that feedback from the community is valued and taken into consideration. This will establish how the engagement process for this project is one component in a larger effort to incorporate public and stakeholder engagement into the future of the multimodal transportation system in Norfolk.

Participant Analysis

The project team engaged with, and gathered feedback from, approximately 282 people via the survey, about 20 via the public open house, over 100 at the pop-up events, and 32 at the stakeholder meetings. Demographics were only collected from the online survey responses. The following is a summary of key participant demographics.

- Race: Survey respondents and attendees were primarily White, with some people of color participating, namely American Indian or Alaskan Native and Hispanic or Latino residents.
- Age: Most participants were 25-44 and 45-64 years old.
- Gender: The majority of participants identified as female, though many male, and a minor number of gender-nonconforming people participated.
- Homeownership: Participants overwhelmingly identified as homeowners, with some renters, people living with friends or family, and people experiencing homelessness.
- Disability: A number of community members who identify with physical limitations participated.
- Living with Children or Older Adults: About half of the participants are regularly responsible or living with school-aged children, and around a quarter living with adults over 65.
- Relationship to Norfolk: Most participants live and/or work in Norfolk, with a small number of participants that identified as a visitor.
- Local Preference Areas: 69% of survey participants indicated their home location. 27% of the participants indicated their home location is in the areas of higher local preference.

Walk Audit Summary

Two walk audits were held in the fall of 2024. The first was around the US-275 and 1st Street area including around Washington Grade School. The second was around the US-81 and Norfolk Avenue area including around Grant Elementary School.

The walk audit revealed a mix of well-maintained and poorly conditioned sidewalks and ADA ramps, with issues such as narrow, weedy, and uneven ramps without raised domes. A notable example is the misaligned crosswalk ramp and pedestrian refuge across 13th Street, posing challenges for low vision users. Wheelchair and stroller accommodations are hindered by uneven patches and unpaved areas, often requiring detours into the street. Crosswalks, while generally marked, need better lighting and alignment with ramps, and audible notifications at signalized crossings can be confusing for guide dogs. Common obstructions include vehicles on crosswalks, low tree branches, and overgrown shrubs, with specific instances like the hidden school sign at Grant Elementary. Participants highlighted the minimal likelihood of constructing sidewalks post-development and the variability in sidewalk conditions due to individual property owners' responsibility for upkeep.

Safety and comfort concerns were prominent, with intersections needing extended pedestrian crossing times and better visibility. Sound notifications at larger intersections and signalization at mid-block crossings were suggested improvements. Participants expressed a strong dislike for sidewalks attached to curbs along high-traffic streets, noting the positive impact of flowers on perceived safety. The presence of crossing guards, particularly around Washington Elementary, received overwhelming support for improving comfort and safety of children.

Convenience issues included the burden of walking several to reach viable crosswalks on larger roadways and insufficient crossing times for elderly or young children. Engagement along the walks was noted to be lacking, with areas having rundown buildings and poor landscaping. Simple improvements to houses and porches were highlighted as beneficial, and Northwestern was identified as having potential to become a neighborhood center of activity. Overall, the audit emphasized the need for better maintenance, safety measures, and pedestrian-friendly design to enhance the walking experience.

Question Category Response Summaries

Accessibility

Sidewalks and ADA ramps: The conditions are mixed, with some areas well-maintained and others in poor condition. Issues include narrow, weedy, and uneven ramps, and ramps without raised domes. For example, there is a provided crosswalk and pedestrian refuge across 13th Street, however the crosswalk ramp is not aligned with the refuge and might be difficult to use or find for low vision users. The audit participants also discussed the difficulties of constructing sidewalks after the initial development, and how the likelihood of someone building a sidewalk in front of their house later down the line is very minimal.

Wheelchair or stroller accommodation: Many responses highlighted difficulties due to uneven patches and unpaved areas. Some areas require going out into the street to readjust. It was noted that the variability of sidewalk conditions likely results from individual property owners being solely responsible for the upkeep.

Crosswalks and pedestrian ramps: Many crosswalks are marked, but some need additional lighting and better alignment with ramps. The audible notification at each of the corners signalized crossings can be hard to hear with road traffic. It was noted that if the audio queues are able to be heard from the opposite corner, it can confuse guide dogs, particularly when the walk timers are not synced up. It was noted that crosswalks should direct the walker straight across the street, and that “Radial” ramps are less desirable.

Visual and physical obstructions: Common sidewalk obstructions include vehicles stopping on crosswalks, low tree branches, and overgrown shrubs. In one location, the school sign at Grant Elementary was totally hidden from drivers view by a tree. In some instances, the bushes were too close to the sidewalk, limiting sidewalk use to single file.

Safety and Comfort

Traffic control devices: Some intersections need extended time for pedestrians, and there are issues with visibility and parked cars blocking pedestrian views. There should be sound notification at each of the corners of larger intersections such as 13th and Norfolk Avenue. Mid-Block crossings, such as 13th and Phillip, would benefit from signalization, particularly in higher pedestrian volume areas. It was discussed that Rectangular Rapid Flashing Beacons (RRFB) are likely not appropriate on roadways with more than 3 lanes of traffic, due to the visibility for all lanes of traffic.

Sidewalk width: Some areas along the routes had wide sidewalks, such as along Northwestern and others were too narrow, especially near schools. It was noted that some of the sidewalk was in good condition, but many places were uneven, easy to trip or fall, and some were cracked and broken, making it unsafe for the walker.

Protection from moving traffic: Most participants expressed their dislike for sidewalks that are attached to the curb, particularly along faster or higher volume streets. There was significant discussion about the impact that simple flowers had on perceived safety and distance from moving traffic. It was also discussed the conflict between a pedestrian's perceived safety and "clear-zone" plant height restrictions for the benefit of cars.

Crossing guard: Crossing guards were on duty for the morning walk route around Washington Elementary, specifically there was a hired guard for 1st Street, while older school children were assisting at the smaller intersection. There was overwhelming support for these people in their ability to slow and stop traffic, be alert to issues, and drastically improve the comfort of children and parents.

Convenience

Signalized crosswalks: The distance between crosswalks for larger roadways was discussed by many participants, with the consensus that having to walk more than 1-2 blocks to get to a viable crosswalk seemed like a burden. It was also noted that some crosswalks might not give enough time for elderly or young children to cross, such as 1st and Omaha.

Engagement

Visual interest: Some areas, like the school zone, were stated to be visually interesting, but many areas along the walk had rundown buildings and lack landscaping. Simple improvements to houses and porches were noted by many participants, highlighting the benefits of maintenance and upkeep to the walking experience.

Pedestrian-friendly design: Buildings generally provide transparency to pedestrians, but many are in disrepair and lack adequate protection from the elements. There was a noted a lack of intentional engagement for pedestrians, with few businesses using sidewalks for sales or dining, however it was noted that Northwestern had a lot of potential to be a neighborhood center of activity.

Engagement Recommendations

While various engagement strategies have been conducted through this project, this is the beginning stage for engaging the public in future transportation safety efforts. Considering the assessment of the participant analysis, the project team has developed recommendations for the next phase of engagement, as well as considerations for future transportation planning efforts by the city.

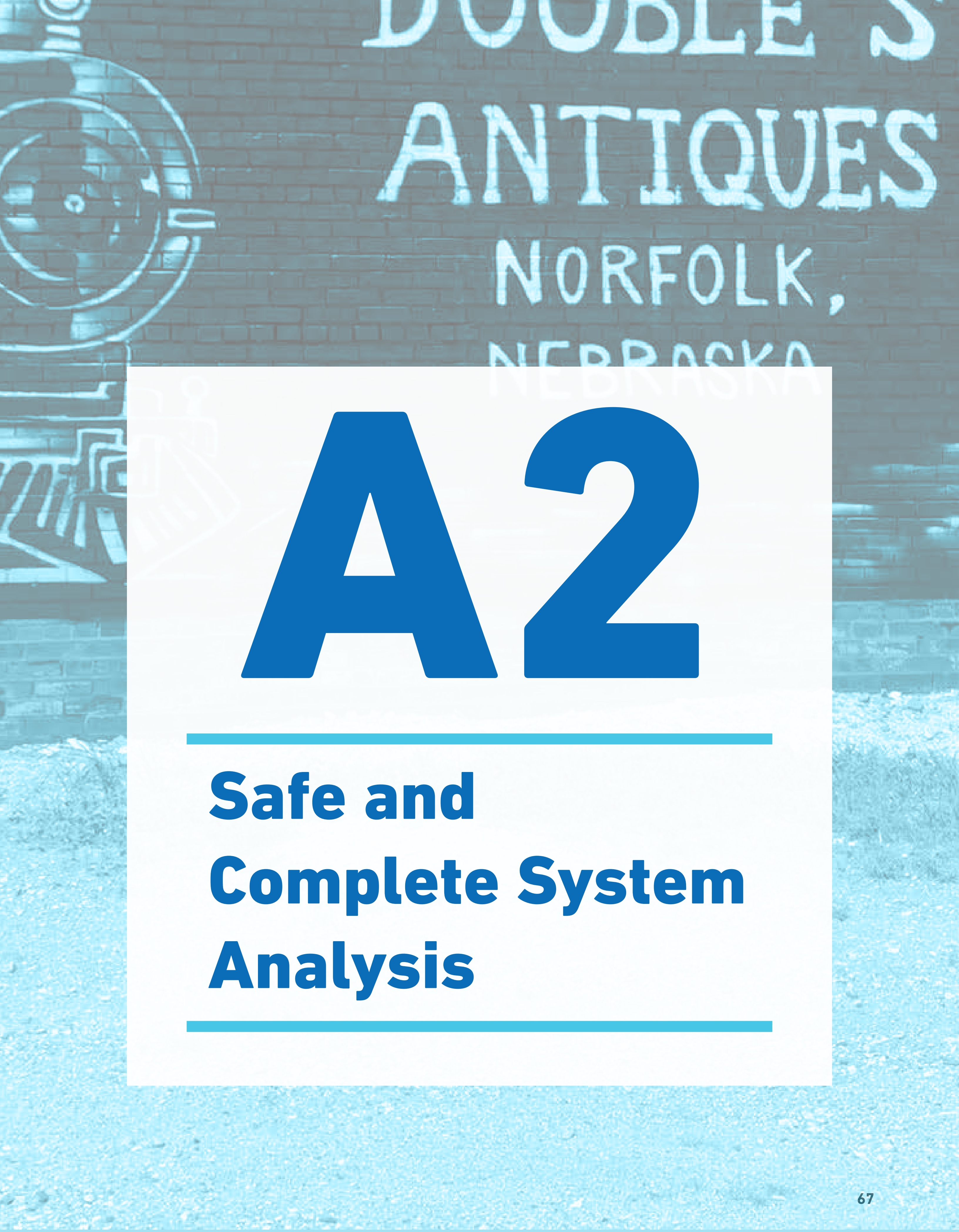
While the survey was able to reach a good cross section of the community, it is important to elevate the voices and perspectives of community members that are most vulnerable in the transportation system and/or are historically underrepresented in planning efforts. For this reason, intimate conversations that invite targeted groups to share their insight are vital. The stakeholder interviews accomplished this to a large degree by reaching specific community members and representatives for in-depth conversations.

Unfortunately, there were important community groups that the project team were not able to reach for this process, such as the non-English speaking and low-income communities. Building relationships and trust with community groups, regularly providing welcoming opportunities for participation, and being mindful of barriers that certain members of the public may have to participation will be a long-term effort that extends beyond the scope of this project. Table 7 outlines recommendations for successful engagement processes for transportation planning efforts. Upon review of the participant groups and demographic representation from the first phase of engagement, the project team will be focusing on reaching the following community members for the future phase:

- BIPOC residents
- Non-English speaking and Hispanic residents
- Youth and parents of school-age children
- College students
- South Norfolk residents

TABLE 7 Engagement Analysis and Recommendations

Recommendations	Justification	Description
Build trust in the community	•Residence expressed suspicion and hesitation about the engagement process and transportation projects. •Participation was low for engagement strategies conducted.	•Conduct regular engagement and normalize engagement efforts with the community for consistency in outreach. •Improve communication and transparency in planning efforts to the public. •Consider an ambassadors program to employ select community members to help build relationships and conduct outreach to the community through a trusted liaison.
Collaborate with community organizations and transportation partners	•Community organizations have relationships with community members and can help support/spread the word about planning efforts. •Collaborating with other agencies and organizations will allow a flow of ideas and help to share the load of outreach.	•Regularly communicate with organizations and share ongoing/upcoming opportunities for engagement to share with members of the community. •Share engagement data and feedback received with other agencies.
Develop an engagement process	•A streamlined process will simplify efforts, reduce workload, and allow improvements to be made. •Formalizing an engagement process will build trust with the community through reliability and consistency.	•Create a formalized process for public and stakeholder engagement that outlines focus areas, audiences, and strategies. Include a process to analyze and improve engagement efforts. •Create a comment section or submission form on the MTAP website for residents to regularly provide their input. •Conduct training for staff to engage with public and stakeholders. •Create a process for implementing feedback into the planning process.
Target engagement in Local Preference Areas and historically marginalized communities	•Targeted outreach was most successful for engaging diverse residents. •Residents from marginalized communities are still underrepresented through this process.	•Prioritize non-traditional engagement strategies that meet people where they are at in the community and provide a more comfortable environment for them to provide feedback, such as pop-ups and stakeholder meetings.



A2

Safe and Complete System Analysis

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Introduction

The Norfolk Multimodal Transportation Action Plan (MTAP) combines elements of a Comprehensive Safety Action Plan and a Complete Streets Plan. In combining these efforts, the city of Norfolk is able to holistically analyze safety issues experienced by all modes of travelers and plan for the successful development of a complete streets network that not only feels safe, but is safe for all users.

The Safety and Complete Streets Analysis Report is arranged into three parts:

Safety Analysis includes the methods and results of three analyses used to evaluate state of roadway safety in Norfolk. The first is the Descriptive Safety Analysis that describes the characteristics and contributing factors of crashes. The second is the High Injury Network Analysis that identifies the corridors with the highest density of crashes by mode. The third is the Systemic Safety Analysis that identifies locations with the greatest crash risk based on roadway, demographic, and land use characteristics.

Complete Streets Analysis includes the methods and results of two analyses used to evaluate active transportation need and opportunity.

Local Preference Analysis defines areas of local preference. This part overlays the results of the Safety Analysis and the Complete Streets analysis onto the areas of local preference to show potential disparities in safety and multimodal access.

Safety Analysis

The safety analysis summarizes the evaluation of the state of roadway safety in Norfolk, Nebraska. It outlines the methods and results of each analysis including the Descriptive Safety Analysis (DSA), the High Injury Network (HIN), the Systemic Safety Analysis, and finally the Local Preference Analysis as it related to travel safety. Each analysis and its findings are presented in a separate section of this Report.

The safety analysis uses crash data obtained from the Nebraska Department of Transportation's (NDOT) Highway Safety Data Systems Office for 2016 through 2020, the most current five years of available data. There is a heavy focus on **fatal and serious injury (FSI)** crashes, which is based on the city's goal of eliminating crashes resulting in fatalities and serious injuries. This section articulates high-level FSI crash trends by user and identifies areas of concern and opportunity to reduce FSI crashes through proven, innovative, and comprehensive strategies.

The safety analysis includes four sections:

Descriptive Safety Analysis describes the characteristics and contributing factors of crashes that occurred in Norfolk.

High Injury Network Analysis identifies the location of crashes and the corridors with the highest density of crashes by mode (pedestrian, bicyclist, and motor vehicle)

Systemic Safety Analysis identifies locations with the greatest crash risk—and therefore greatest potential for safety improvement—based on roadway, demographic, and land use characteristics.

Local Preference Analysis evaluates potential disparities in crash history and crash risk for transportation disadvantaged populations.

FSI = Fatal and Serious Injury

FAI = Fatal and All Injury

Descriptive Safety Analysis

This section articulates key data and trends and summarizes the characteristics and contributing factors of crashes in Norfolk.

Methodology

The descriptive safety analysis methodology consisted of data collection, consolidation, processing, and contextualization based on available crash and roadway attribute data. A series of high-level descriptive summaries capture relationships between region-wide crash data, infrastructure data, and contextual variables. These statistics explore overall crash trends and patterns that can be used to guide the selection of variables warranting deeper analysis, new roadway behavior programs, policy changes, or the selection of safety countermeasures for project development.

Crash Data Overview

Police officers complete the State of Nebraska Investigator's Motor Vehicle Accident Report when investigating a roadway crash.[1] The Report Form prompts responding officers to document information about the involved parties, location, crash factors, and vehicle types involved in the crash using the evidence and testimony available.

Data Sources

Table 8 lists the primary data sources used in the descriptive safety analysis. These data sets were used and interpreted as-is.

Temporal Consistency Limitations

Crashes that occurred during a period of five years, from 2016 through 2020, were studied. The compiled roadway data reflects current conditions according to the data made available at the time of this analysis. It can be assumed that some changes in roadway design and operations have occurred over the previous years that cannot be accounted for. For example, if a crash occurred in 2016 and the posted speed limit changed from 35 mph down to 30 mph in 2018, this analysis would link the 2016 crash with the present day 30 mph speed limit. As crash data is viewed at an aggregate level within this document, the impacts of these temporal inconsistencies are expected to be minor.

Exposure Data Limitations

The analyses reported here show crash density but do not adjust for exposure rates based on volumes by modes. This is because real-world pedestrian and bicycle traffic volume data is not available. The lack of exposure data must be kept in mind to avoid misinterpreting analysis results. For example, in many communities, pedestrian crashes are more common during daylight conditions than dark conditions. This does not mean that daylight conditions are more dangerous than dark conditions. Rather, it reflects the fact that people are more likely to travel, especially by walking, in light conditions than in dark conditions.

Transportation Data for Future Study

As the Safe System Approach is used throughout the project area, additional data can assist the city of Norfolk in understanding crash risk and take a more proactive approach to safety. Below are some recommendations for additional data components that may be valuable for future study.

- Bicycle and pedestrian volume data would allow for a measure of crash exposure for bicyclists and pedestrians.
- Several datasets listed below would help identify or refine risk factors. At this time, this data is either not available in a geospatial format, or is available, but with limited coverage:
  - Vehicle operating speeds, marked crosswalks and crosswalk enhancements and crosswalk style, street and/or lane width, traffic signal phasing, transit frequency and boarding/alighting counts, location of fixed objects (raised medians, barriers, utility poles, etc.), sidewalks, etc.

1 https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/ne_par_rev1_2009_sub_12_22_09.pdf

TABLE 8 Descriptive Safety Analysis Data Sources

Dataset	Source	Attributes
Crash Data	NDOT	Attributes consistent with information documented in DR Form 40 State of Nebraska Investigator's Motor Vehicle Accident Report. Crash data was already geocoded.
Road Inventory	Norfolk	Speed Limit, Functional Class, Roadway Jurisdiction
Schools	Norfolk	Location of schools
Parks	Norfolk	Location of parks
Traffic Signals	Norfolk	Location of traffic signals

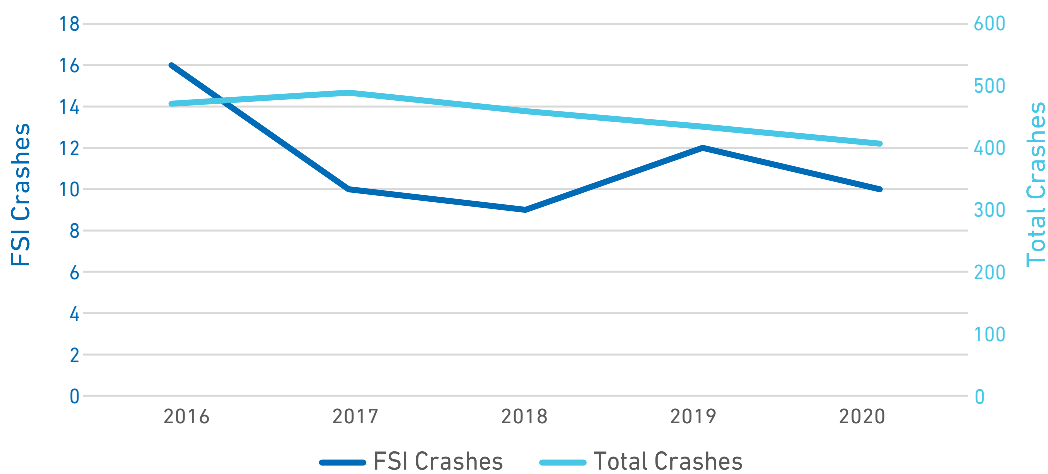
Results

General Crash Trends

FSI Crashes Per Year

Figure 8 shows crash data spanning from 2016 to 2020, detailing the total number of crashes and the associated FSI crashes for each year. During this period, the total number of crashes fluctuated, peaking at 489 in 2017 and reaching its lowest at 407 in 2020. Concurrently, the FSI crashes varied between 9 and 16 over the years, with the highest number recorded in 2016, and the lowest in 2018. The cumulative data reveals a total of 2,260 crashes throughout the five-year period analyzed, including 57 FSI crashes.

FIGURE 8 Total Crashes and Fatal and Serious Injury Crashes by Year



Crashes by Mode

Table 9 shows FSI crashes by mode, including fatalities, suspected serious injuries, visible injuries, possible injuries, and property damage. Bicyclists were involved in a total of 19 crashes, 4 of which resulted in suspected serious injury, and 15 in less severe injuries. Pedestrians were involved in a total of 30 crashes, of which 9 resulted in fatalities and suspected serious injuries. 2,211 crashes involved vehicles only, with 44 crashes resulting in fatalities and suspected serious injuries. These figures highlight the varying degrees of severity across different crash modes, highlighting that bicyclist- and pedestrian-involved crashes are more likely to result in severe or fatal injuries. In Norfolk, 30% of pedestrian-involved crashes were FSI crashes, 21% of bicyclist-involved crashes were FSI crashes, and 2% of vehicle-only crashes were FSI crashes.

TABLE 9 Crashes by Mode and Severity (2016-2020)

	Fatal	Suspected Serious Injury	Visible Injury	Possible Injury	Property Damage Only	Total
Bicyclist	0	4	9	6	0	19
Pedestrian	4	5	14	7	0	30
Motor Vehicle	6	38	175	408	1,584	2,211
Total	**10**	**47**	**198**	**421**	**1,584**	**2,260**

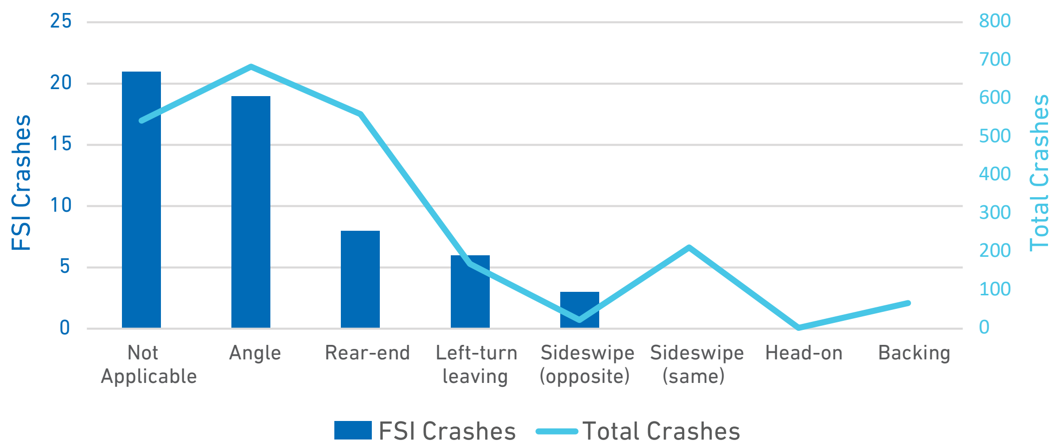
Crash Causation

Crash Types

Figure 9 summarizes FSI crashes by crash type in Norfolk. Angle crashes are collisions where vehicles strike each other at or near right angles, with the front of one vehicle hitting the side of another. Rear-end crashes are collisions that occur when a forward-moving vehicle strikes the back of another vehicle in front of it. In Norfolk, 684 total crashes, and 19 of the FSI crashes are due to angle collision, and 569 total crashes, and 8 FSI crashes are due to rear-end collisions.

Other crash types that produced FSI crashes include left-turn leaving (when a vehicle was making a left turn and was struck by a vehicle traveling in the opposite direction), sideswipe-opposite (where two vehicles traveling in opposite directions struck each other's side), and sideswipe (where two vehicles traveling in the same direction struck each other's side). Crashes where "Not Applicable" was marked on the police report usually only involved one vehicle or was between a vehicle and a pedestrian or bicyclist.

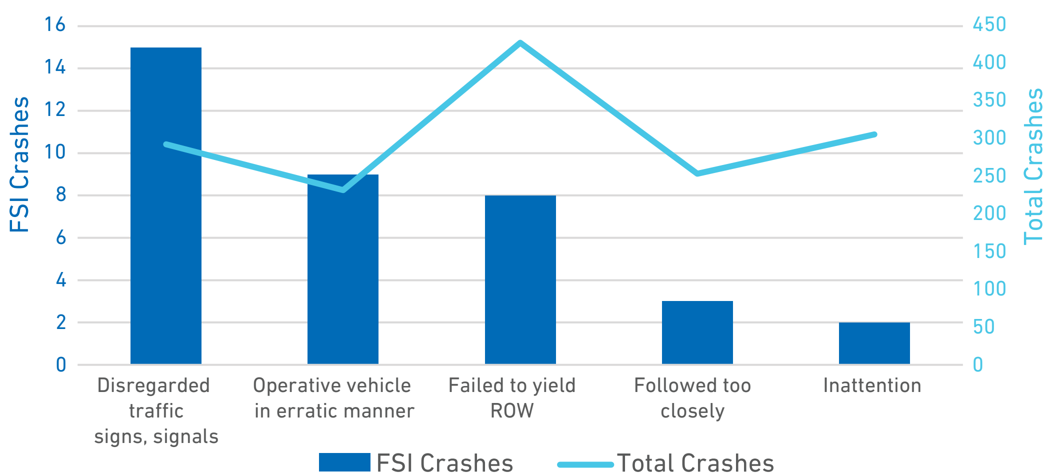
FIGURE 9 Crashes by Crash Type (2016-2020)



Top Driver Contributing Circumstances

Figure 10 summarizes the top driver contributing circumstances that led to FSI crashes in Norfolk. Drivers disregarding traffic signs and signals resulted in 15 FSI crashes, followed by erratic vehicle operation, including speeding, lane departure, judgment errors, and lack of vigilance, resulting in 9 FSI crashes.

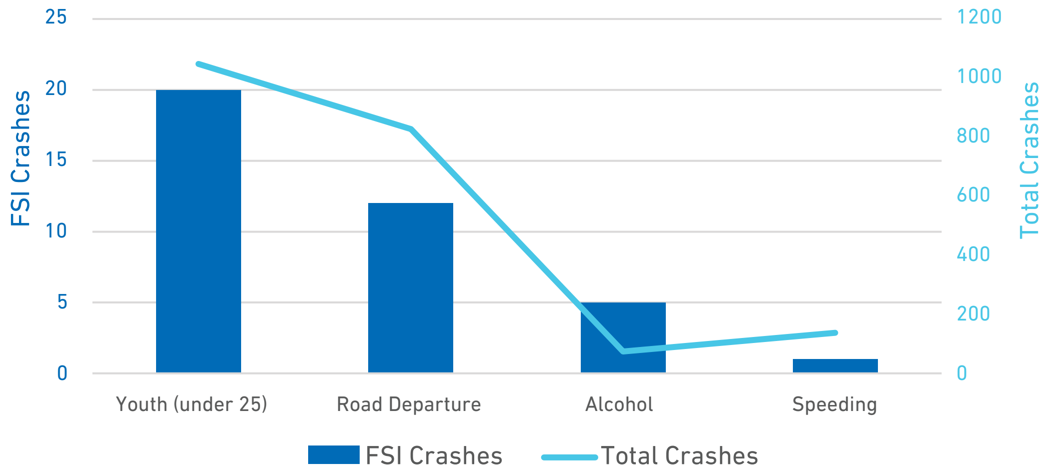
FIGURE 10 Crashes by Top Driver Contributing Circumstances (2016-2020)



Driver Behaviors

Figure 11 highlights the key driver behaviors that led to FSI crashes, including road-departure, youth (under 25 years), speeding, and alcohol impairment. In Norfolk, the most common crash behaviors in FSI crashes are youth (under 25 years) resulting in 20 FSI crashes, followed by road departure causing 12 FSI crashes.

FIGURE 11 Crashes by Driver Behaviors (2016-2020)

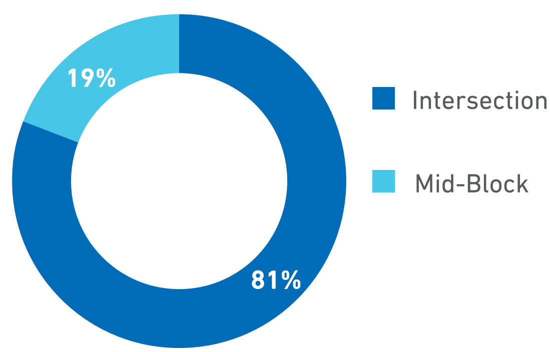


Roadway Characteristics

Crash Location (Intersection vs. Mid-Block)

Figure 12 summarizes the FSI crashes by location type in Norfolk. Crashes within 250 feet of a signalized intersection or within 150 feet of an unsignalized intersection are considered intersection crashes. Crashes within 100 feet of the roadway centerline network but not near intersections are considered mid-block crashes. Any remaining crashes would be considered off-network, as their spatial location are not near any intersection or roadways. In Norfolk, 46 (81%) of FSI crashes are intersection related, and 11 (19%) of crashes are at mid-block locations, while no FSI crashes were reported occurring off-network (on private property or in parking lots).

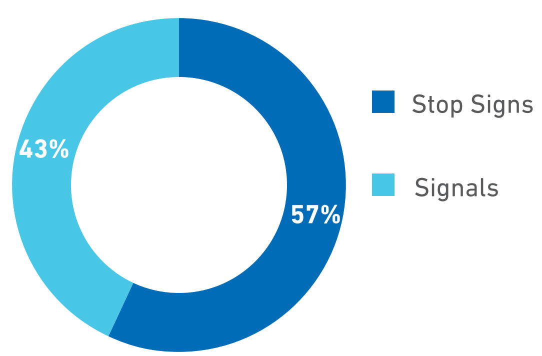
FIGURE 12 FSI Crashes by Crash Location (2016-2020)



Intersection Control for Intersection Crashes

Figure 13 summarizes the intersection control for intersection FSI crashes. In Norfolk, 26 (57%) FSI crashes occurred at intersections controlled by STOP signs and 20 (43%) FSI crashes occurred at intersections controlled by signals.

FIGURE 13 FSI Crashes by Intersection Control (2016-2020)



Functional Classification

Table 10 summarizes FSI crashes by roadway functional classification in Norfolk. State Highways and roadways connecting primary highways to local neighborhoods, with lower traffic volumes and speeds, are considered collector roads. Examples include US-81, US-275, and Norfolk Ave. Roadways serving neighborhoods, connecting residences and businesses, are considered local roads. Examples include Benjamin Ave, Braasch Ave, 1st St, and Elm Ave. Private roads, driveways, parking lots, etc. are considered off-network roads. Collector roads averaged 1.4 FSI crashes per mile and local roads averaged 0.2 FSI crashes per mile.

TABLE 10 **FSI Crashes by Roadway Functional Classification (2016-2020)**

Functional Classification	Total Crashes	FSI Crashes	Miles	FSI Crashes per Mile
Collector Roads	1,006	34	24	1.4
Local Roads	1,235	23	150	0.2
Off-Network	19	0	N/A	N/A
Total	**2,260**	**57**	**176.2**	**0.3**

Posted Speed Limit

Table 11 highlights FSI crashes categorized by posted speed limits. Notably, streets with a posted speed limit of 55-mph registered the highest number of FSI crashes, totaling 34 incidents, alongside a total crash count of 1,006. Streets with a posted speed limit of 45-mph recorded a total crash count of 14 and no FSI crashes, while those with a 30-mph speed limit reported 23 FSI crashes and 1,221 total crashes.

TABLE 11 **FSI Crashes by Posted Speed Limit (2016-2020)**

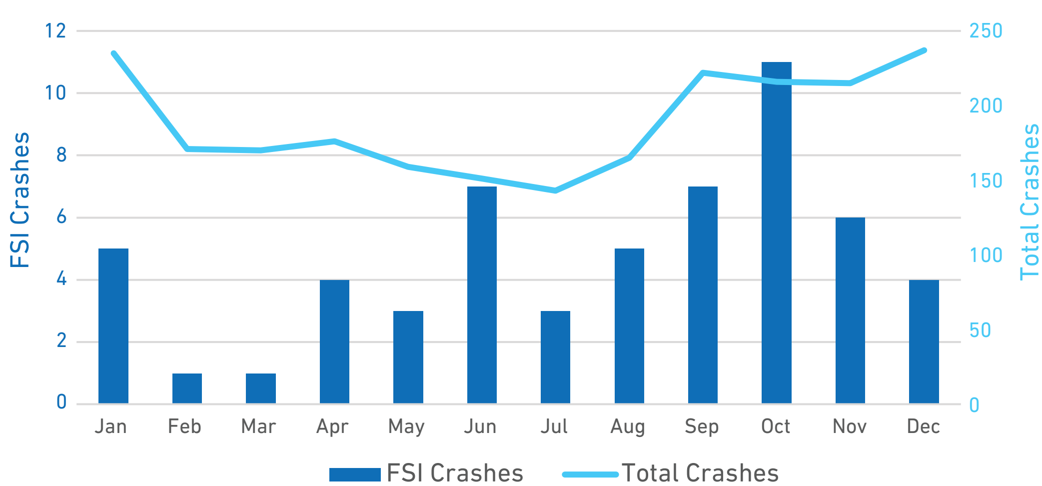
Functional Classification	Total Crashes	FSI Crashes	Miles	FSI Crashes per Mile
<=25 mph	0	0	0.5	0
30 mph	1,221	23	136	0.2
45 mph	14	0	13	0
55 mph	1,006	34	24	1.4
Off-Network	19	0	NA	N/A
Total	**2,260**	**57**	**176.2**	**0.3**

Environmental Characteristics

Crashes by Month of Year

Figure 14 summarizes crashes by month in Norfolk. October had the most FSI crashes at 11, followed by September and June, each recording 7 FSI crashes. While January exhibits a total crash count of 235, the number of FSI crashes remains relatively low at 5. Conversely, June, with a total of 151 crashes, sees a higher proportion of FSI crashes at 7. These patterns suggest seasonal trends, particularly a notable increase in crash severity during the fall months.

FIGURE 14 Crashes by Month (2016-2020)



Crashes by Day of Week and Time of Day

Table 12 summarizes total crashes by day of week and time of day in Norfolk. The darker cells indicate higher crash counts. Generally, more crashes are occurring on weekdays between 12 to 3 PM and 3 to 6 PM.

Table 13 summarizes FSI crashes by day of week and time of day in Norfolk. The darker cells indicate higher crash counts. Generally, more FSI crashes are occurring on weekdays between 3 to 6 PM. More FSI crashes occur later in the week (Thursday – Saturday) than early in the week.

TABLE 12 Crashes by Day of Week and Time of Day (2016-2020)

Day	12-3am	3-6am	6-9am	9-12pm	12-3pm	3-6pm	6-9pm	9-12am	Unknown	Total
Sun	14	5	5	24	43	36	31	12	23	**170**
Mon	5	1	47	43	76	**100**	30	10	22	**312**
Tues	7	6	52	53	83	**100**	30	10	21	**341**
Wed	4	6	78	58	**98**	**91**	26	16	21	**377**
Thurs	8	5	60	45	80	**96**	25	12	17	**331**
Fri	9	2	58	80	85	87	43	18	17	**382**
Sat	12	5	11	37	33	49	33	23	23	**203**
Total	**59**	**30**	**311**	**340**	**498**	**559**	**218**	**101**	**144**	**2,260**

TABLE 13 FSI Crashes by Day of Week and Time of Day (2016-2020)

Day	12-3am	3-6am	6-9am	9-12pm	12-3pm	3-6pm	6-9pm	9-12am	Unknown	Total
Sun	1	1	0	0	1	1	3	0	0	**7**
Mon	0	0	0	1	2	2	0	0	0	**5**
Tues	0	0	2	0	2	2	0	0	0	**6**
Wed	0	0	1	0	0	4	1	1	0	**7**
Thurs	0	0	1	0	2	**6**	0	1	0	**10**
Fri	0	0	1	4	2	2	2	2	0	**13**
Sat	0	0	0	0	3	1	3	2	0	**9**
Total	**1**	**1**	**5**	**5**	**12**	**18**	**9**	**6**	**0**	**57**

FSI Crashes by Lighting Condition

Figure 15 summarizes FSI crashes by lighting condition in Norfolk. The majority of FSI crashes (38 total, or 67% of FSI crashes) occurred in daylight conditions. The second highest share of 16 (28%) FSI crashes occurred in dark-lighted conditions, while the third highest share of 3 (5%) FSI crashes occurred in dark- not lighted conditions.

Figure 16 summarizes pedestrian- and bicyclist-involved FSI crashes by lighting conditions in Norfolk. The majority of FSI crashes (7, or 54%) occurred in dark-lighted conditions while 6 (46%) FSI crashes occurred in daylight. Pedestrians were involved in 5 FSI crashes in dark-lighted conditions, and 4 FSI crashes in daylight, while bicyclists were involved in 2 FSI crashes in dark-lighted conditions, and 2 FSI crashes in daylight.

FIGURE 15 FSI Crashes by Lighting Condition (2016-2020)

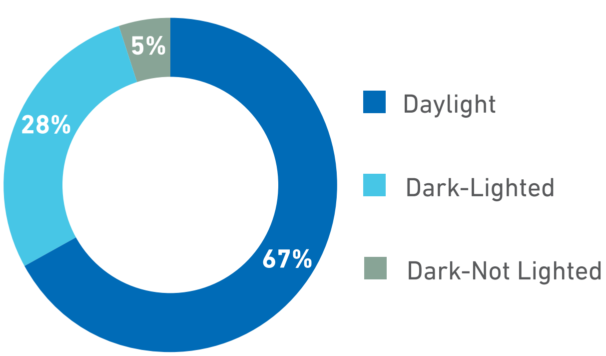
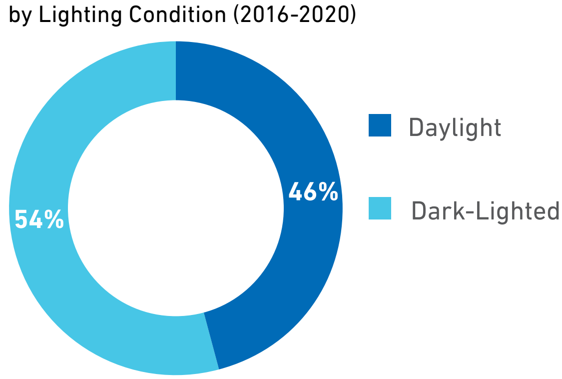


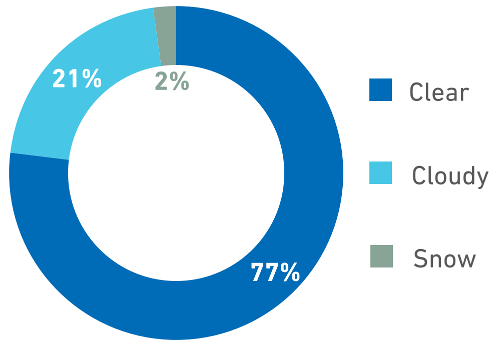
FIGURE 16 Pedestrian- and Bicyclist-Involved FSI Crashes by Lighting Condition (2016-2020)



FSI Crashes by Weather Condition

Figure 17 summarizes FSI crashes by weather conditions in Norfolk. The majority of FSI crashes occurred in clear weather conditions. However, it can be noted that this prevalence does not necessarily indicate clear weather conditions are more dangerous; rather, it reflects higher chances of clear weather. The second most common weather condition was cloudy, and the third most cited weather condition was snow.

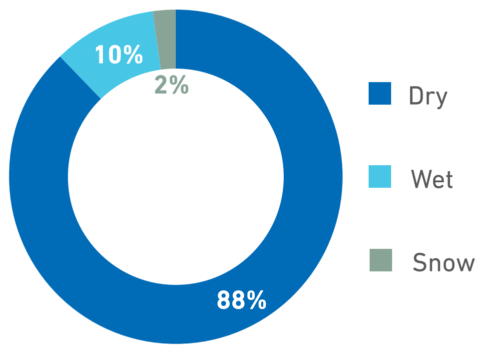
FIGURE 17 FSI Crashes by Weather Condition (2016-2020)



FSI Crashes by Road Surface Condition

Figure 18 summarizes FSI crashes by road surface condition in Norfolk. The highest number of FSI crashes occur on dry road surfaces, followed by wet road surfaces, and lastly on snowy road surfaces. This pattern likely reflects the prevalence of dry road conditions most of the time, rather than indicating that dry roads are inherently more dangerous than wet or snow-covered roads.

FIGURE 18 FSI Crashes by Road Surface Condition (2016-2020)



Land Use Context

FSI Crashes near Schools

Figure 19 summarizes FSI crashes by proximity to schools in Norfolk. There were 20 (35%) FSI crashes that occurred within ¼ mile of one or more schools, while 65% of FSI crashes occurred away from schools.

FIGURE 19 FSI Crashes near Schools (2016-2020)

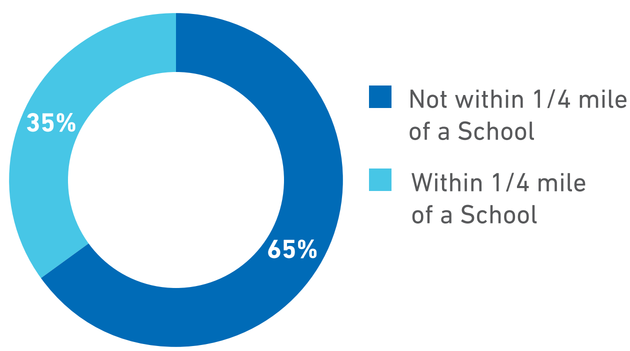
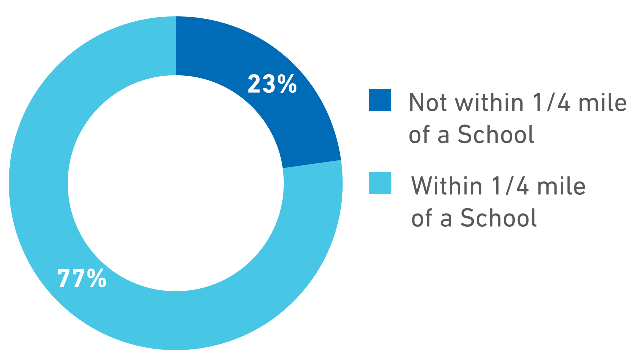


Figure 20 summarizes FSI crashes involving pedestrians and bicyclists by proximity to schools in Norfolk. 10 (77%) FSI crashes involving pedestrians and bicyclists occurred within ¼ mile of one or more schools, and 3 (23%) FSI crashes occurred beyond ¼ mile of schools. Within ¼ mile of schools in Norfolk, pedestrians were involved in 8 FSI crashes, and bicyclists were involved in 2 FSI crashes. Beyond ¼ mile of schools in Norfolk, pedestrians were involved in 1 FSI crash,

FIGURE 20 Pedestrian- and Bicyclist-Involved FSI Crashes near Schools (2016-2020)



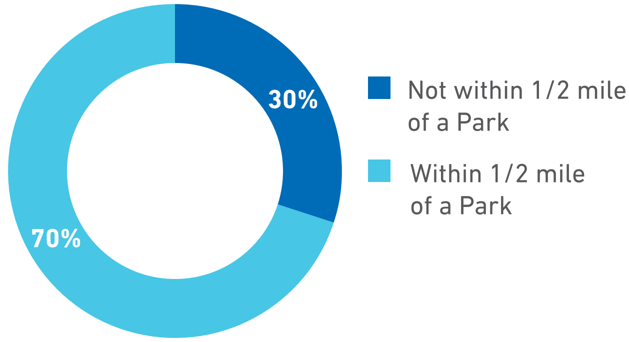
and bicyclists were involved in 2 FSI crashes.

FSI Crashes near Parks

Figure 21 summarizes FSI crashes by proximity to parks in Norfolk. There were 40 (70%) FSI crashes that occurred within ½ mile of one or more parks in Norfolk.

All 13 FSI crashes involving pedestrians and bicyclists occurred within ½ mile of parks. Within ½ mile of parks in Norfolk, pedestrians were involved in 9 FSI crashes, and bicyclists were involved in 4 FSI crashes. No crashes were reported beyond ½ mile from parks.

FIGURE 21 FSI Crashes near Parks (2016-2020)



Key Findings

- There was a total of 2,260 crashes over a five-year period, averaging out to 452 crashes per year.
- A total of 57 crashes resulted in death or life altering injuries to people in Norfolk, averaging out to 11.4 FSI crashes per year.
- 198 crashes resulted in people being injured and 421 crashes resulted in people being possibly injured.
- Crashes involving pedestrians and bicyclists are more likely to result in death or serious injury.
  - 30% of pedestrian-involved crashes resulted in a fatality or serious injury.
  - 21% of bicyclist-involved crashes resulted in a fatality or serious injury.
  - 2% of vehicle-only crashes resulted in a fatality or serious injury.
- The most common crash type for FSI crashes was angle crashes, comprising 37% of all FSI crashes.
- The most common driver contributing circumstance for FSI crashes was disregarding traffic signs or signals, comprising 26% of all FSI crashes.
- The most common crash behaviors for FSI crashes was youth drivers, comprising 35% of all FSI crashes.
- FSI crashes tend to occur on weekdays between noon and 6 PM.
- The majority (81%) of FSI crashes occurred at intersections.
- The majority (70%) of FSI crashes occurred within ½ mile of a park.
- All pedestrian-involved FSI crashes occurred within ½ mile of a park.

Additional data collection and evaluation can deepen our understanding of the roadway context. Desktop review or field check of the following attributes can be valuable for risk-based analysis:

- Traffic volume
- Demographic context
- Land use
- Key generators of pedestrian/cyclist traffic

High Injury Network Analysis

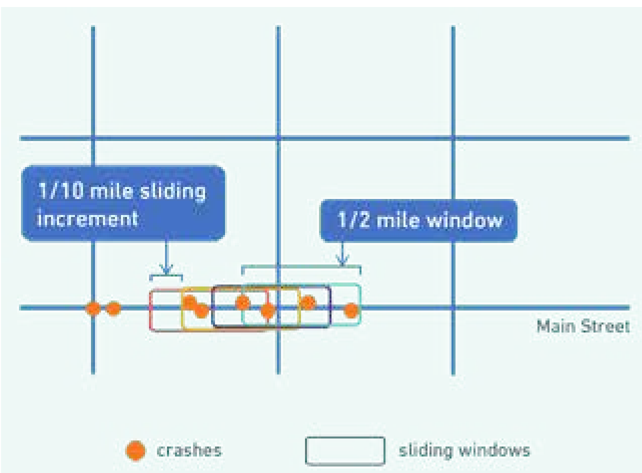
This section articulates the data sources, methodology, thresholds, and results of a sliding window analysis of crashes in Norfolk.

Methodology

Sliding Windows Analysis

A sliding window analysis helps in understanding historical crashes throughout a transportation network and identify segments with the highest crash density that are weighted by crash severity. For each neighborhood, the analysis was performed by determining the number and severity of crashes in a half-mile window on a roadway and shifting that window along the roadway 1/10 of a mile at a time. An example of a sliding window analysis is shown below in Figure 22.

FIGURE 22 Example of Sliding Window Analysis. Source: Toole Design



The sliding window scores weight fatal and severe injury (FSI) crashes three times more heavily than other injury crashes. The corridors were then classified into low, medium, and high crash density based on the weighted crash score. The crash score thresholds were determined so that at least 50% of the roadways are in low crash density. The high crash density category captures the segments with outstandingly high scores, while the remaining segments fall in the medium crash density category. The upper score thresholds for each crash density category and the percentages of street segments in each category are listed in Table 14.

Sliding Windows Analysis Results

The results from the Pedestrian Crash Density Map (Map 12) reveal that West Norfolk Avenue, South 13th Street, and North 1st Street had high pedestrian crash density. North and South 18th St, South 1st St, South 9th St, East and West Madison Avenue, West Park Avenue, South 9th Street, West Park Avenue, West Phillip Avenue, East and West Madison Avenue, West Pasewalk Avenue, including South 3rd, 4th, and 5th Streets showed medium pedestrian crash density.

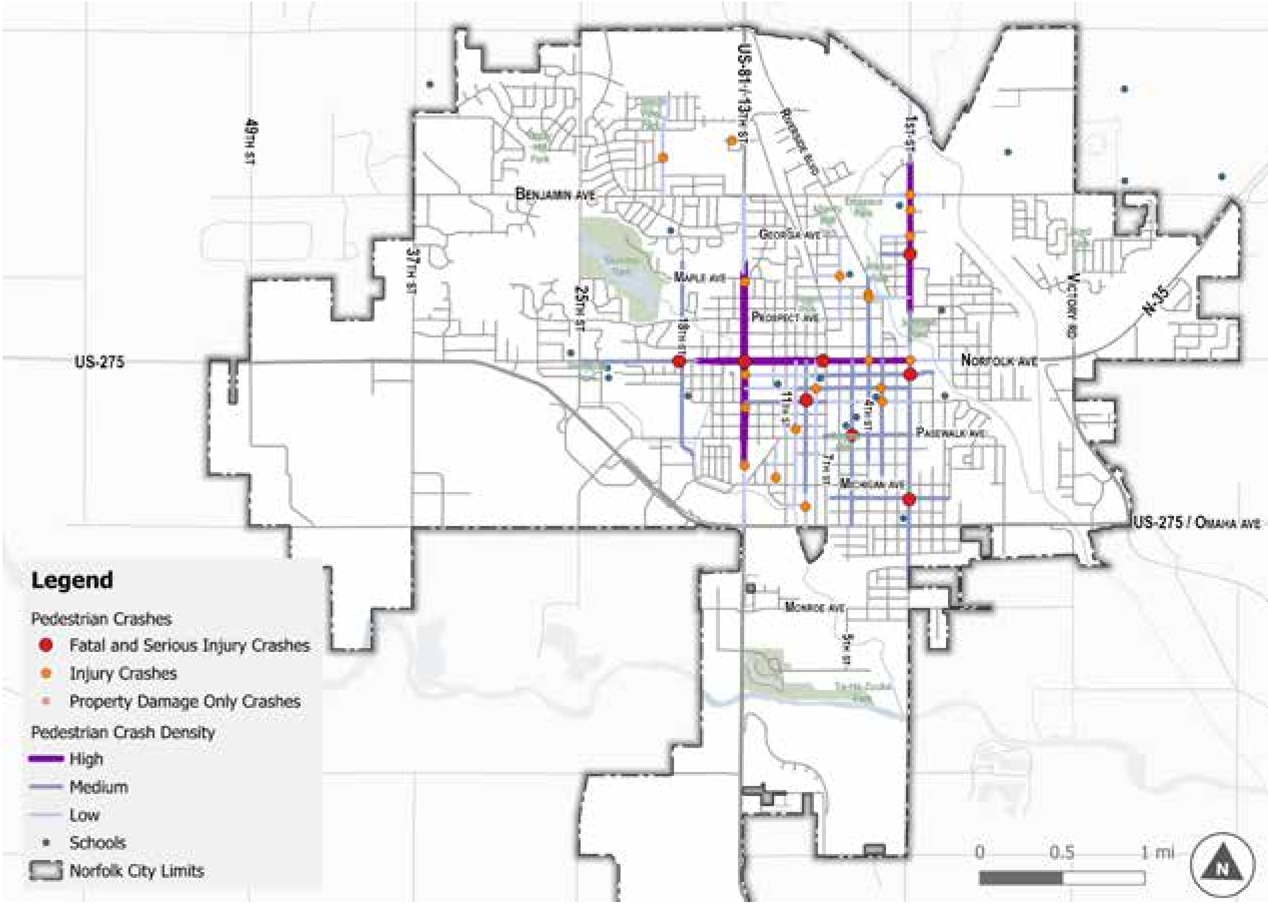
The results from the Bicycle Crash Density Map (Map 13) highlight West Norfolk Avenue and West Omaha Avenue as roadways that experienced high bike crash density. North 13th Street, Bel Air Road, North and South 4th Street, South 7th Street, South 2nd Street, and North and South 1st Street, experienced medium bike crash density. Highway 275 Bypass, South 20th Street, South 13th Street, East Norfolk Avenue, Indiana Avenue, South Logan Street, and West Michigan Avenue experienced relatively few bike crashes.

Lastly, the Vehicle-Only Crash Density Map (Map 14) reveals that the high-volume corridors in Norfolk, including West Benjamin Avenue, North and South 13th Street, West Prospect Avenue, East and West Norfolk Avenue, West Pasewalk Avenue, Highway 275 Bypass, East and West Omaha Avenue, North and South 1st Street, and West Madison Avenue, experienced high vehicle-only crash density. South 4th Street, South 7th Street, and Central Drive also had high crash density.

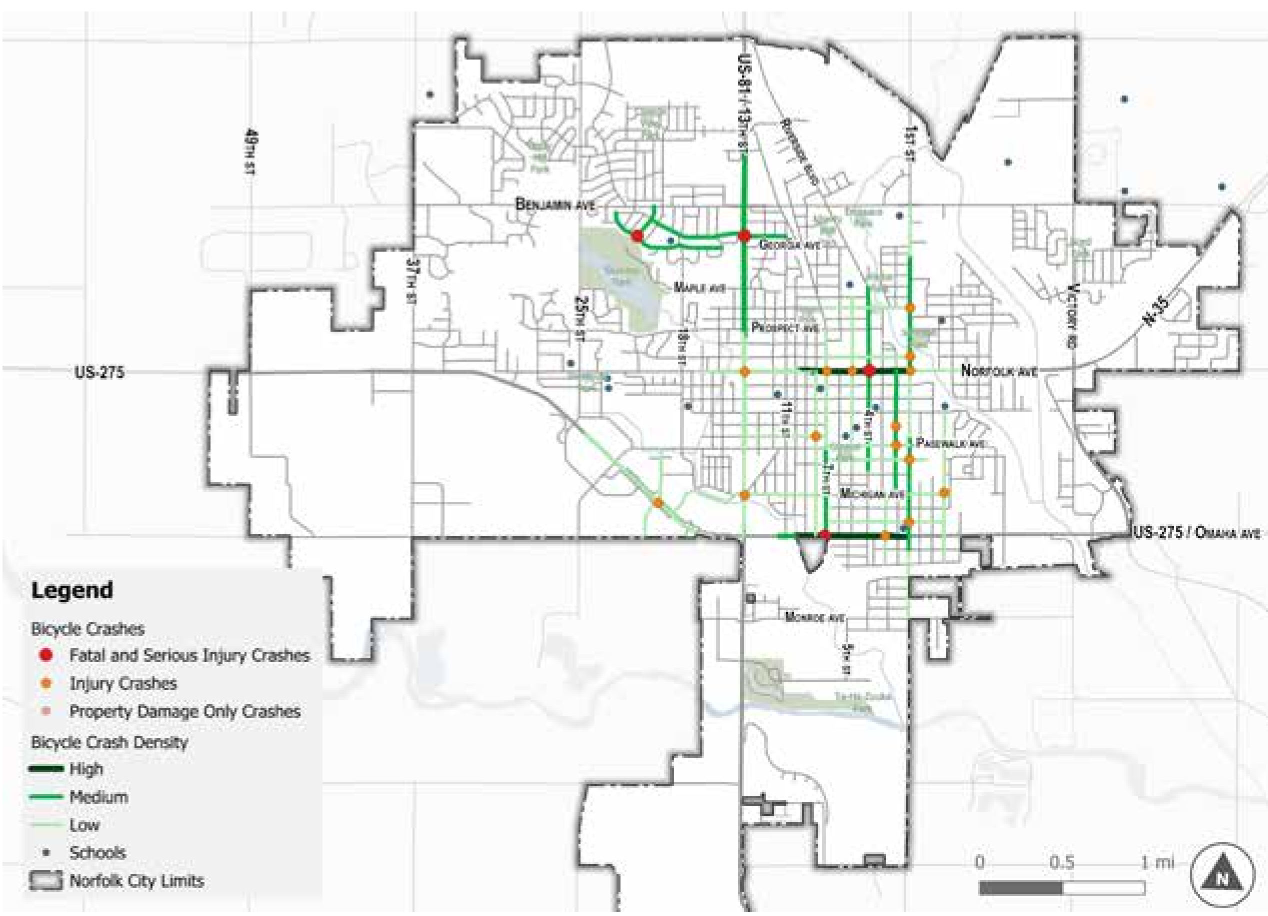
TABLE 14 **Weighted Crash Score Threshold and Percentage of Total (%) by Crash Density Categories**

	Low Crash Density	Medium Crash Density	High Crash Density
Bicycle	2 (99%)	4 (0.6%)	6 (0.4%)
Pedestrian	2 (96%)	4 (1%)	8 (3%)
Vehicle-Only	4 (63%)	16 (25%)	12%)

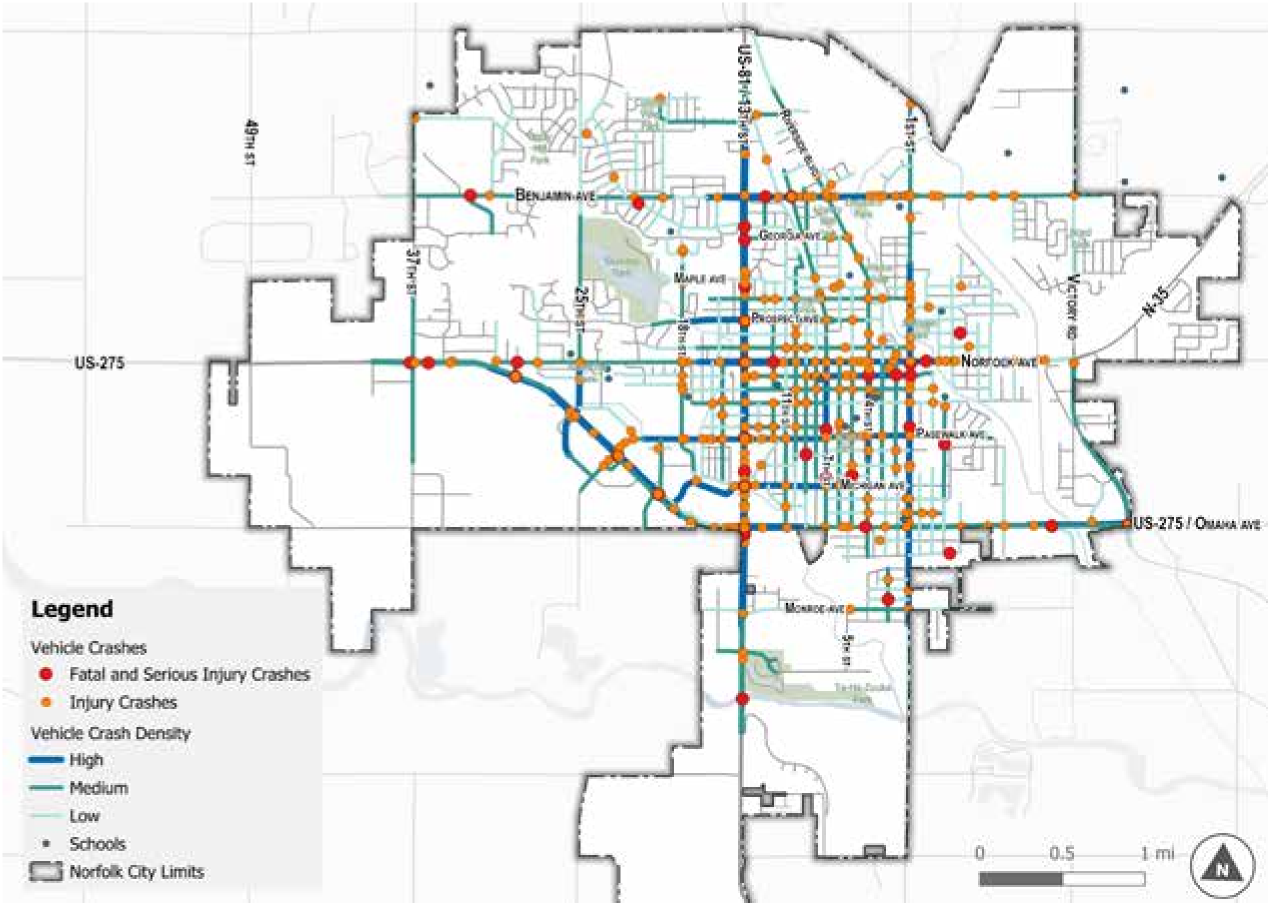
MAP 12 Norfolk Pedestrian Crash Density



MAP 13 Norfolk Bicycle Crash Density



MAP 14 Norfolk Vehicle-Only Crash Density



Results

The High Injury Network (HIN) was developed based on the results of the crash density maps from the sliding window analysis. Both intersection and segment crashes were included in this evaluation, as the focus is on overall corridor conditions. The HIN aims to help identify corridors that may warrant special attention. Identification of these streets helps the city prioritize investment in the areas where crash history demonstrates the most serious problems and easily communicate those priorities to the community.

Developing a HIN is an iterative process. It is expected that the city of Norfolk will review the HINs produced during this task and recommend additional streets to be considered for inclusion or specific streets to be removed from the current HIN. The HIN development process relies on historical crash data, which is imperfect and incomplete because not every crash is reported to the police. As such, this process requires engineering judgment as well as local knowledge. The following process was used to develop the mode-specific HINs and the overall HIN:

1. Map the sliding windows analysis results for each mode (pedestrian, bicycle, and motor vehicle) individually.
2. For each mode, determine the threshold of the sliding window score required to be included in the HIN. This step eliminates streets that have a lower crash density thereby prioritizing streets that have higher crash severities and frequencies.
3. Review and manually adjust for false-positive segments that have a high crash score due to a single intersection crash but do not have any other crashes along the corridor.

High Injury Network Thresholds

The goal of the minimum HIN threshold setting process is to settle on a minimum sliding window score for each mode independently that will create a network that covers a selective set of the city streets but a relatively large share of crashes with an emphasis on FSI crashes.

Thresholds for each mode included in the HIN are listed below. A segment that meets or exceeds the weighted crash score threshold noted below for each mode were included in each mode-specific HIN and the overall HIN. The weighted crash score thresholds for areas included in the HIN are 4 for pedestrian, 4 for bicycle, and 16 for motor vehicle.

In summary, the overall HIN accounts for 21 miles, or 12% of roadways in Norfolk, and includes the locations of 36 (63%) fatal and severe injury crashes in Norfolk.

High Injury Network Corridors

Norfolk's HIN map (Map 15) and HIN table (Table 15) highlights streets where the highest number and density of fatal and severe injury crashes are occurring. Manual adjustments based upon city input and results of public engagement may lead to refinements to the HIN.

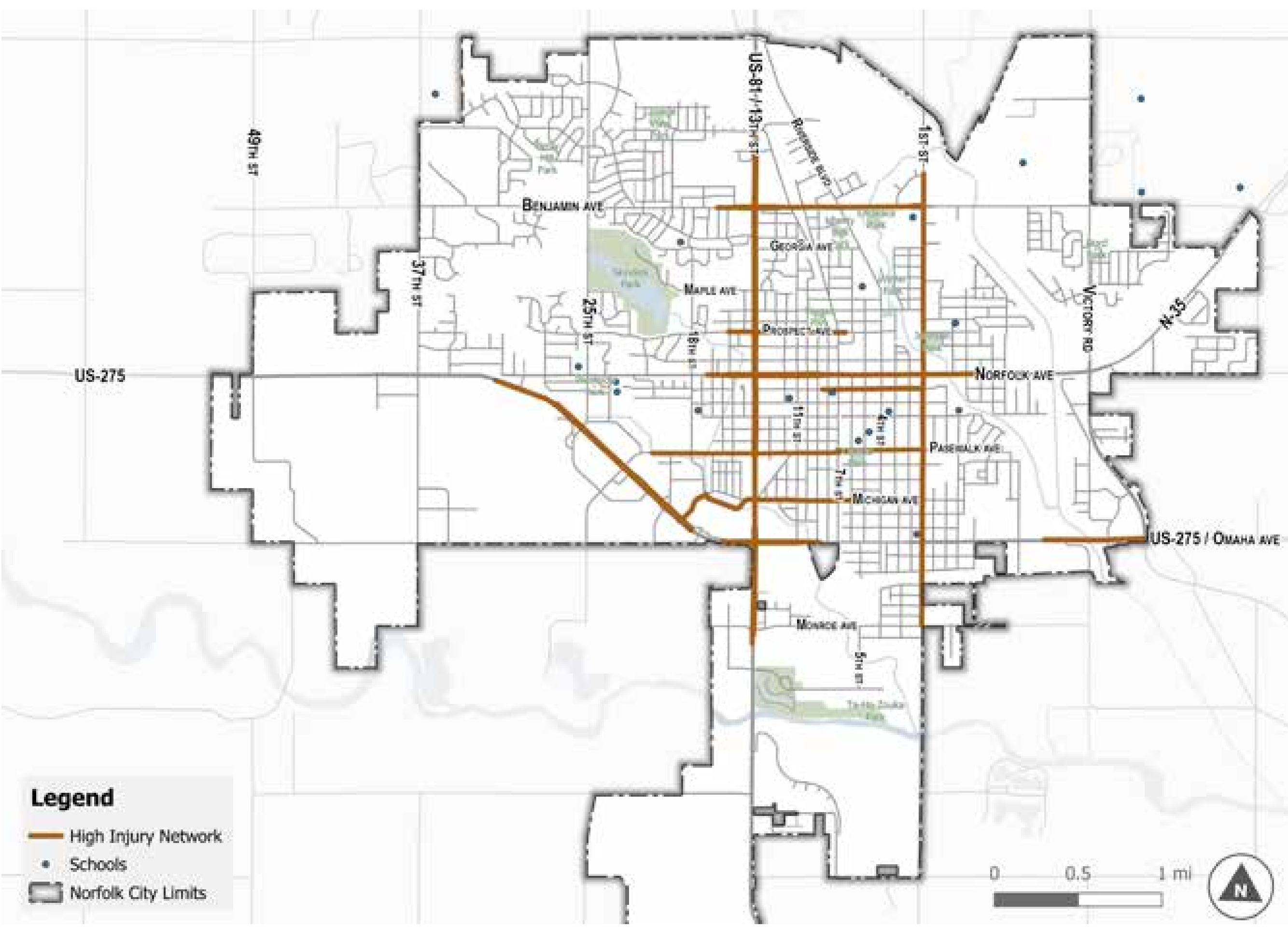
Key Findings

- Most of the HIN corridors are along major roadways in Norfolk.
- Most of the HIN corridors are east/west corridors.

TABLE 15 High Injury Network Corridors

Corridor	From	To
US-81 / 13th St	North City Limits	Monroe Ave
1st St	Andrews Dr	Monroe Ave
Benjamin Ave	Greenlawn Dr	1st St
Prospect Ave	14th St	5th St
Norfolk Ave	17th St	Chestnut St
Madison Ave	9th St	1st St
Pasewalk Ave	Taylor Ave	1st St
Michigan Ave / Center Dr	US-275 / Omaha Ave	5th St
US-275 / Omaha Ave	Business US-275 / (Faith Regional Medical)	Center Dr
US-275 / Omaha Ave	West of US-81	9th St
US-275 / Omaha Ave	Victory Rd	Business US-275 / SH-24

MAP 15 Norfolk Overall High Injury Network



Systemic Safety Analysis

This section documents the systemic analysis process and results. While the HIN summarizes hot spots of historical crashes, systemic analysis identifies roads with factors that can contribute to higher crash risks, regardless of crash history. This proactive approach can help identify the greatest potential for safety improvement in the city of Norfolk.

Methodology

Systemic Screening Factors

One of the key outcomes of the systemic safety analysis is the identification of roadway, demographic, and land use characteristics that correlate with high crash frequency. These are also known as systemic screening factors or risk factors. Combinations of these factors identify roadway facility profiles that are associated with higher crash frequencies. However, it is important to note that this does not necessarily indicate a causal relationship, nor that these individual factors should necessarily be the target of treatments. For example, though the presence of nearby pedestrian generators may be found as a factor that correlates with elevated pedestrian crash frequencies, this does not mean that these generators should be removed, but instead that facilities near such generators may require additional safety investment.

Screening factors and roadway facility profiles should be studied from a practical and policy-driven perspective to determine what components may be reasonable targets of safety improvements and which should be viewed primarily as non-causal correlations.

Table 16 includes all roadway segment characteristics that were prepared and identified as candidate risk factors for consideration in the analysis. Factors considered in the analysis were limited by data quality and availability.

Systemic Analysis Process

The systemic analysis focused on the study period of 2016 through 2020, using a selection of crash severities for different modes. For crashes of all modes, the analysis considered fatal and serious injury (FSI) crashes, including crashes that were fatal and/or led to a suspected serious injury. For crashes involving a pedestrian or bicyclist, the analysis considered fatal and all injury (FAI) crashes, including crashes that were fatal or led to a suspected serious injury, a suspected minor injury, or a possible injury. FSI crashes were weighted three times higher than other injury crashes. This expanded data set for pedestrian and bicyclist crashes was used due to the relatively low frequency of these crashes, providing a larger data set for the models to be based on. Roadway data was segmented into 1/2-mile segments, retaining all relevant roadway cross-sectional and context attributes. Additional census, land use, and network data attributes were applied to the segmented data as needed to include the screening factors.

The screening process is based on a decision tree machine learning algorithm where each factor is screened individually to determine whether the factor distinguishes between locations with relatively high and low average crash densities per mile. For categorical factors such as land use, the algorithm considers each unique classification individually. For numerical factors such as the poverty rate of the surrounding community, it considers all potential breakpoints by which the numerical values could be split. The algorithm screens all factors recursively to identify the most correlated factor and continues until a set of factors are identified as a facility profile. Figure 23 illustrates the decision tree algorithm where three correlated factors define a high-risk facility profile.

Data Limitations

Local law enforcement agencies submit the crash reports that provide the raw crash data. Although crash reports are currently the best way to obtain information about a large number of crashes, they have limitations. Crash severity may have limited accuracy because those completing reports typically don't have medical training, and victims of crashes may be unaware of internal injuries masked by adrenalin. The total number of crashes may be underreported due to fears, language barriers, financial concern, and more. Crash reports may not capture the effects of speed in crashes, as the first responders are typically on the scene after the crash has occurred and witnesses outside a crash are not typically interviewed about operator speed. Even when crash reports are perfect, they do not record near misses or the self-limiting behavior of travelers who don't feel safe in currently configured networks. It is useful to keep these limitations in mind when using crash data and to vet data with priority populations as part of the planning process.

Additional roadway attributes can provide better insights to the needs for infrastructure improvements to reduce crash risks. The roadway-related attributes that can improve this analysis but are not available include:

- Presence and type of medians
- Number of lanes
- Presence and/or types of shoulders
- Lane width
- Right-of-way width

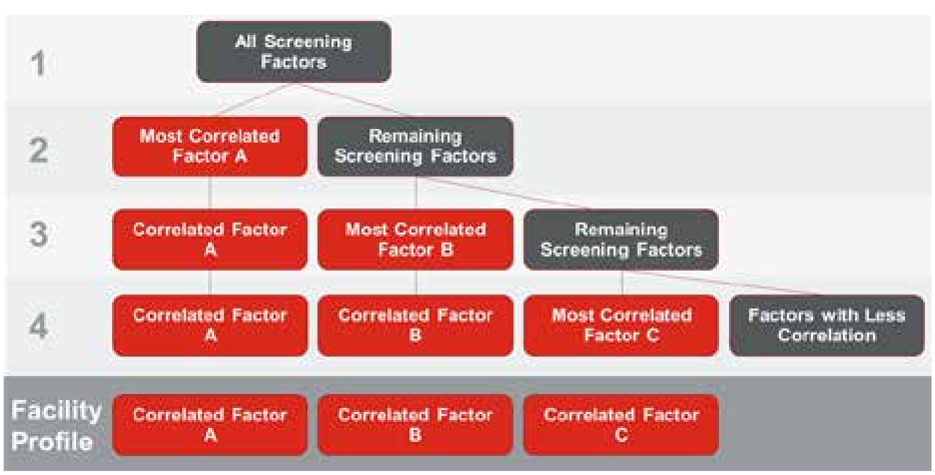
Roadway Facility Profiles

The following section reviews the High-Risk Network (HRN) that was built by developing profiles of the types of road facilities where crashes are more likely to occur. Roadway attributes and contexts like speed, traffic volume, the presence of poverty around the road and others (Table 9) were collected and used to categorize roads into groups of similar road segments. A Machine Learning Algorithm called a Decision Tree was then used to identify the roadway attributes that were most predictive of a high crash risk. The crash risk level is described as buckets, with "High" being the highest level of risk, followed by "Medium", "Low", and "Minimal". This analysis was completed for motor vehicle, vulnerable road users, and all crash modes and provides a more forward-looking assessment of crash risk rather than the simpler backward-looking assessment of crash history that is assessed with the HIN described in the previous section. These critical areas are not only where many crashes have already happened, but areas with characteristics that indicate that crashes may occur there in the future. This is particularly useful for bicyclist and pedestrian crashes which are statistically sparse and unlikely to happen in the same location during shorter periods of time. Thus, this systemic analysis uses risk prediction to equip the city with information that can be used to prevent future crashes.

TABLE 16 Factors Screened for Systemic Analysis

Screening Factor	Source	Description
Traffic Volume	Replica	Categorized as "Low/Unknown Volume": ≤1,000 or unknown; "Medium Volume": 1,000 – 5,000; and "High Volume": >5000
Speed Limit	City provided	Categorized as ≤20 MPH, 25-40 MPH, or 45+ MPH
Roadway Functional Classification	City provided	Categorized as "Collector Class": Secondary roads, or "Low Functional Class": Local roads
Liquor Store Nearby	City provided	Categorized as "Nearby": within 500 feet of a liquor store; or "Not Nearby": more than 500 feet from a liquor store
Household Poverty	Justice 40	Percent of households in adjacent census tracts with income below 200% poverty level
Youth Population	Justice 40	Percentage of population in adjacent census tracts 25 years old or younger
Zero Vehicle Households	Justice 40	Percent of households in adjacent census tracts with zero vehicles
Senior Population	Justice 40	Percentage of population in adjacent census tracts 65 years old or older
ATP Activity	City provided	Categorized as "High": within 500 feet of a park, hospital, library, or school; "Low": not near the aforementioned destinations
Land Use Category	City provided	Categorized as Agricultural, Residential, Commercial, Industrial, and other.

FIGURE 23 Illustration of Decision Tree Screening Process



Results – All Modes

All Modes FSI Summary

Table 17 ranks the roadway facility profiles based on their associated average all mode fatal and severe injury (FSI) crash frequency per mile during the study period and the combination of screening factors that indicate a high FSI crash frequency. The screening factors identified to be most effective at indicating elevated FSI crash frequency are:

- Functional Class
- % Young Residents
- Vehicle Volume (AADT)

Combinations of these factors can be separated into four distinct facility profiles with divergent safety performance for high-severity crashes. These profiles match with four different tiers based on their relative risk levels for fatal and serious injury crashes.

The facility profile identified to have the highest FSI crash risk is a secondary roadway (or collector as described in the descriptive safety analysis) in areas with over 25% young (age 25 or younger) residents. Medium risk is also associated with secondary roads but in areas with 25% or fewer young residents.

Facility Profile Metrics

The associated average high-severity crash frequency per mile, as well as the relative mileage of each facility, are summarized in Table 18. Over 56% of FSI crashes in the study area occur on High and Medium tier facilities, even though these facilities represent only 14% of the total roadway miles in Norfolk, as seen in Figure 24. The detailed breakdown in Table 18 shows that High tier roads, despite comprising just 7% of the total mileage, account for 40.4% of FSI crashes. Medium tier roads, also representing 7% of the mileage, account for 15.8% of FSI crashes. Low and Minimal tier facilities, while covering 86% of the total mileage, account for 43.8% of FSI crashes.

High-Risk Network Mapping – All Modes

Map 16 displays the High-Risk Network for all modes in two buckets – High and Medium.

TABLE 17 All Modes FSI Roadway Facility Profiles

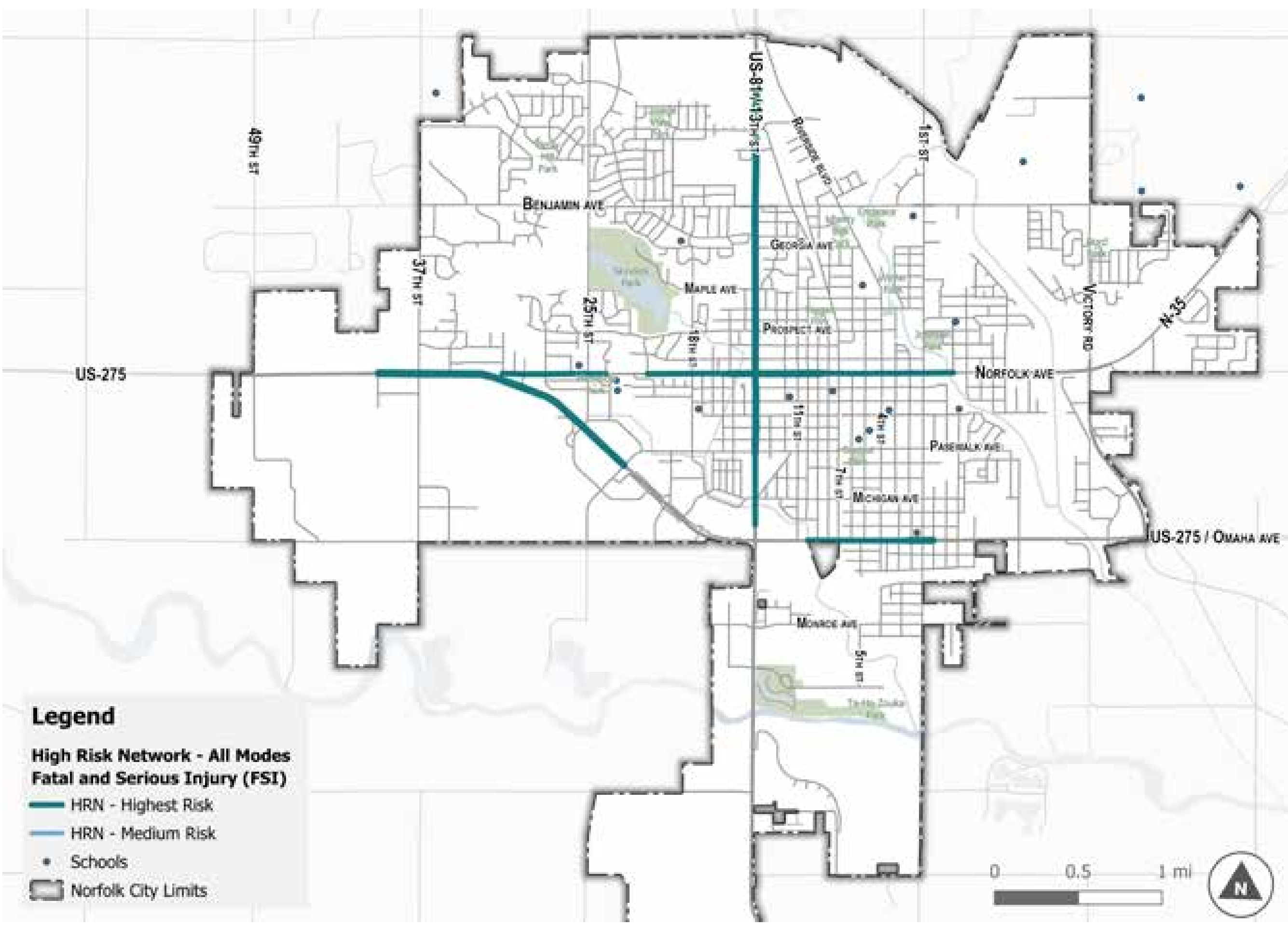
Facility Profile Tier	Facility Profile Definition		
	Functional Classification	% Young Residents	AADT
High	Secondary	>25%	
Medium	Secondary	<=25%	
Low	Local		>=1,000
Minimal	Local		<1,000 or unknown

TABLE 18 All Modes FSI Roadway Facility Profiles Ranked by FSI Crashes per Mile

Facility Profile Tier	Facility Profile Definition				
	Avg FSI Crashes per Mile	Total Miles in Study Area	FSI Crashes	% Miles in Study Area	% FSI Crashes
High	1.9	12.2	23	7.0%	40.4%
Medium	0.7	12.1	9	7.0%	15.8%
Low	0.4	33.8	15	19.4%	26.3%
Minimal	0.09	115.8	10	66.6%	17.5%

FIGURE 24 All Modes FSI Facility Profile Tier Metrics

MAP 16 All Modes FSI High Risk Network



Results – Motor Vehicles

Motor Vehicle Summary

Table 19 ranks the roadway facility profiles based on their associated average motor vehicle fatal and injury (FAI) crash frequency per mile during the study period and the combination of screening factors that indicate a high FAI crash frequency. The screening factors identified to be most effective at indicating elevated FAI crash frequency are:

- Functional Class
- % Senior Residents aged 65 and above
- Vehicle Volume (AADT)

Combinations of these three factors can be separated into four distinct facility profiles with divergent safety performance for high-severity crashes. These profiles match with four different tiers based on their relative risk levels for fatal and injury crashes.

The facility profile identified to have the highest FAI crash risk is a high-volume roadway in census tracts where 15% or less population is senior residents. Medium risk is associated with high volume roads but in areas with over 15% senior population.

Facility Profile Metrics

The associated average FAI crashes per mile, as well as the relative mileage of each facility, are summarized in Table 20. Over 41.4% of FAI crashes in the study area occur on High and Medium tier facilities, even though these facilities represent only 12.3% of the total roadway miles in Norfolk, as seen in Figure 25. The detailed breakdown in Table 20 shows that High tier roads, despite comprising just 5.4% of the total mileage, account for 25.5% of FAI crashes. Medium tier roads, also representing 6.9% of the mileage, account for 15.9% of FAI crashes. Low and Minimal tier facilities, while covering 87.7% of the total mileage, account for 58.7% of FAI crashes.

High-Risk Network Mapping – Motor Vehicle

Map 17 displays the High-Risk Network for motor vehicles in two buckets – High and Medium.

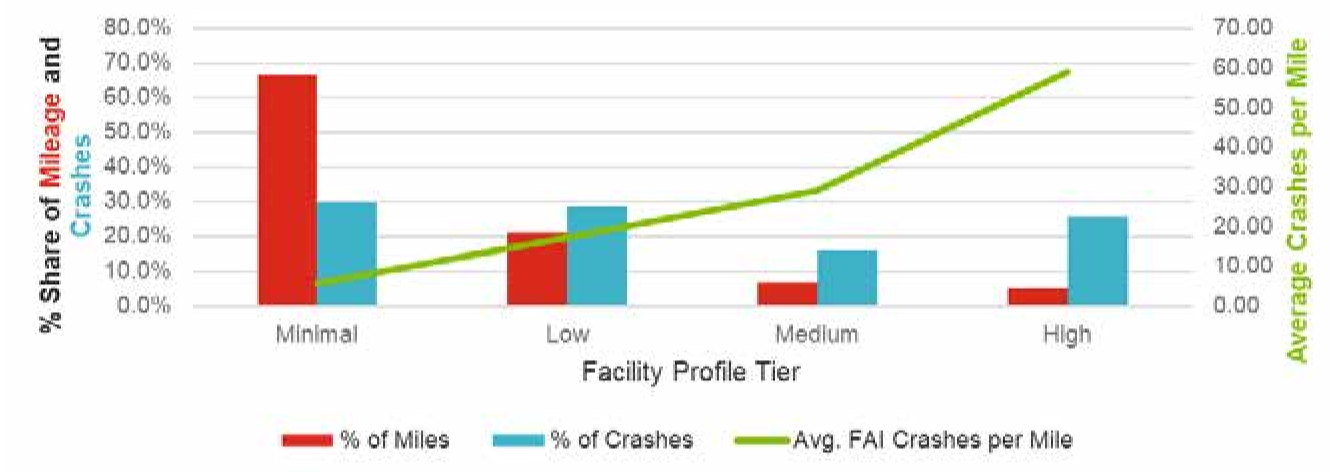
TABLE 19 Motor Vehicle FAI Roadway Facility Profiles

Facility Profile Tier	Facility Profile Definition	
	% Senior Population	AADT
High	<=15.0	>5,000
Medium	>15.0	>5,000
Low		1,000 - 5,000
Minimal		<1,000 or unknown

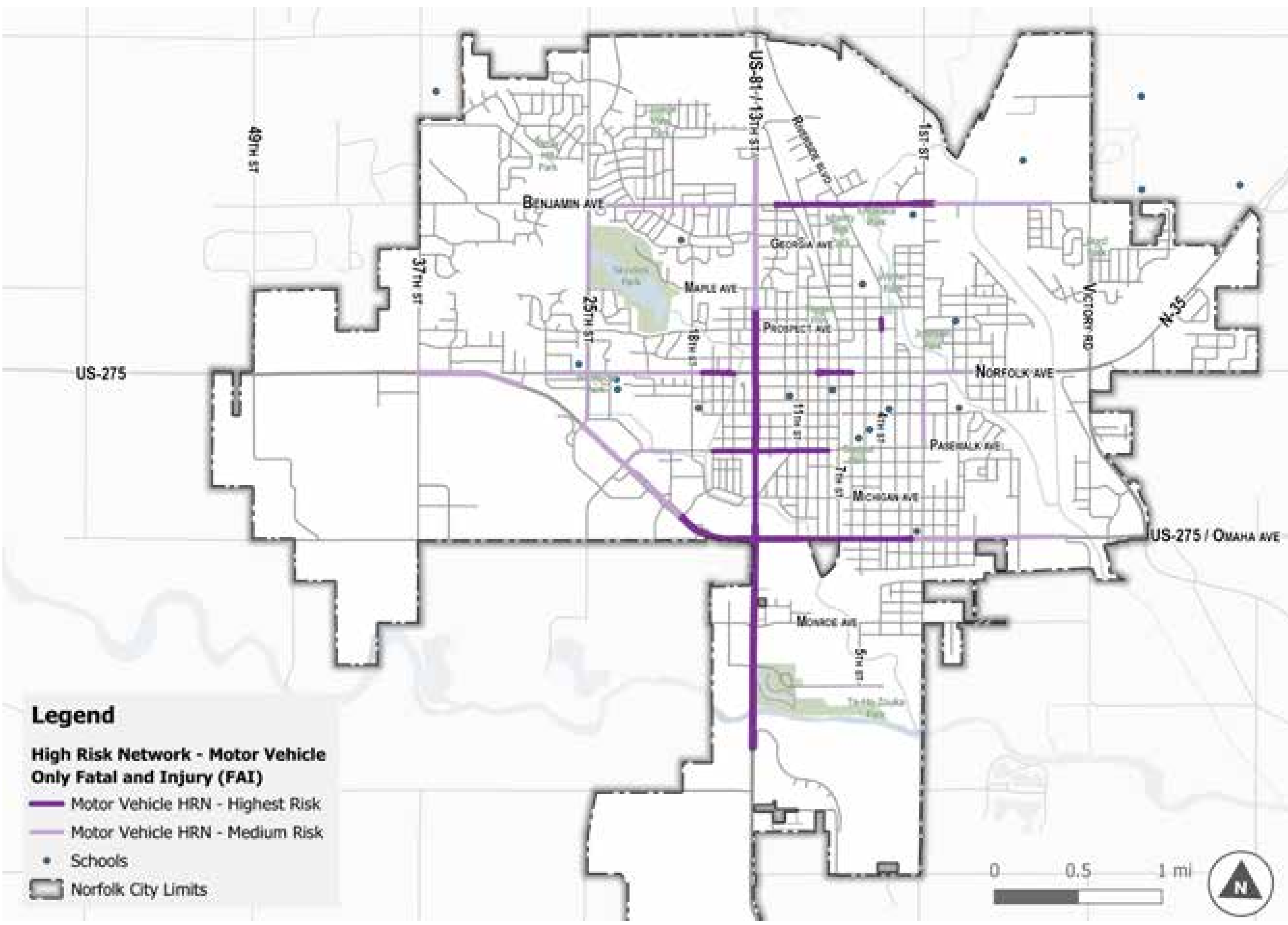
TABLE 20 Motor Vehicle FAI Roadway Facility Profiles Ranked by FAI Crashes per Mile

Facility Profile Tier	Facility Profile Definition				
	Avg FAI Crashes per Mile	Total Miles in Study Area	FAI Crashes	% Miles in Study Area	% FAI Crashes
High	58.9	9.5	558	5.4%	25.5%
Medium	28.9	12.1	348	6.9%	15.9%
Low	17.2	36.4	626	21.0%	28.6%
Minimal	5.7	115.9	659	66.7%	30.1%

FIGURE 25 Motor Vehicle FAI Facility Profile Tier Metrics



MAP 17 Motor Vehicle FAI High Risk Network



Results – Vulnerable Road Users

VRU Analysis Summary

Vulnerable road user systemic analysis was performed for the study area to identify a combination of risk factors that have a high number of fatal and injury (FAI) crashes. Vulnerable road users (VRU) are those more at risk of injury and death on roadways including pedestrians and bicyclists. Roadways are classified as High, Medium, Low, or Minimal tiers based on the risk factors present on them. High tier has the highest crash rate while minimal has the lowest.

Table 21 ranks the roadway facility profiles based on their associated average VRU fatal and injury severities (FAI) crash frequency per mile during the study period and the combination of screening factors that indicate a high VRU FAI crash frequency. The screening factors identified to be most effective at indicating elevated VRU FAI crash frequency are:

- Proximity to liquor stores
- % Young Residents (25 or younger)
- % in Poverty

Combinations of these three factors can be separated into four distinct facility profiles with divergent safety performance for injury crashes. These profiles are matched with four different tiers based on their relative risk levels for fatal and injury crashes.

The facility profile identified to have the highest FAI crash risk is a roadway near a liquor store with over 25% young residents. Medium risk is not associated to roadways near liquor stores, but is associated with areas of concentrated poverty. Low risk is also associated with roads near liquor stores but in areas with 25% or fewer young residents.

Facility Profile Metrics

The associated average FAI crash frequency per mile as well as the relative mileage of each facility are summarized in Table 22. Over 85.7% of FAI crashes in the study area occur on High and Medium tier facilities, even though these facilities represent only 43.5% of the total roadway miles, as seen in Figure 26. Table 22 shows that High tier roads, despite comprising just 12.1% of the total mileage, account for 46.9% of FAI crashes. Medium tier roads, representing 31.4% of the mileage, account for 38.8% of FAI crashes. Low and Minimal tier facilities, while covering 56.5% of the total mileage, account for 14.3% of FAI crashes.

High-Risk Network Mapping – Vulnerable Road Users

Map 18 displays the High-Risk Network for Vulnerable Road Users (VRU) in two buckets – High and Medium.

TABLE 21 Vulnerable Road User FAI Roadway Facility Profiles

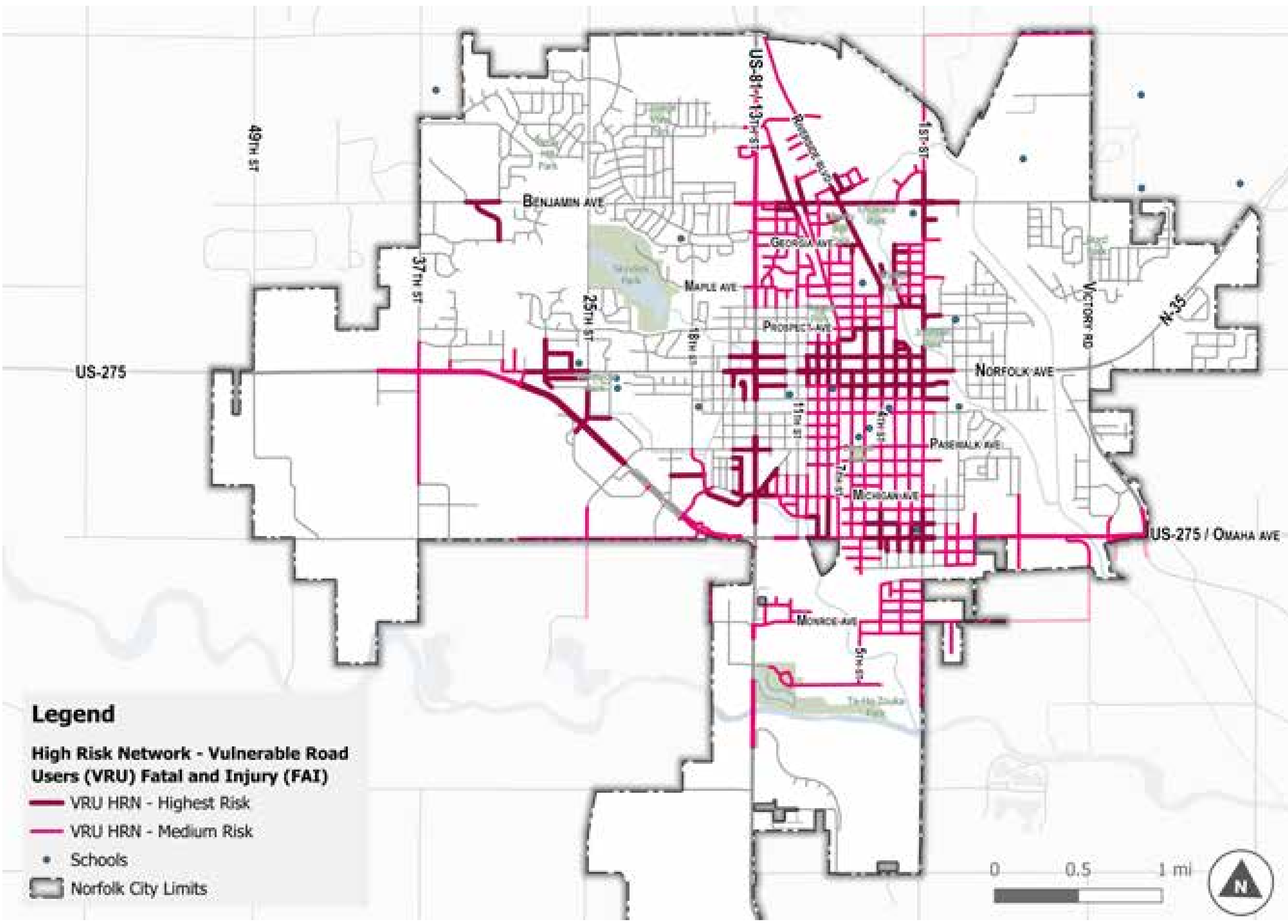
Facility Profile Tier	Facility Profile Definition		
	Proximity to Liquor Store	% of Young Residents	% in Poverty
High	Nearby	>25%	
Medium	Not Nearby		>45%
Low	Nearby	<=25%	
Minimal	Not Nearby		<=45%

TABLE 22 Vulnerable Road User FAI Roadway Facility Profiles Ranked by FAI Crashes per Mile

Facility Profile Tier	Facility Profile Definition				
	Avg FSI Crashes per Mile	Total Miles in Study Area	FSI Crashes	% Miles in Study Area	% FSI Crashes
High	1.1	21.1	23	12.1%	46.9%
Medium	0.4	54.7	19	31.4%	38.8%
Low	0.1	12.0	1	6.9%	2.0%
Minimal	0.1	86.1	6	49.5%	12.3%

FIGURE 26 Vulnerable Road User FAI Facility Profile Tier Metrics

MAP 18 Vulnerable Road User FAI High Risk Network



Key Findings

- The high-risk roads for FSI crashes are secondary roadways located in census tracts with over 25% young residents.
- High risk roads for motor vehicle FAI crashes are in census tracts with 15% or fewer old residents with a high AADT of 5,000 vehicles.
- High risk roads for FAI crashes involving vulnerable road users are near liquor stores, in areas with more than 25% young residents.

The risk factors captured in the systemic analysis identify high-risk roadway segments, focusing on high tiers for the implementation of low-cost systemic safety improvements, regardless of whether crashes have happened at those locations historically. This proactive approach complements reactive improvements that address locations with recurring crash patterns.

Complete Streets Analysis

The Complete Street Analysis identifies key corridors and locations that would greatly benefit from Complete Streets interventions by assessing safety data, travel patterns, street network attributes, demographic context, and past planning efforts. These data provide insights into active transportation need and opportunity throughout the street network.

Methodology

The project team used a variety of existing data and past studies to illustrate the needs and opportunities for active transportation activities within the city of Norfolk. Table 23 summarizes the data sources used to assess the condition and context of active transportation travel patterns.

There were a few data availability and quality challenges present. Future data efforts that address the following issues could improve the Complete Streets assessment:

- The manual data collection for number of lanes focused on streets on lower functional classes with an AADT greater than 1,000. Only 1-3 sample points were reviewed on each corridor; the reliability of this analysis could be improved with better centerline-level number of lane data.
- The AADT, short vehicle trip, and bike and walk trips data were based on Replica activity-based travel demand model from the Fall of 2023. The reliability of this analysis may be improved by replacing the simulated trips data with network-level traffic volume counts.

Results

Needs

The project team developed a need score for the street network to identify the challenges for bike and pedestrian travel in Norfolk. The network segments received one point for each of the need factors present:

- Safety: Crashes involving VRU within 250 feet of the segment.
- Safety: Fatal or severe injury crashes involving VRU within 250 feet of the segment (in addition to factor #1).
- Safety: Segment is of high VRU crash risk based on the results of the systemic safety analysis.
- Connectivity: Segment is within 250 feet of an identified walking/biking problem area from the Network Plan.
- Connectivity: Segment is a part of the identified gaps for walking from the Network Plan.
- Connectivity: Segment is a part of the identified gaps for bicycling from the Network Plan.

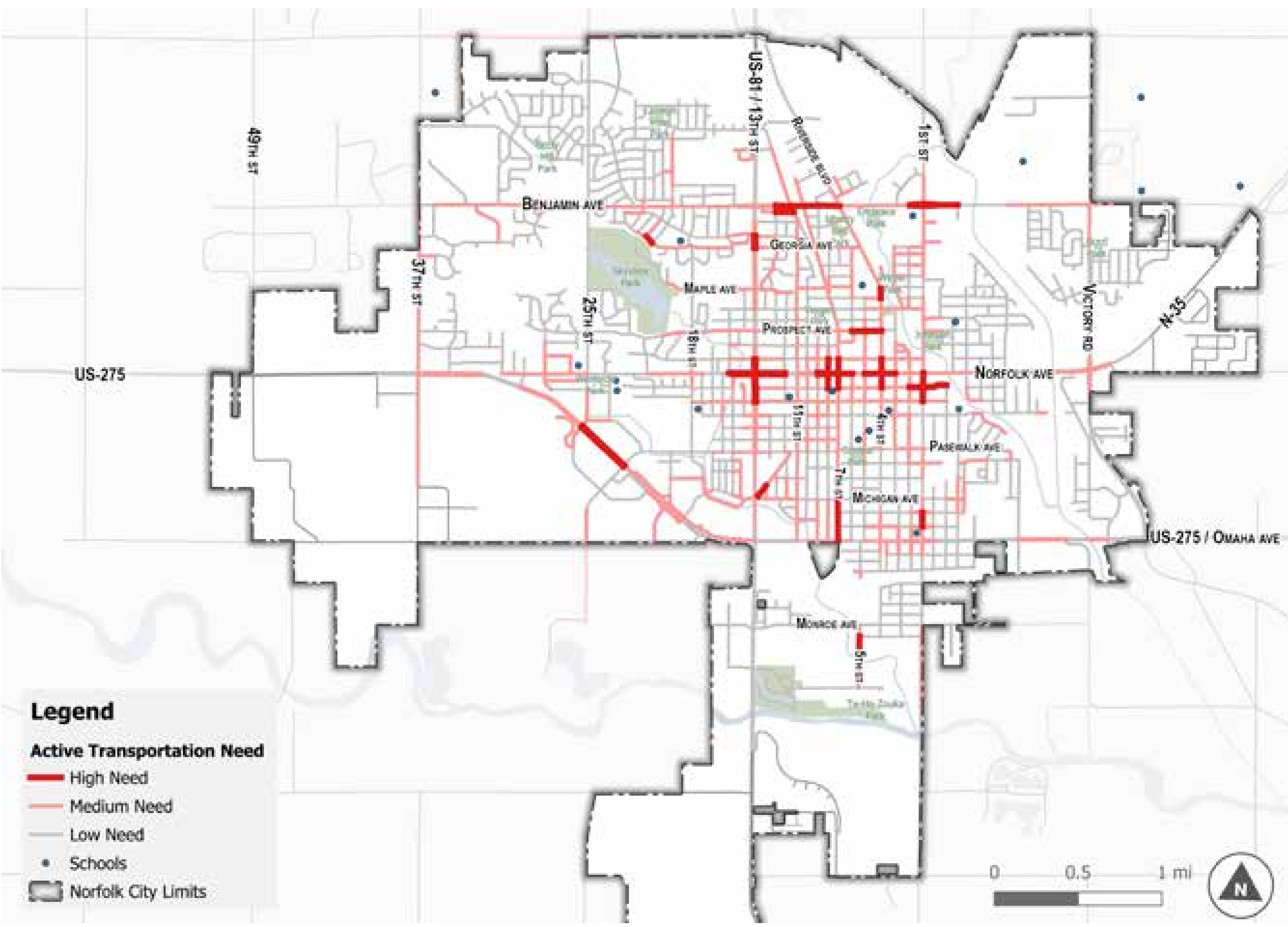
Theoretically, a segment can score as high as six points by fitting all the criteria above. However, the highest points scored is four, where segments receive 2-3 points from the safety factors, and 1-2 points from connectivity factors.

Segments scoring 3 points or above are considered as having high need for active transportation activity, while segments scoring 1 or 2 points are considered having medium need. Segments that do not have any of the factors present are considered to have low need. The network needs results are illustrated in Map 19. The areas of greatest need are primarily in Downtown Norfolk along or adjacent to Norfolk Ave, along Benjamin Ave, and in other spot locations around Norfolk.

TABLE 23 Complete Streets Analysis Data Sources

	Factor	Description	Source
Need	Roadway Safety	Crashes involving Vulnerable Road Users (VRU) and systemic risk factors for VRU crashes	Safety analysis tasks
Need	Connectivity Gaps	Walking and bicycling gaps, as identified through web-based map survey	Norfolk Bicycling and Walking Network Plan
Need	Problem Areas	Problem areas for walking and bicycling, as identified through web-based map survey	Norfolk Bicycling and Walking Network Plan
Opportunity	Demographic Characteristics	High percentages of senior (>65) or youth (<18) populations and zero-vehicle households can indicate higher needs for walking and biking	American Community Survey (2022)
Opportunity	Existing Active Transportation Use	Based on Replica activity-based travel demand model, the number of walking and biking trips at the block group level can indicate the level of active transportation use in the area.	Replica
Opportunity	Potential Trip Conversion	Based on Replica activity-based travel demand model, the number of short vehicle trips under 3 miles at the block group level can indicate the potential for trip conversion in the area.	Replica
Opportunity	Excess Travel Lane Capacity	Vehicle volume per lane is a proxy for traffic capacity and can help identify opportunities for road diet.	Replica + Desktop Data Collection
Opportunity	Planned Network	The planned bike and pedestrian network developed from the previous study.	Norfolk Bicycling and Walking Network Plan

MAP 19 Overall Active Transportation Activity Needs



Opportunities

To understand the flow of short vehicle trips in the city of Norfolk, the origin and destination of vehicle trips under three miles in distance were mapped. Map 20 shows the intensity of short vehicle trips between block groups using the activity-based travel demand model by Replica. Most short vehicle trip activities occur within the city, with the exception of the block group on the south side of the city limits where the Norfolk Regional Airport is located. Downtown Norfolk generates a lot of short vehicle trips. A walking and cycling network that provides connection to regional destinations while improving connection to downtown has the potential to convert some of these short vehicle trips to walking and bicycling.

A variety of factors were used to measure the network-level opportunities for pedestrian and bicyclist travel in Norfolk. The network segments receive one point for each of the following opportunity factors present (2 points were awarded if the segment overlaps the Bicycling and Walking Network Plan's planned network):

- Youth population% (aged 18 and under) in the block group is above 20%.
- Senior population% (aged 65 and above) in the block group is above 20%.
- Zero vehicle household% in the block group is above 5%.
- The street segment is a part of the planned network from Norfolk Bicycling and Walking Network Plan (2 points).
- Ratio of walking/biking trips to short vehicle trips - For every walk and bike trip on the segment, there are more than three short vehicle trips under three miles.
- The amount of short vehicle trips (3 miles or less) is in the top 25% in the city.
- The vehicle volume per lane is lower than 3,750 per day[2], and the street segment is not a two-lane local street.

Based on this scoring method, street segments received scores ranging from zero to seven points, where the segments scored four points or higher are considered high-scoring segments. As shown in , these high opportunity segments are located on key arterials and some adjacent local streets.

Need and Opportunity Locations

To identify the focus locations for Complete Streets policies, the street network is categorized into five tiers:

- High need and high opportunity
- High need and medium opportunity
- Medium need and high opportunity
- Medium need and medium opportunity
- Low need and/or low opportunity (medium need and low opportunity, low need and medium opportunity, low need and low opportunity)

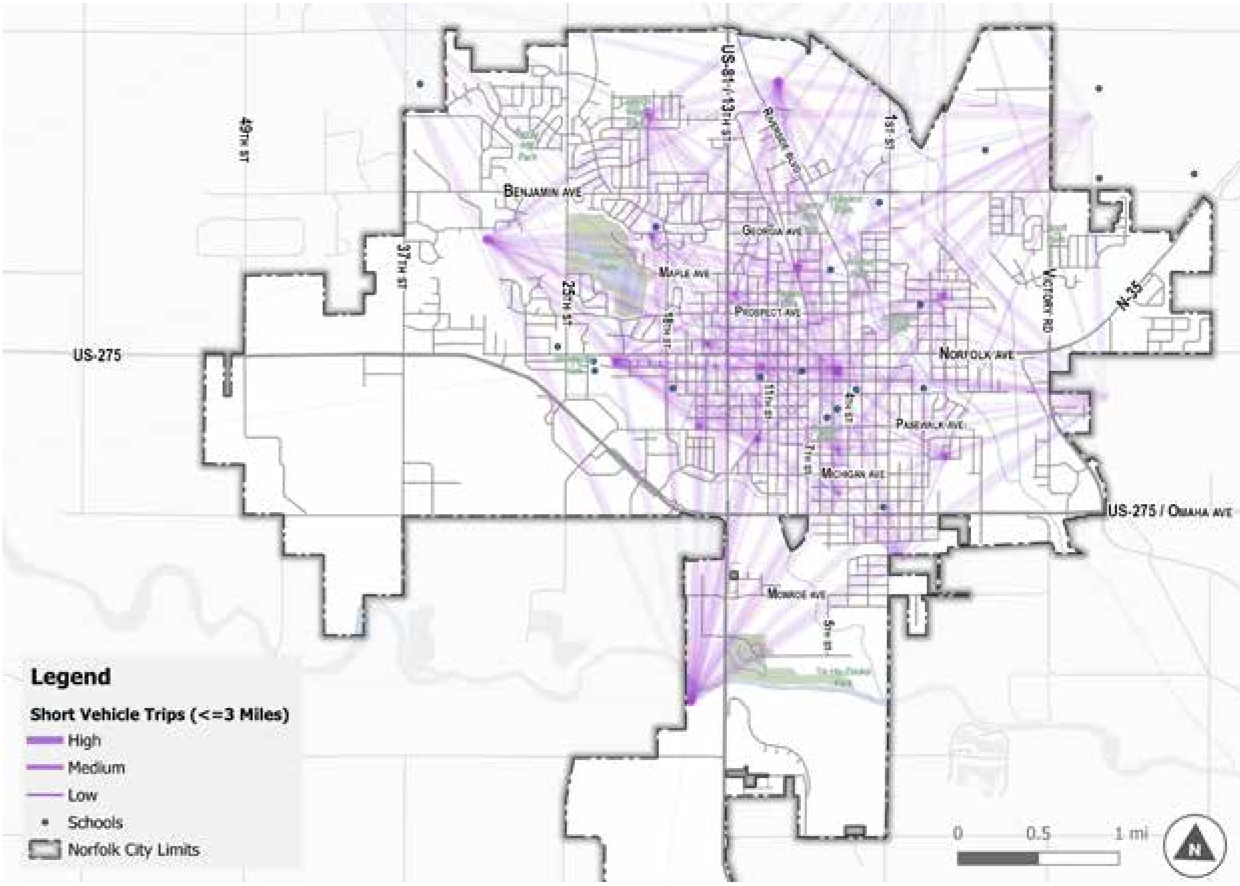
As shown in Map 22, areas of high need and high opportunity mostly overlap and illustrate areas in dark red that are prime for Complete Street interventions. Many of the Planned Pedestrian and Bicycle Network routes include areas of higher need and opportunity, such as Benjamin Ave, Norfolk Ave, Queen City Blvd / 7th St, US-275 / Omaha Ave, Prospect Ave, Riverside Blvd / 4th St, and Philip Ave.

Key Findings

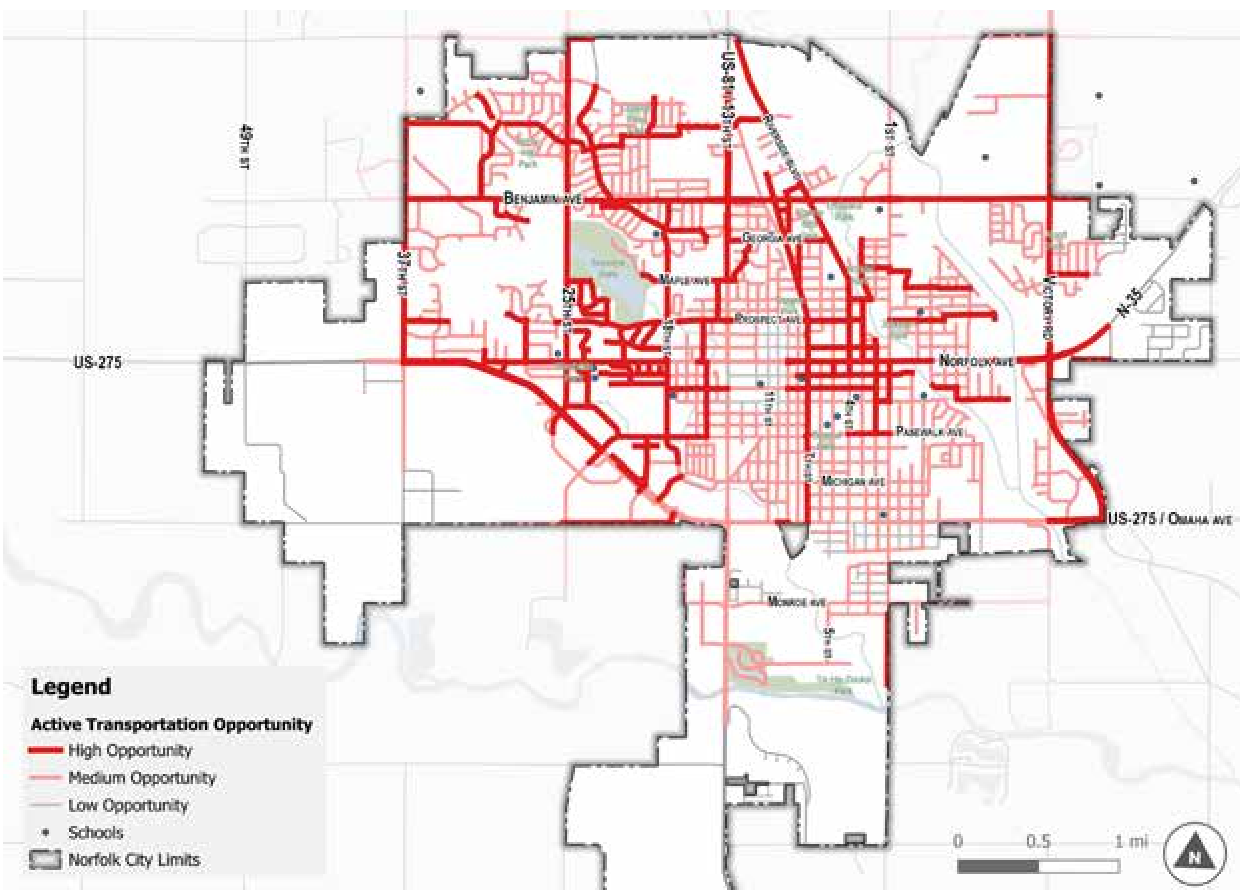
- Downtown Norfolk attracts many short trips, which could be converted to walking and bicycling trips.
- Corridors of high need are located primarily in Downtown Norfolk along or adjacent to Norfolk Ave and along Benjamin Ave.
- Corridors of high opportunity are located along key arterial streets and many local streets.
- Corridors of high need and high opportunity include Benjamin Ave, Norfolk Ave, Queen City Blvd / 7th St, US-275 / Omaha Ave, Prospect Ave, Riverside Blvd / 4th St, and Philip Ave.

2 Based on Highway Capacity Manual and local context, we determine that the daily traffic capacity per lane is 3,750. https://www.fhwa.dot.gov/policyinformation/pubs/pl18003/hpms_cap.pdf

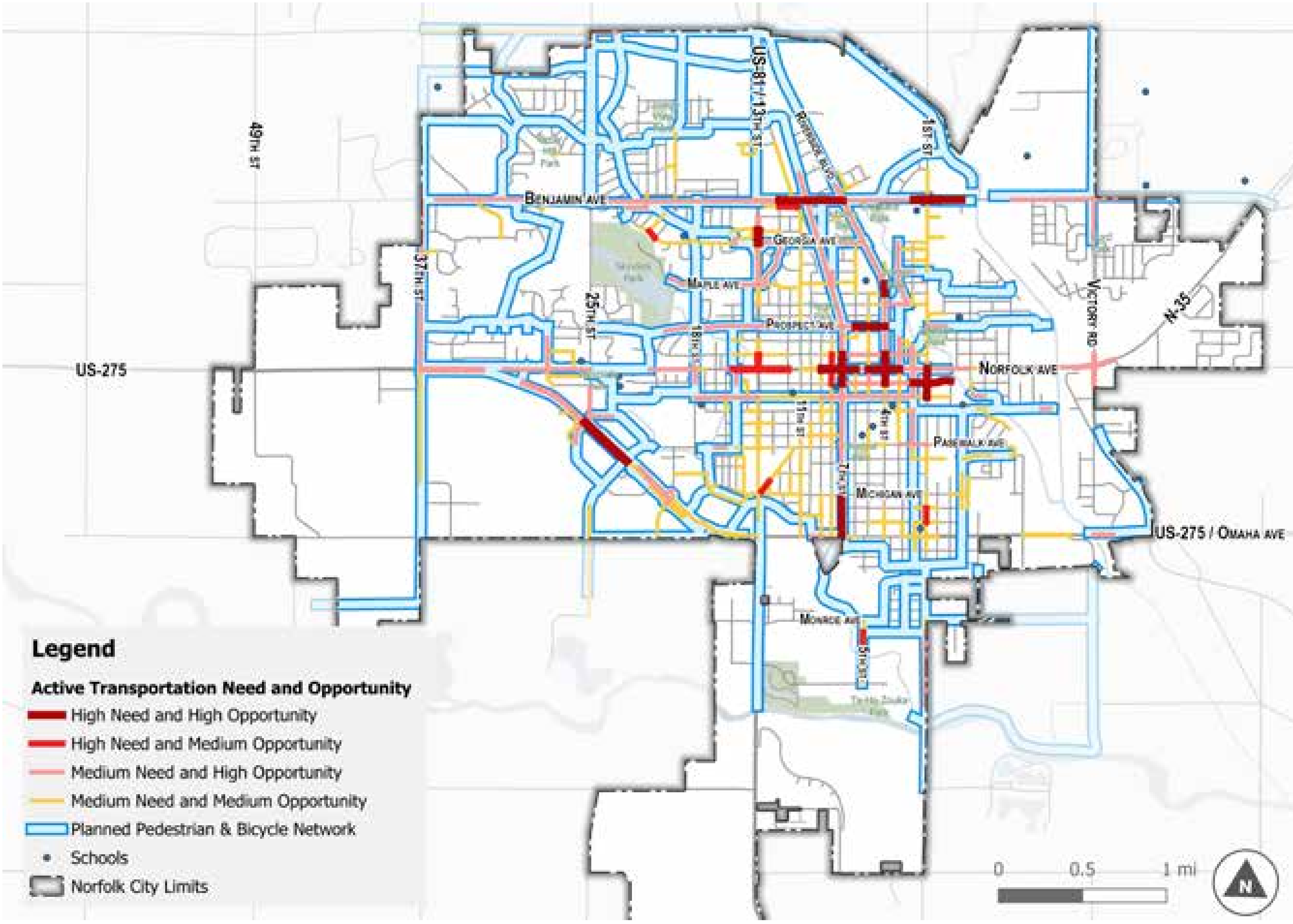
MAP 20 Flow of Short Vehicle Trips



MAP 21 Active Transportation Opportunity



MAP 22 Priority Locations for Complete Streets Policies



Local Preference Analysis

The goal of this local preference analysis is to assess safety and active transportation impacts on populations that experience heightened transportation burdens in order to advance transportation safety and access for all. The results of the analysis reveal demographic patterns in safety and multimodal access outcomes and provide valuable information for incorporating local needs and preferences into the prioritization of investments.

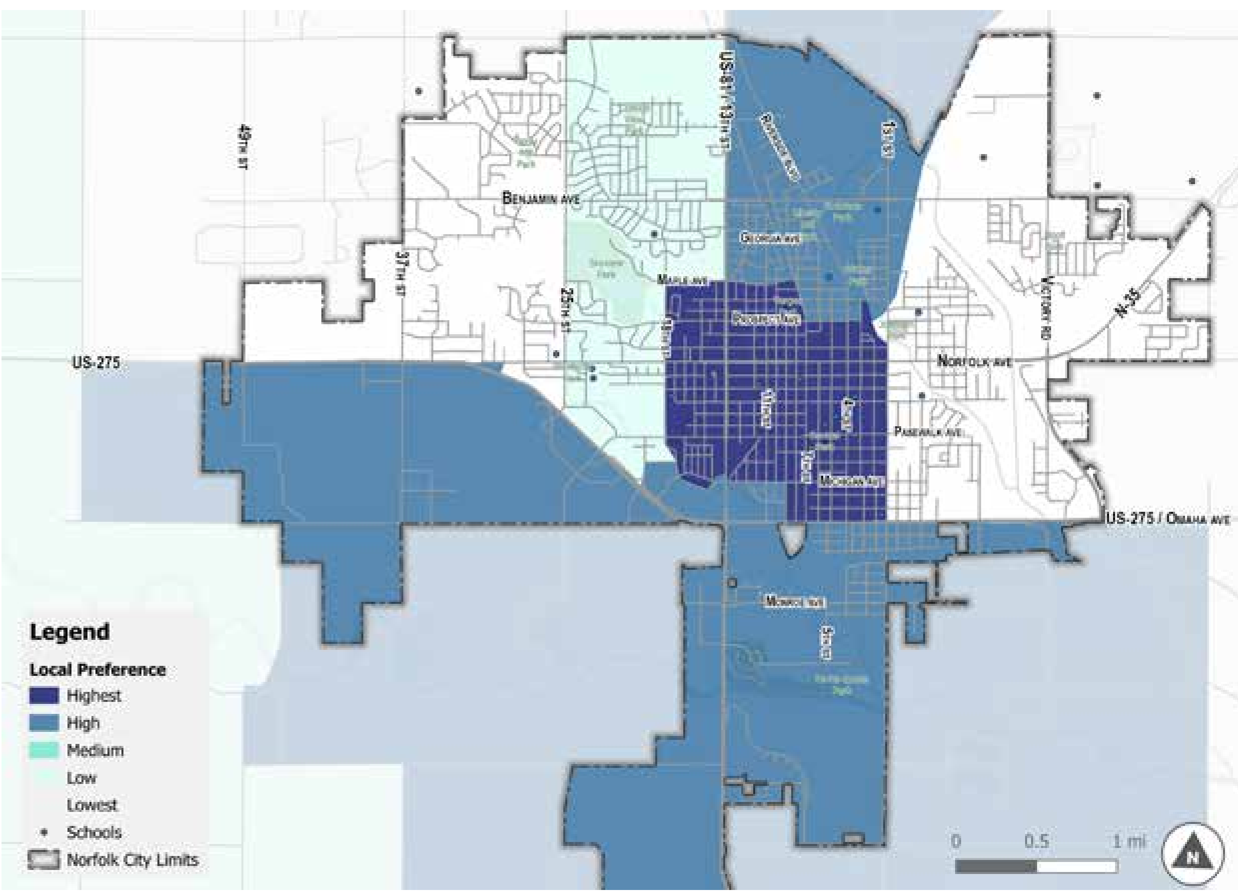
Local Preference Areas

The local preference analysis identified the degree of characteristics were present in areas of the community, including:

- Social vulnerability considers how some demographic factors have an impact on quality of life. This index includes sociodemographic indicators related to marginalization and disadvantage such as income, age, ability, and education attainment.
- Transportation insecurity represents when people are unable to regularly, reliably, and safely get where they need to go to meet their needs for daily life. This index includes transportation access, cost burden, and safety.
- Health vulnerability considers health impacts related to the transportation system. This index includes measures for the prevalence of health conditions correlated directly or indirectly to transportation.
- Environmental burden recognizes the impacts hazardous environments have on communities. This index includes air quality indicators, health risks, and proximity to toxic sites and pollution generators.
- Climate and disaster risk burden considers the impact climate can have on the performance, safety, and reliability of the transportation system. This index includes measures of extreme weather risk, losses due to hazards, and impervious surfaces.

Census block groups were scored based upon the degree of vulnerability, insecurity, and burden. Map 23 shows that communities in central Norfolk have the largest population that is experiencing transportation insecurity, environmental burden, health vulnerability, social vulnerability, and climate/disaster risk burden. Areas of high disadvantage are in southern Norfolk and north central Norfolk.

MAP 23 Local Preference Areas



Local Preference and Safety Analysis

Methodology

The project team applied a methodology for examining network safety outcomes on local preference areas, specifically in terms of traffic violence. The local preference and safety analysis overlays the results of the safety analysis with the local preference areas to provide insights into geographic differences in traffic safety.

Results

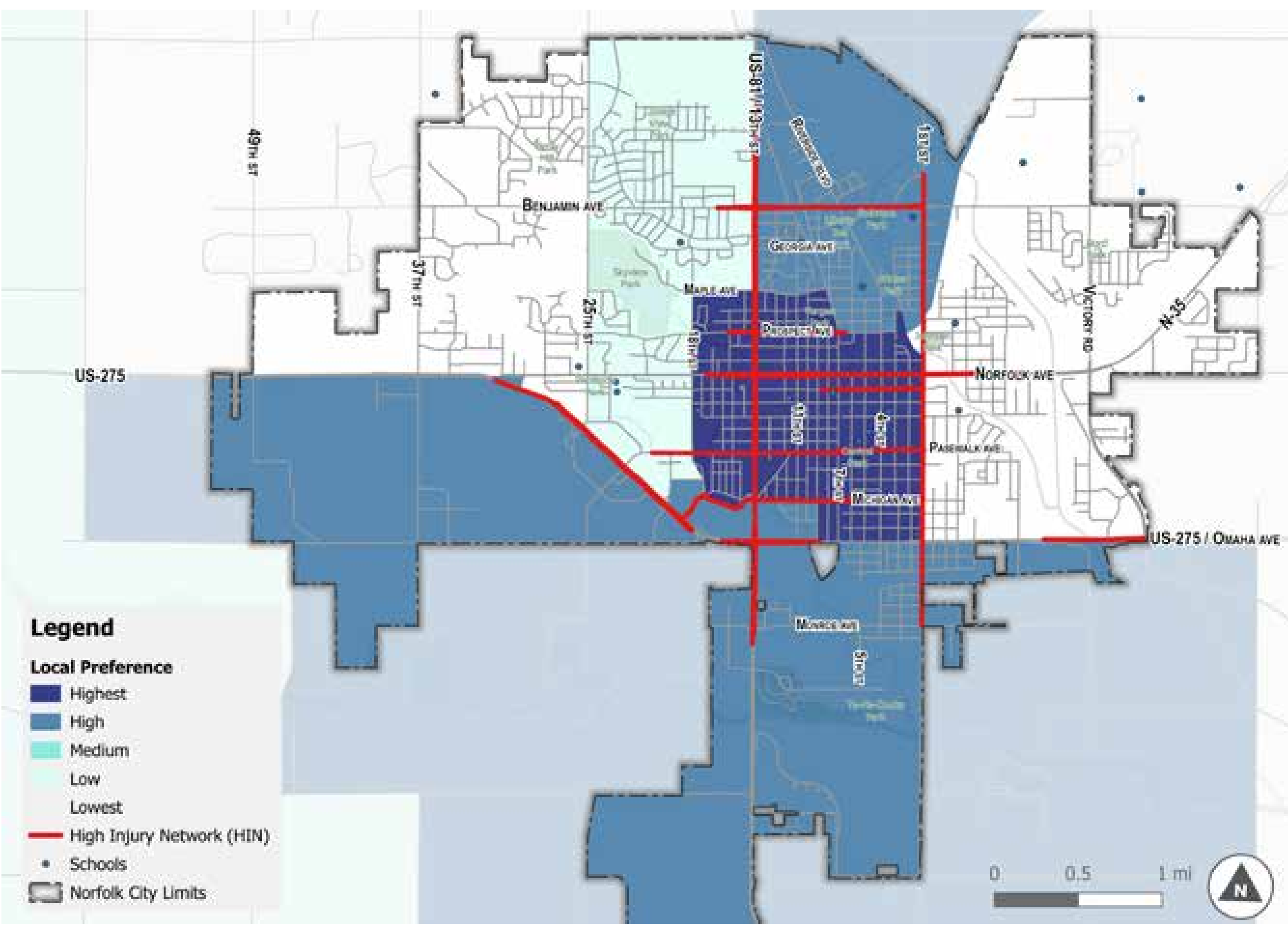
Local Preference Areas – High Injury Network

The safety analysis includes a High Injury Network (HIN). The HIN defines roadway segments where most of the serious injury and fatal crashes occurred in the city. When the HIN is used in concert with the local preference areas, the safety impacts on the key populations can be assessed.

Although extensive demographic data on all parties involved in crashes is not available, it can be assumed that people residing along and near roadways with more crashes are exposed to more traffic safety risks. Therefore, we can examine HIN segments within local preference areas to gain insight into the traffic safety risk exposure and safety disparities that may exist.

The HIN was overlaid on the local preference areas, as shown in Map 24. The map shows that the HIN roadways are primarily concentrated within and along areas with higher local preference.

MAP 24 Local Preference Areas and High Injury Network



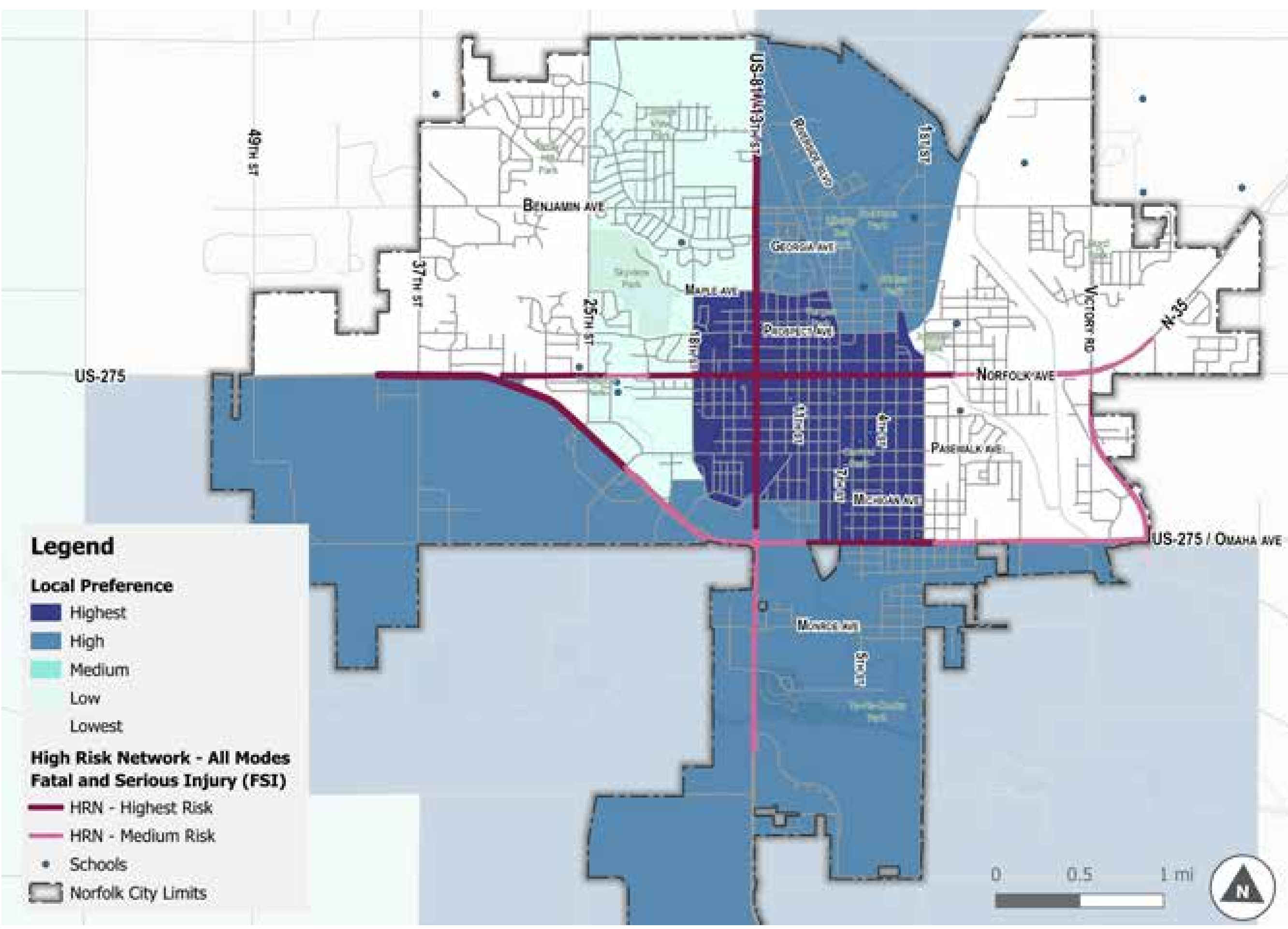
Local Preference Areas – High-Risk Network

The safety analysis includes an assessment of fatal and injury crash risk leading to three High-Risk Networks (HRN). The first is an overall HRN that includes fatal and serious injury (FSI) crashes for all modes of travel, as shown in Map 25. Although the majority of this HRN are within or along areas of higher local preference, the HRN corridors are generally the main roads in Norfolk.

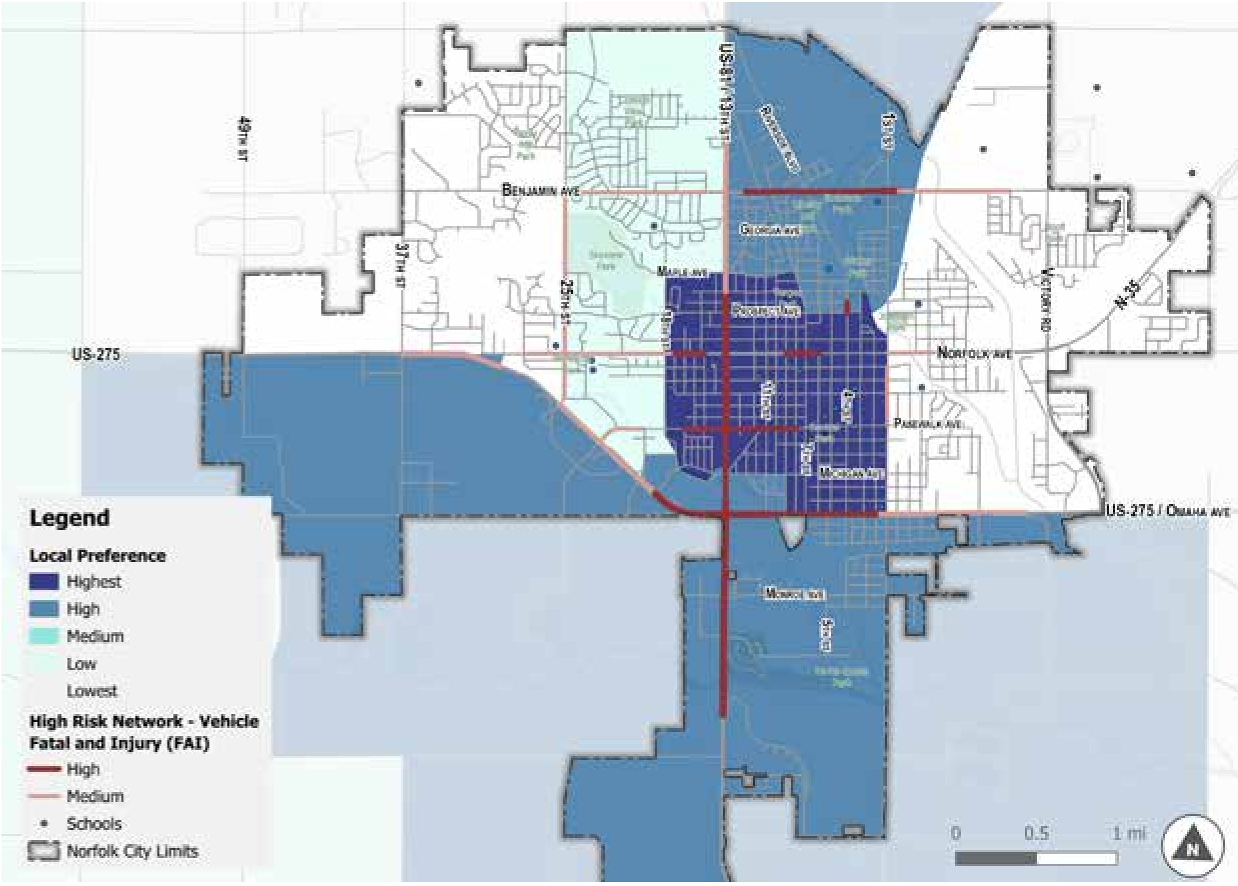
The second is an HRN that includes fatal and injury (FAI) crashes for motor vehicles only, as shown in Map 26. The corridors with high risk for vehicle FAI crashes primarily fall within areas with high or the highest local preference.

The third is an HRN that includes FAI crashes for vulnerable road users (VRU) only, as shown in Map 27. The corridors with high risk and medium risk for VRU FAI crashes primarily fall within areas with high or the highest local preference.

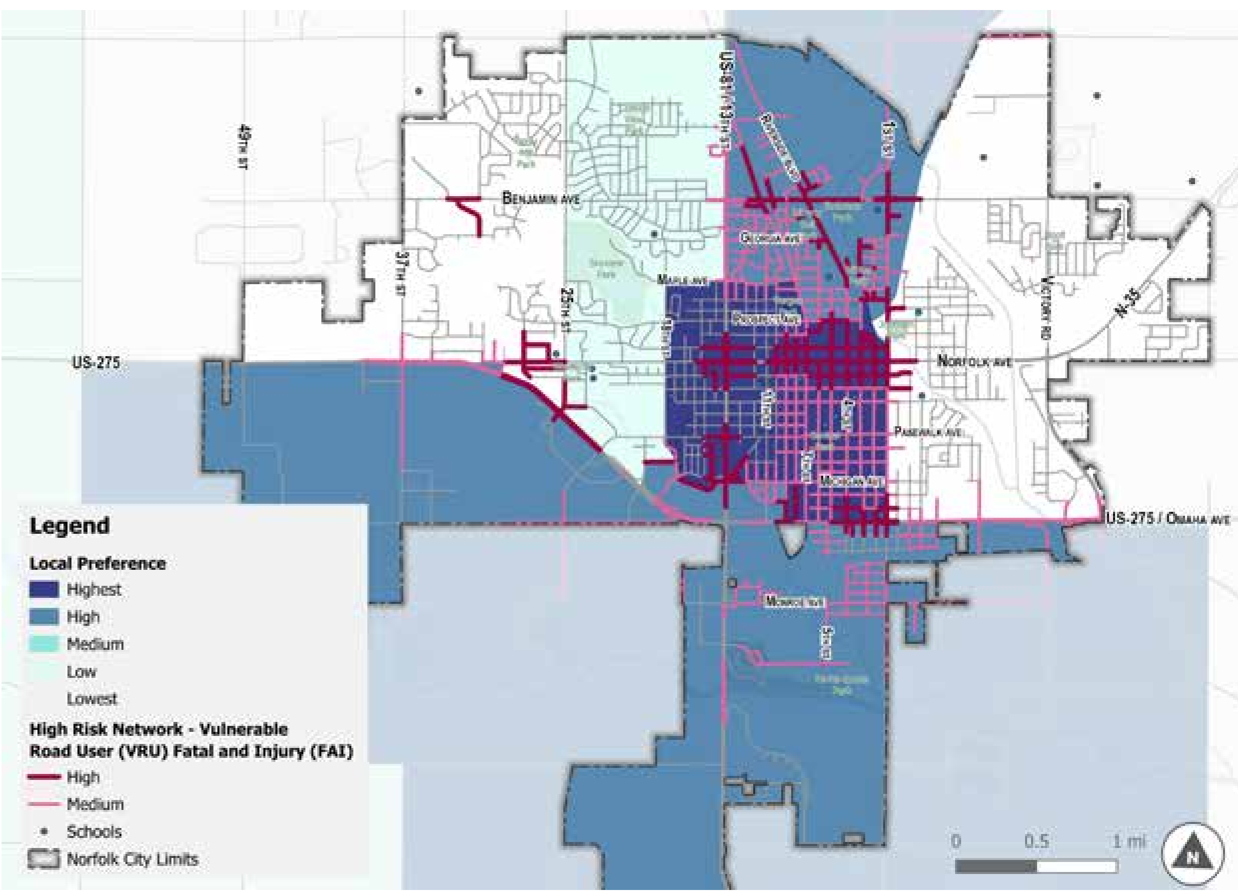
MAP 25 Local Preference Areas and High Risk Network for All Modes



MAP 26 Local Preference and High Risk Network for Motor Vehicles



MAP 27 Local Preference and High Risk Network for Vulnerable Road Users



Local Preference and Complete Streets Analysis

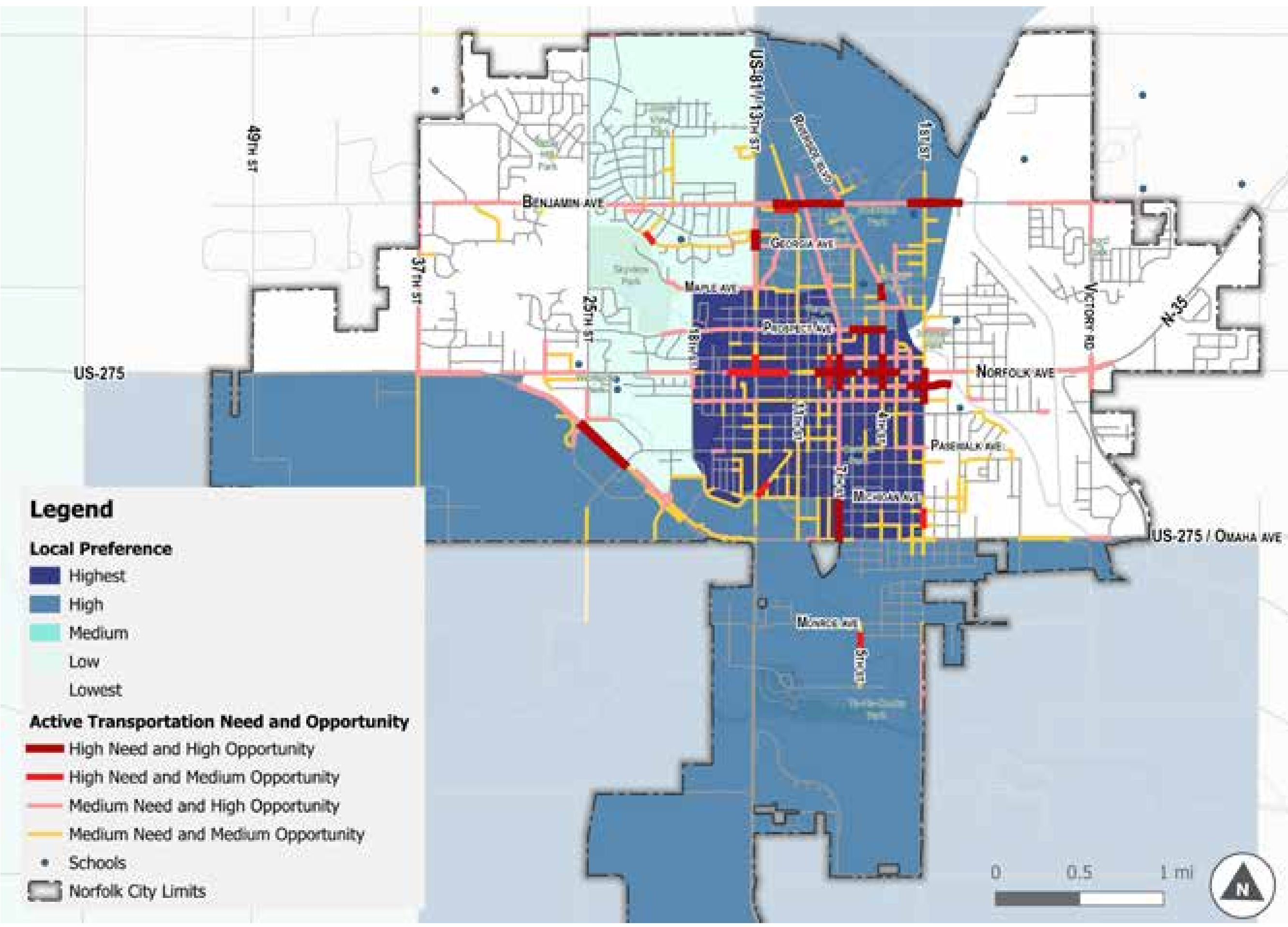
Methodology

The project team applied a methodology for examining active transportation access and safety on local preference areas. The local preference and complete streets analysis overlays the results of the complete streets analysis with the local preference areas to provide insights into geographic differences in active transportation access and safety.

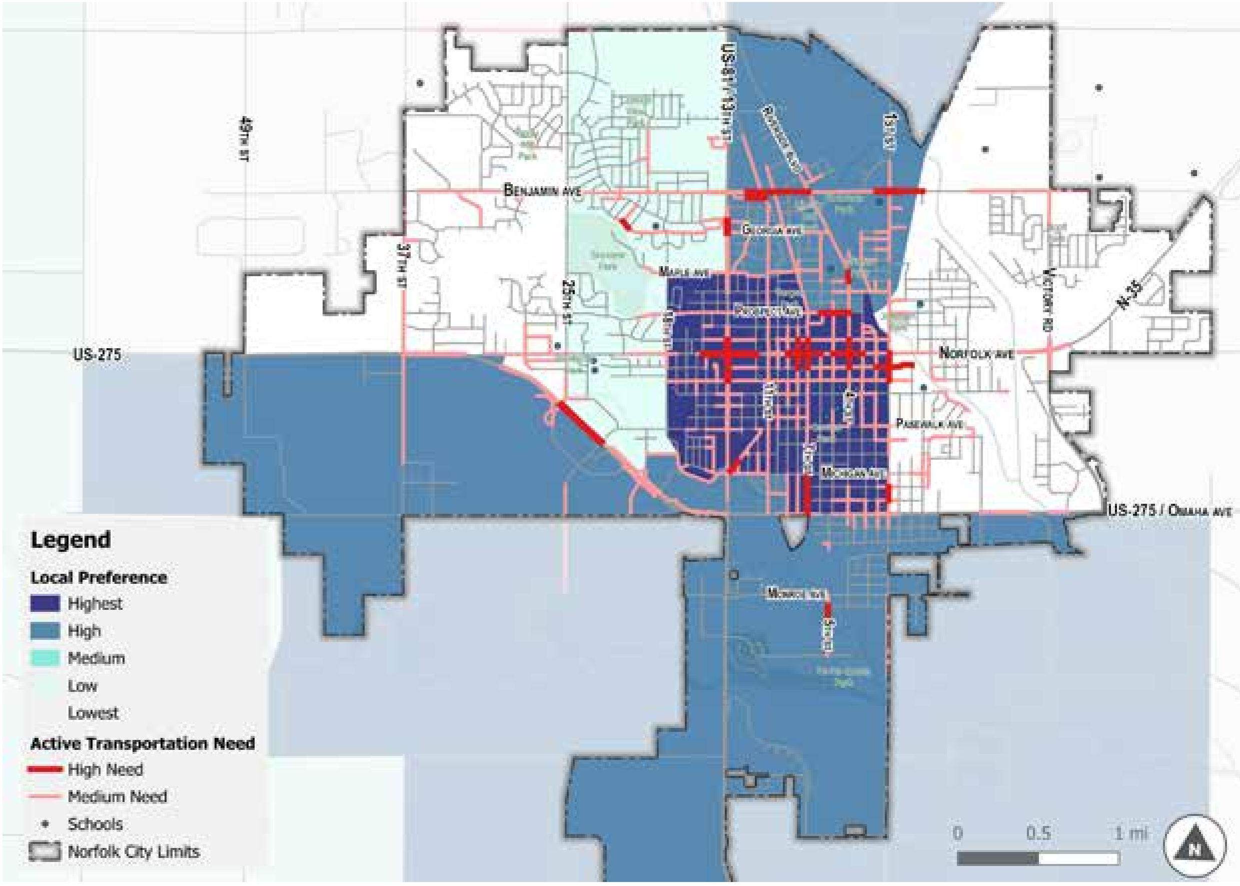
Results

The complete streets analysis identified active transportation need and opportunity. Map 28 shows combined active transportation need and opportunity. Routes with high need and high opportunity are concentrated in areas with high or highest local preference. As shown in Map 29, the routes with high active transportation need generally fall within or along areas with high local preference. As shown in Map 30, routes with the high active transportation opportunity extend throughout the entire city.

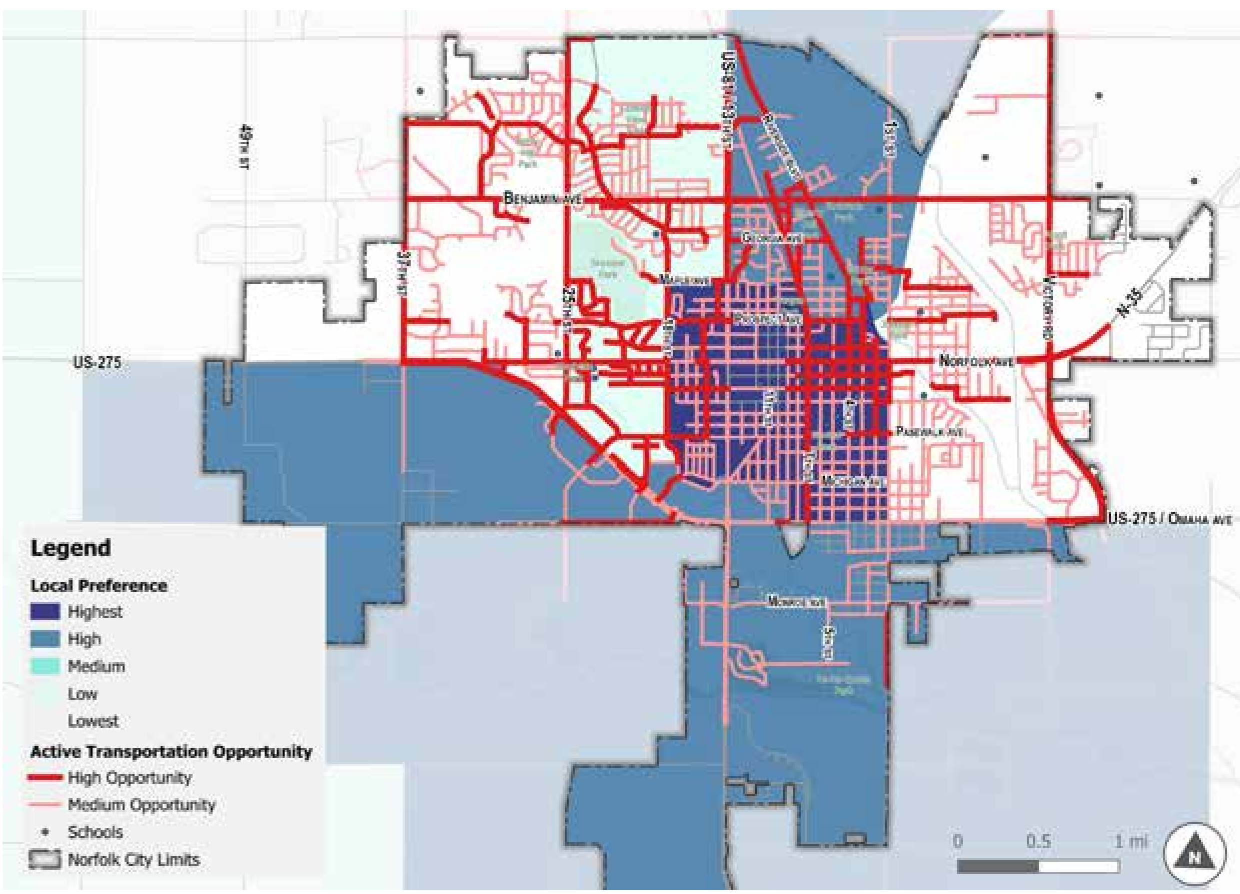
MAP 28 Local Preference and Active Transportation Need and Opportunity



MAP 29 Local Preference and Active Transportation Need



MAP 30 Local Preference and Active Transportation Opportunity



Recommendations for Advancing Local Preferences

The local preference analysis is a component of the Multimodal Transportation Action Plan (MTAP) with the express purpose of influencing the decision-making processes that result from of this project. Recognizing that traffic violence has disproportionate impacts on low-income households and other communities that have been marginalized, focusing interventions and improvements to serve these communities advances transportation safety and access for all people.

Continued Assessment

As Norfolk implements the MTAP and evaluates progress on safety, the city can examine progress in addressing disparities as well. The local preference analysis reveals disparities and establishes a baseline on which to evaluate performance. Key performance indicators that focus on safety for all people can help the city track progress.

Qualitative Data

The quantitative local preference analysis provides only part of the puzzle. To understand transportation disparities, we need to understand the lived experience. The best data for this assessment is from community engagement. This data helps define transportation disadvantage, identify areas of safety risk, highlight barriers to access and mobility, and establish the existing conditions and context. The public and stakeholder input from MTAP engagement should be used to contextualize the results of the local preference analysis. Feedback can also be used to adjust the analysis to include new or different communities or assess different impacts.

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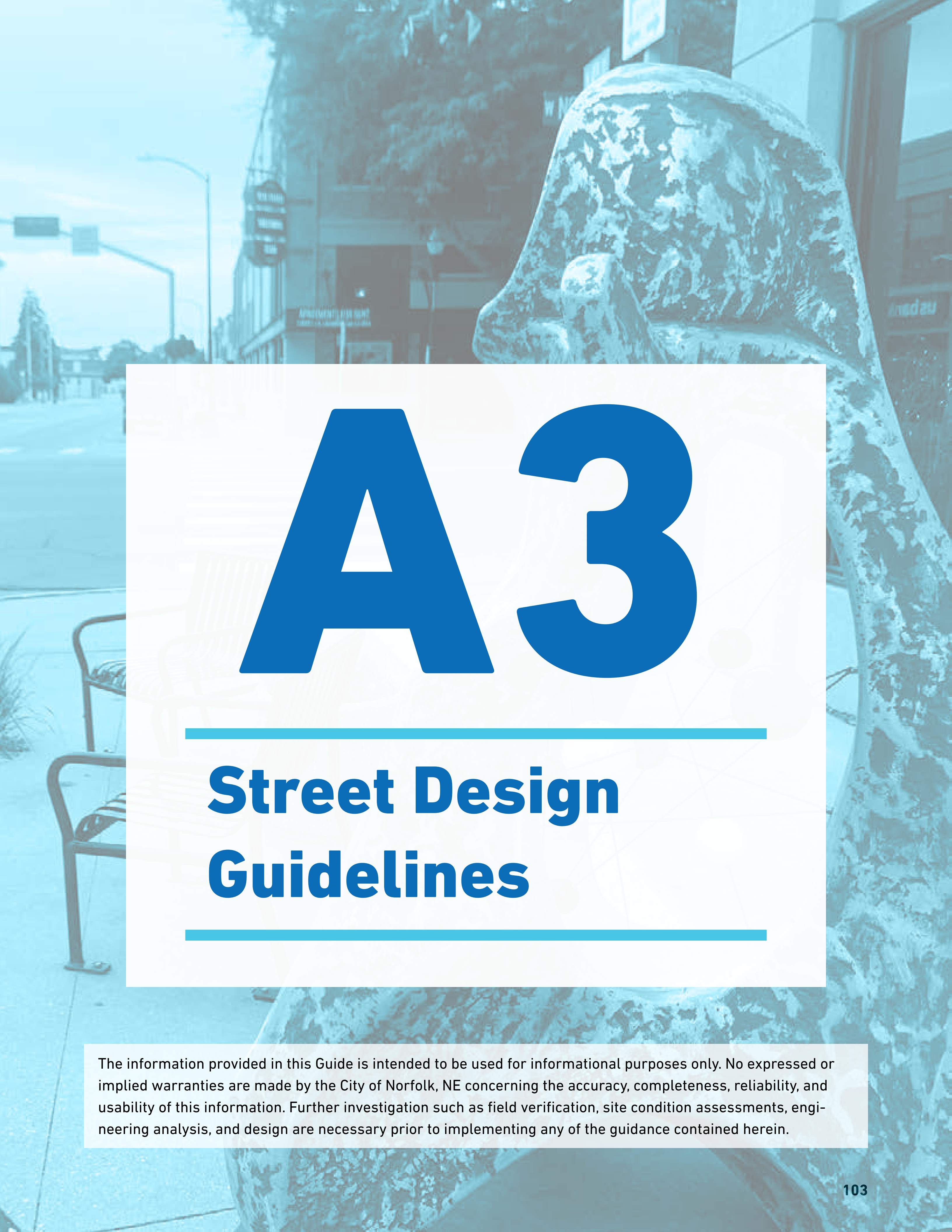

A3

Street Design Guidelines

The information provided in this Guide is intended to be used for informational purposes only. No expressed or implied warranties are made by the City of Norfolk, NE concerning the accuracy, completeness, reliability, and usability of this information. Further investigation such as field verification, site condition assessments, engineering analysis, and design are necessary prior to implementing any of the guidance contained herein.

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Introduction

This appendix contains draft street design guidelines developed during the MTAP project and recommended for adoption by the City of Norfolk. These guidelines are based upon the Safe and Complete System Policy, best practices in Complete Streets and safety, and customized for Norfolk.

Street Typology

Norfolk's Safe and Complete System Approach requires a shift from solely relying on the conventional street classification hierarchy. The conventional approach defines classifications based primarily upon transportation function—ranging from throughput to access-focused. The State of Nebraska uses six functional classifications—Interstate, Expressway, Major Arterial, Other Arterial, Collector, and Local[1]. These classifications are almost exclusively focused on the perspective of motor vehicles and do not explicitly address non-motorized travel. They also do not explicitly address the surrounding context and lack the flexibility to change classifications based upon changing context along a corridor.

The State classifications will still be used in Norfolk, but the context-based street typology in this guide will serve as an overlay and supplement functional classification. Using the street typology will integrate considerations of the context of the surrounding area and the intended function of the street, resulting in streets designed to serve all anticipated users in balance with the specific development context. Categorizing streets allows different design elements and parameters to be established based upon function and context.

Determining Street Type(s)

The street typology is based on combinations of land use contexts and transportation functions, described in the following sections. The land use context should be the primary factor when determining street type, then the transportation function, using Table 24. Additional factors can include more conventional function metrics such as multimodal traffic demand and regional connectivity.

TABLE 24 Street Type Selection

Land Use Context	Transportation Function		
	Access	Balanced	Throughput
Mixed Use	Active Street	Active Avenue	Not Compatible
Residential	Neighborhood Street	Avenue	Connector
Commercial	Industrial Street	Avenue	Connector, Thoroughfare
Industrial	Industrial Street	Avenue	Connector
Rural	*	Rural Road	Rural Thoroughfare

**Due to the rural development density, rural access streets are rare and design guidance is not provided*

1 Nebraska Revised Statute 39-2104

Streets can also change transportation functions, especially as they travel through different land use contexts. As an example, a long street corridor that is primarily classified as a throughput street that travels through a commercial / mixed-use area will likely change transportation function to a balanced street. This means that the street design should change at this point to better balance access and throughput, such as slowing traffic, improving pedestrian crossing comfort, creating more separation and protection for bicyclists, and/or improving pedestrian visibility.

As much as practical, the City should limit classifying streets as throughput streets, as they are more likely to create unsafe and uncomfortable conditions for non-motorized users and for people living, working, and shopping alongside the street. Throughput streets act as barriers for non-motorized users. Creating safe and comfortable non-motorized crossings of throughput streets are either quite expensive, reduce vehicle speed or flow, or are not comfortable for non-motorized travelers. They also tend to inherently encourage higher vehicle speeds, which are less safe for all people using the street, no matter the mode. As such, any throughput streets should be designed to limit vehicle speeds, especially where conflicts occur, such as at intersections.

Land Use Contexts

Land use context describes the area surrounding a street—the land use types, development density, and character. These guidelines stratify land use context into five simplified categories, as described in Table 25.

When selecting the appropriate land use context, consider the following:

- Land use contexts are not static. Select the desired or planned land use if it is available, or the existing land use if it is not available.
- Land use context can change along a corridor. Street designs should reflect the adjacent context, the context of the entire corridor, and the context of the surrounding neighborhood or district. Shifting land use contexts should be considered to create right-sized treatments and countermeasures given the context.
- Land use contexts are related to, but do not replace, the City's zoning classification system. Zoning can be one factor to inform the selection of the appropriate land use context.

TABLE 25 Land Use Contexts

Land Use Context	Land Uses & Density	Buildings	Non-Motorized Activity	Example
Mixed Use	Moderate to high density of a mix of primarily businesses and residences. Typical land uses include retail, office, and residential.	Buildings are close to the street and are accessed from the street.	High amount of walking and bicycling along and crossing streets.	W Norfolk Ave between 8th St and 1st St
Residential	Low to moderate density of primarily residences. Typical land uses include housing, recreation, schools, and places of worship.	Buildings have small to medium front setbacks and are accessed from the front, or back using alleys.	Moderate amount of walking and biking along and crossing streets.	S 4th St between Phillip Ave and Northwestern Ave
Commercial	Low to moderate density of primarily large businesses. Typical land uses include big-box or strip development, retail, office, and parking.	Buildings have medium to large front setbacks and are accessed from parking lots.	Low to moderate amount of walking and biking along and crossing streets.	E Norfolk Ave between 1st St and Chestnut St
Industrial	Low density of primarily industrial businesses. Typical land uses include industrial, office, and parking.	Buildings have medium to large front setbacks and are accessed from parking lots.	Low amount of walking and biking along and crossing streets.	Omaha Ave between S 25th St and US-275
Rural	Low to very low density of primarily undeveloped land. Typical land uses include agricultural, natural, and sparse housing.	Buildings have large front setbacks and are accessed from on-site parking areas.	Low amount of walking and biking along and crossing streets and primarily recreational.	W Eisenhower Ave between N 25th St and Old Hadar Rd

Transportation Functions

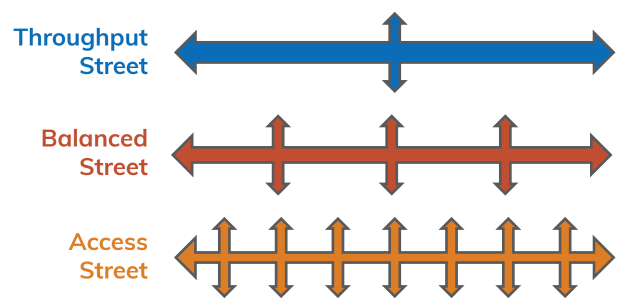
Transportation function describes how a street serves the people traveling along the street and accessing the adjacent land uses. Transportation function ranges from a focus on throughput, or moving many people efficiently through the corridor, to a focus on access, or providing more localized circulation and access to land uses. Transportation function is not defined by functional classification, though there are common correlations (e.g., local streets are typically access-oriented and arterials are often—but not always—throughput-oriented). These guidelines stratify the spectrum of transportation function into three simplified categories, as described below and illustrated in Figure 27.

Access Streets: access-oriented streets focus on a high level of access to allow people to easily reach destinations along the street by any mode. Access streets typically have lower vehicle speeds and a moderate to high amount of walking and bicycling, depending on the context. Dense, active areas and areas with a high concentration of destinations should primarily be served by access streets.

Balanced Streets: access and throughput balanced streets provide a moderate level of access and throughput. Balanced streets typically have low to moderate vehicular speeds and moderate traffic volumes. Balanced streets can serve higher volumes of vehicular traffic, but should have lower speeds to minimize safety risks.

Throughput Streets: throughput-oriented streets prioritize the efficient movement of people over longer distances and often carry more vehicles at somewhat higher speeds. Higher volumes and speeds typically require limiting access points, providing physical separation between travel modes, and implementing higher intensity crossing controls. While walking and bicycling activity may be lower on these streets, accounting for all road users' safety (including vulnerable road users) is still the top priority. Throughput streets are most appropriate in lower-density places.

FIGURE 27 Transportation Function



Street Zones

Street design guidance provided in the subsequent sections is based upon zones and areas within the street right-of-way, from property line to property line. A street is comprised of two zones—the roadway zone and the pedestrian zone, which are each further divided into smaller areas with specific purposes, as illustrated in Figure 28.

Pedestrian Zone

The Pedestrian Zones are the spaces between the face of the curb or edge of pavement and the property lines on each side of the street and can include the Frontage Area, Sidewalk Area, and Buffer Area.

The Frontage Area is the space between the right-of-way line and the Sidewalk Area. This area is comprised of space that buffers the street from private property. The Frontage Area provides some buffer when there are structures or other vertical elements on the right-of-way line like buildings, fences, hedges, and low walls. It also provides space for activities and furnishings such as sidewalk cafes, sandwich board signs, retail displays, building entrances, and landscaping. This area can also provide space between a sidewalk and private property for sidewalk and other maintenance activities. More than other parts of the right-of-way, the size of the Frontage Area can vary widely from 0 to 16 or more feet in width.

The Sidewalk Area is the space between the frontage area and the buffer area. This area is reserved for pedestrian travel, and potentially bicycle travel if a shared use path is provided instead of a sidewalk. The Sidewalk Area should include the accessible route for pedestrians (comply with PROWAG requirements) and should not include any temporary or permanent vertical elements that would impede pedestrian access.

The Buffer Area is the space between the Sidewalk Area and the Roadway Zone. This area provides a horizontal buffer between the pedestrians and the roadway zone to increase pedestrian comfort. It also provides a space for opening vehicle doors and vehicle overhangs when there is on-street parking. The Buffer Area provides space for many other elements such as street trees, light poles, above- and below-ground utilities, signs and signals, street furniture, bus stops, landscaping, green stormwater infrastructure, and open ditch drainage.

Roadway Zone

The Roadway Zone is the space between the curb faces or edges of pavement and can include the Curbside Area, Travelway Area, and Median Area.

The Curbside Area is the space between the curb face or edge of pavement and the outside edge of the first travel lane. This highly flexible space can be used for on-street parking, on-street bicycle lanes, parklets, mobile vendors (e.g., food trucks), loading zones for people (e.g., taxi, ride-hailing, buses), loading zones for commercial uses, in-street corrals for bicycle or micro-mobility parking, shoulder, rumble strips, and more.

The Travelway Area is the space between the curbside areas, minus the median area. This area is comprised of general-purpose travel lane(s) shared by personal vehicles, transit vehicles, emergency vehicles, delivery vehicles, freight vehicles, and bicycles. The travelway can also include on-street bicycle lanes.

The Median Area runs along the center of the travelway area. This area can include raised or flush medians, turn lanes, landscaping, trees, placemaking features, and signs.

FIGURE 28 Street Zones

Street Types and Design Guidance

Street types provide a standardized starting point for determining a variety of design decisions, from the amount of right-of-way needed to the space desired for each street element. Norfolk has nine standard street types that reflect the combination of land use context and transportation function. Some combinations of context and function have more than one applicable street type. In those instances, detailed consideration of the context, function, and constraints can help determine the most appropriate street type.

Design parameters are key factors to be considered during the street design process, such as travel lane width and target speeds for motor vehicles. Design guidance provides the desired characteristics or values for each parameter, such as eleven feet for travel lane width and 25 miles per hour for target speed. Street design parameters are generally consistent among all street types. However, the design guidance for each parameter is unique to each street type. The parameters and guidance provided in this section allow Norfolk to make informed and consistent decisions related to street designs that achieve community goals. Deviations from this guidance should be carefully considered, occur rarely, and be documented appropriately.

There is additional guidance provided after the design guidance for each street type that provides more details related to the Roadway Zone, Sidewalk Zone, bikeways, and intersections and crossings.

The minimum and typical widths for each area do not always total up to the minimum and typical widths for each zone. The typical, minimum, and maximum widths for each zone should be used to determine the right-of-way needed and general space allocation. Area guidance provides additional direction on space allocation within each zone.

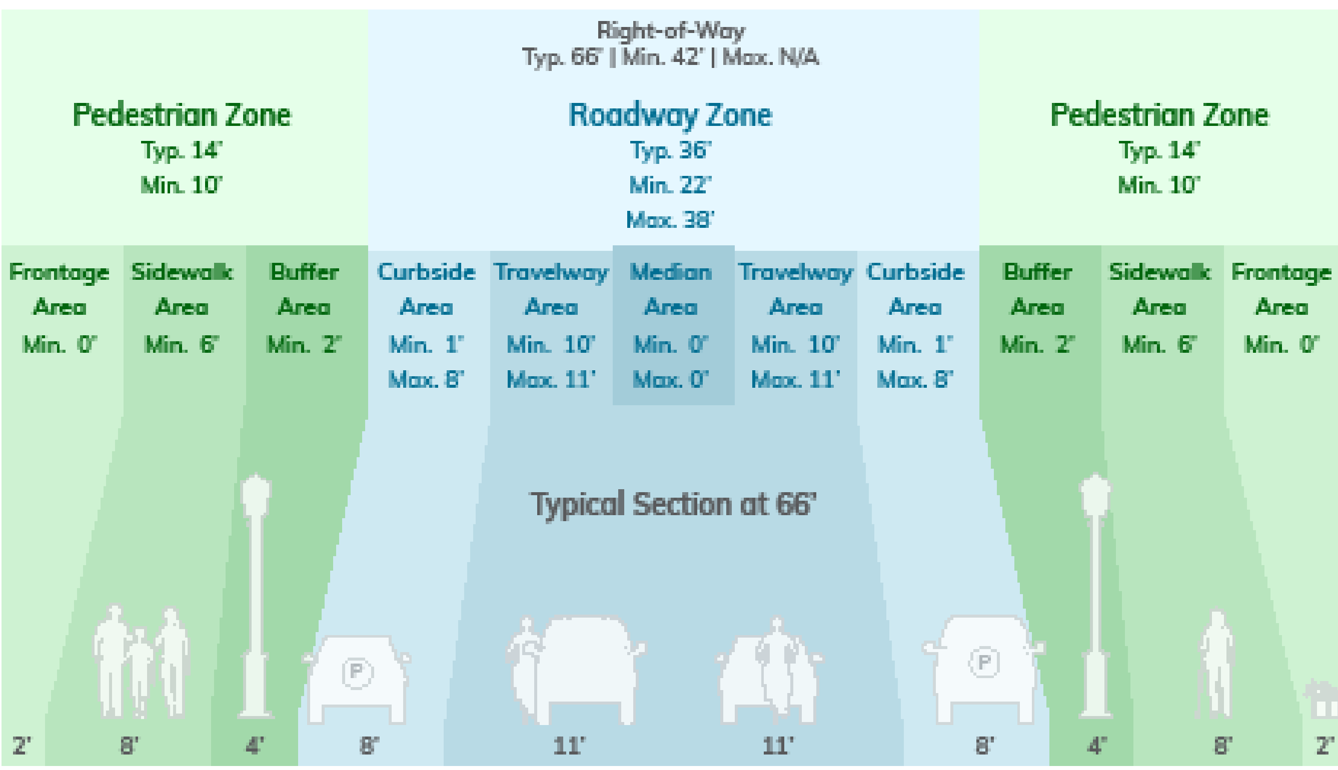
Active Streets

Active Streets are in bustling commercial and mixed-use areas and are primarily the side streets in these areas. However, Active Streets can be the primary streets in these areas when it is desirable to create a more walkable corridor by reducing motor vehicle speeds and through traffic. Buildings are generally close together, close to the street, and are accessed from the street. There are generally high pedestrian volumes and medium to high volumes of bicyclists. Street parking is common and quality streetscaping is included.

Design guidance for Active Streets is provided below and in Figure 29.

- Target Speed: 20 miles per hour to focus on pedestrian access and safety as well as allow bicyclists to share travel lanes with motor vehicle traffic.
- Travelway: No more than two designated travel lanes—one in each direction.
- Bicycling: Travel lanes are shared lanes with bicyclists and motor vehicles.
- Medians: Medians and center turn lanes are not preferred and centerline is striped.
- Parking: Delineated parallel parking on both sides of the street is preferred.
- Curb Radii: Curb radii are preferred to be 5 feet with a maximum of 15 feet.
- Constrained Situations: The preferred order to reduce areas to minimum in constrained situations is – Travelway Area, Frontage Area, Buffer Area, Sidewalk Area, and Curbside Area.

FIGURE 29 Active Street Design Guidance



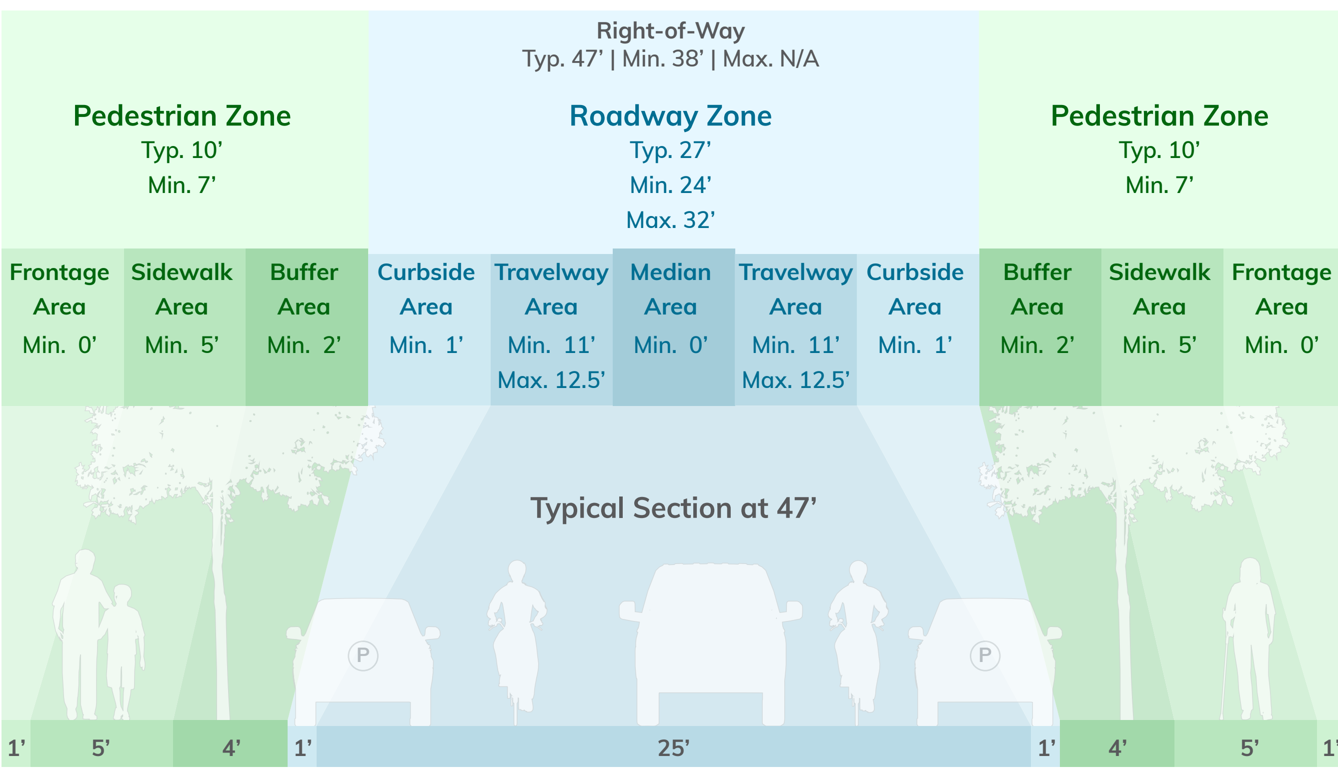
Neighborhood Streets

Neighborhood Streets serve predominantly residential uses and can serve non-residential uses in neighborhoods such as schools, parks, and places of worship. Pedestrian and bicycle activity are common along these streets and motor vehicle traffic is low. Neighborhood Streets serve primarily local access trips and encourage slow speeds, pedestrian connectivity and safety, and street trees. On-street parking on one or both sides of the street are common. Neighborhood Streets can be optimized for bicycle traffic through traffic calming and diversion to function as Bicycle Boulevards (see the Additional Bikeway Design Guidance and Clarification section).

Design guidance for Neighborhood Streets is provided below and in Figure 30.

- Target Speed: 20 miles per hour to focus on pedestrian access and safety as well as allow bicyclists to share travel lanes with motor vehicle traffic.
- Travelway: Shared space between the curbs for two-way vehicle and bicycle travel and on-street parallel parking on both sides.
- Bicycling: Travelway is shared with bicyclists and motor vehicles.
- Medians: Medians and center turn lanes are not preferred and no centerline stripe.
- Parking: Non-delineated parallel parking on both sides of the street is preferred, one side if parking utilization is low.
- Curb Radii: Curb radii are preferred to be 5 feet with a maximum of 15 feet.
- Constrained Situations: The preferred order to reduce areas to minimum in constrained situations is – Travelway Area, Frontage Area, and Buffer Area.

FIGURE 30 Neighborhood Street Design Guidance



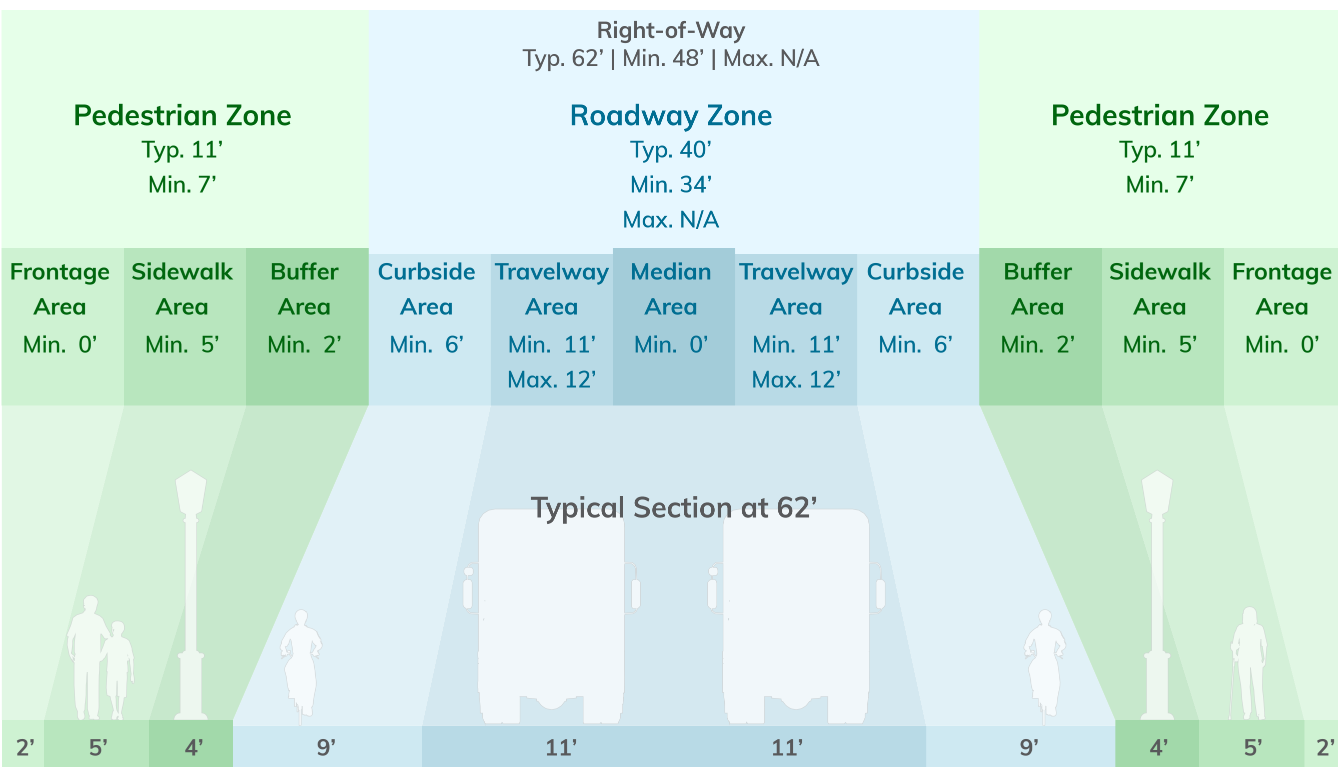
Industrial Streets

Industrial Streets serve industrial, manufacturing, large-scale and automobile-oriented commercial uses. Industrial Streets should focus on accommodating truck traffic and providing adequate lane width and turning radii, while also accommodating pedestrians, bicyclists, and personal vehicles.

Design guidance for Industrial Streets is provided below and in Figure 31.

- Target Speed: 25 miles per hour.
- Travelway: No more than two designated travel lanes—one in each direction to discourage fast and passthrough motor vehicle traffic and limit crossing distance.
- Bicycling: Buffered bicycle lanes are default. Bicycle lane preferred width is 6 feet and practical minimum is 5 feet. Buffer should be placed between the bicycle lane and adjacent travel lane and should be 2 to 4 feet wide.
- Medians: Medians and/or center turn lanes are optional and centerline is striped.
- Parking: Not preferred, but parallel is optional if off-street parking options are limited.
- Curb Radii: Curb radii are preferred to be 20 feet with a maximum of 35 feet. Consider truck aprons to minimize corner radii.
- Constrained Situations: The preferred order to reduce areas to minimum in constrained situations is – Travelway Area, Frontage Area, Buffer Area, and Curbside Area.

FIGURE 31 Industrial Street Design Guidance



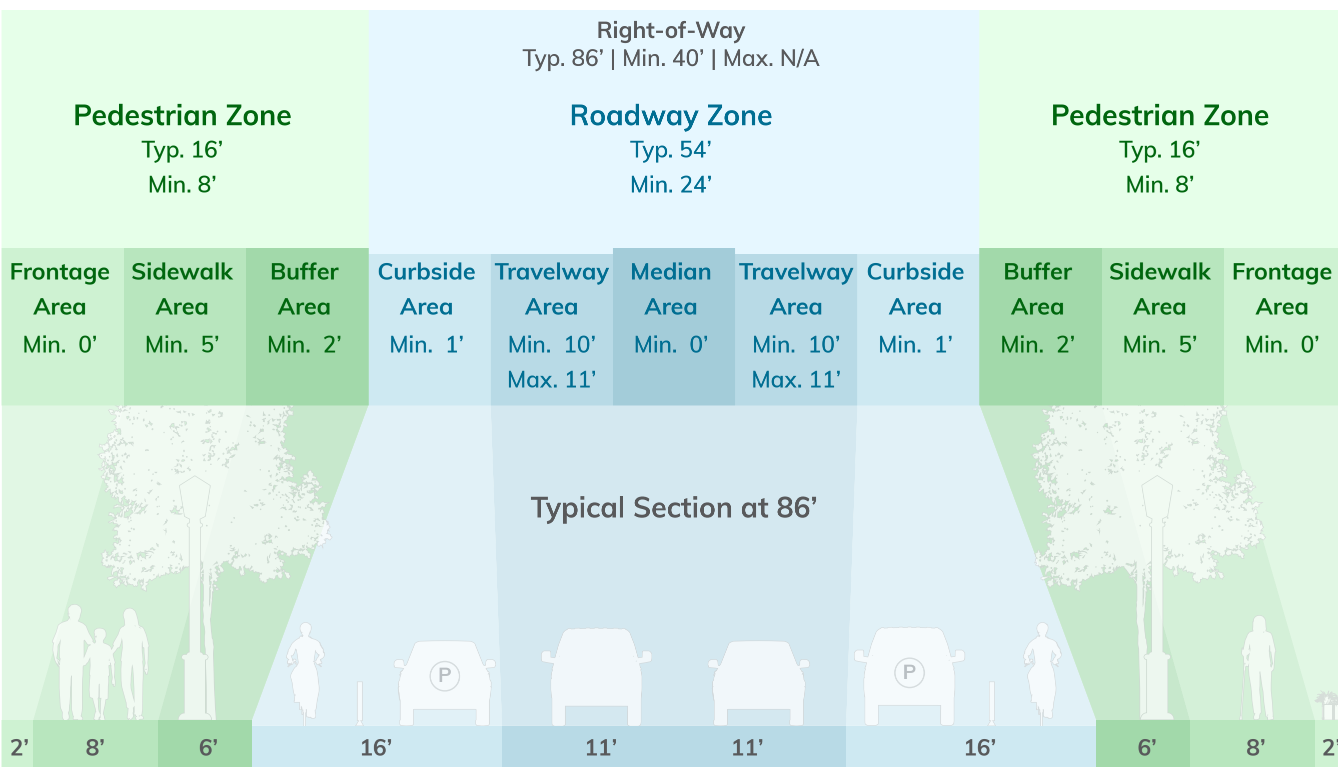
Active Avenues

Active Avenues are the primary motor vehicle access routes to, and within, bustling commercial and mixed-use areas. Active Avenues have the most intense mix of vehicle, pedestrian, and bicycle traffic. As such, conflicts between travel modes are high and should be mitigated by various design treatments including those that focus on reducing motor vehicle traffic speeds. Buildings are generally close together, close to the street, and are accessed from the street. There are generally high pedestrian volumes and medium to high volumes of bicyclists. Street parking is common and quality streetscaping is a priority including gateway treatments for business districts.

Design guidance for Active Avenues is provided below and in Figure 32.

- Target Speed: 25 miles per hour.
- Travelway: Preferred two designated travel lanes—one in each direction—to discourage fast motor vehicle traffic and limit crossing distance. No more than four travel lanes.
- Bicycling: Parking-protected unidirectional bicycle lanes are default. Bicycle lane width is 5 feet. 3-foot-wide painted buffer should be placed between the bicycle lane and parking lane, which could include vertical elements to limit vehicles from entering bicycle lane.
- Medians: Medians and/or center turn lanes are optional and centerline is striped.
- Parking: Delineated parallel parking is preferred on both sides of the street.
- Curb Radii: Curb radii are preferred to be 10 feet with a maximum of 25 feet.
- Constrained Situations: The preferred order to reduce areas to minimum in constrained situations is – Travelway Area, Frontage Area, Buffer Area, Sidewalk Area, and Curbside Area.

FIGURE 32 Active Avenue Design Guidance



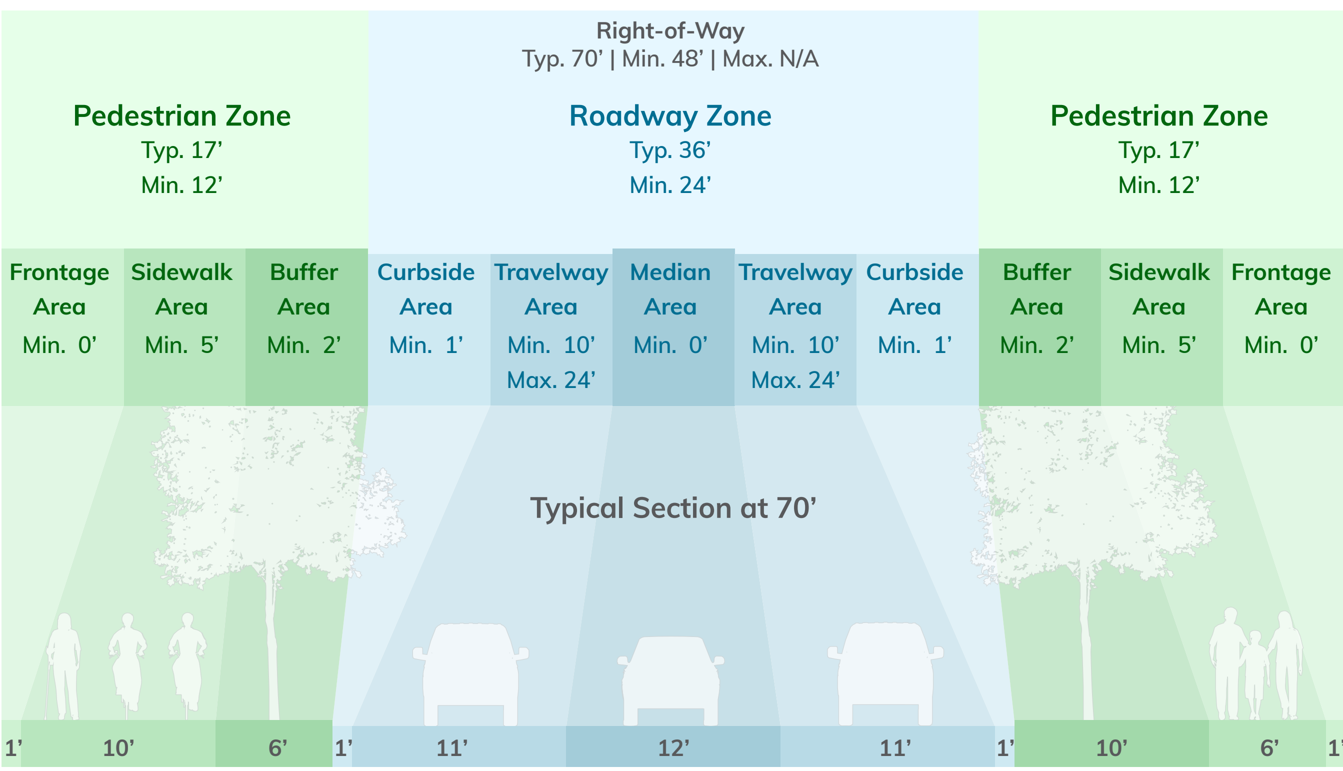
Avenues

Avenues are surrounded by primarily medium- to low-density residential uses and could include some businesses. Avenues serve as residential through streets and connect neighborhoods and districts. They also serve as key bicycle and pedestrian routes and should focus on providing continuous walking and biking routes, reducing vehicle speeds, and providing safe crossings.

Design guidance for Avenues is provided below and in Figure 33.

- Target Speed: 25 miles per hour.
- Travelway: Preferred two designated travel lanes—one in each direction—to discourage fast motor vehicle traffic and limit crossing distance. No more than four travel lanes.
- Bicycling: Shared use path on at least one side of the street. The Pedestrian Zone is wide enough on both sides of the street to include shared use path on both sides of the street. If there are more than two travel lanes, then shared use path on both sides is preferred.
- Medians: Medians and/or center turn lanes are preferred and centerline is striped.
- Parking: Parking is not preferred.
- Curb Radii: Curb radii are preferred to be 10 feet with a maximum of 25 feet.
- Constrained Situations: The preferred order to reduce areas to minimum in constrained situations is – Travelway Area, Frontage Area, Buffer Area, and Sidewalk Area.

FIGURE 33 Avenue Design Guidance



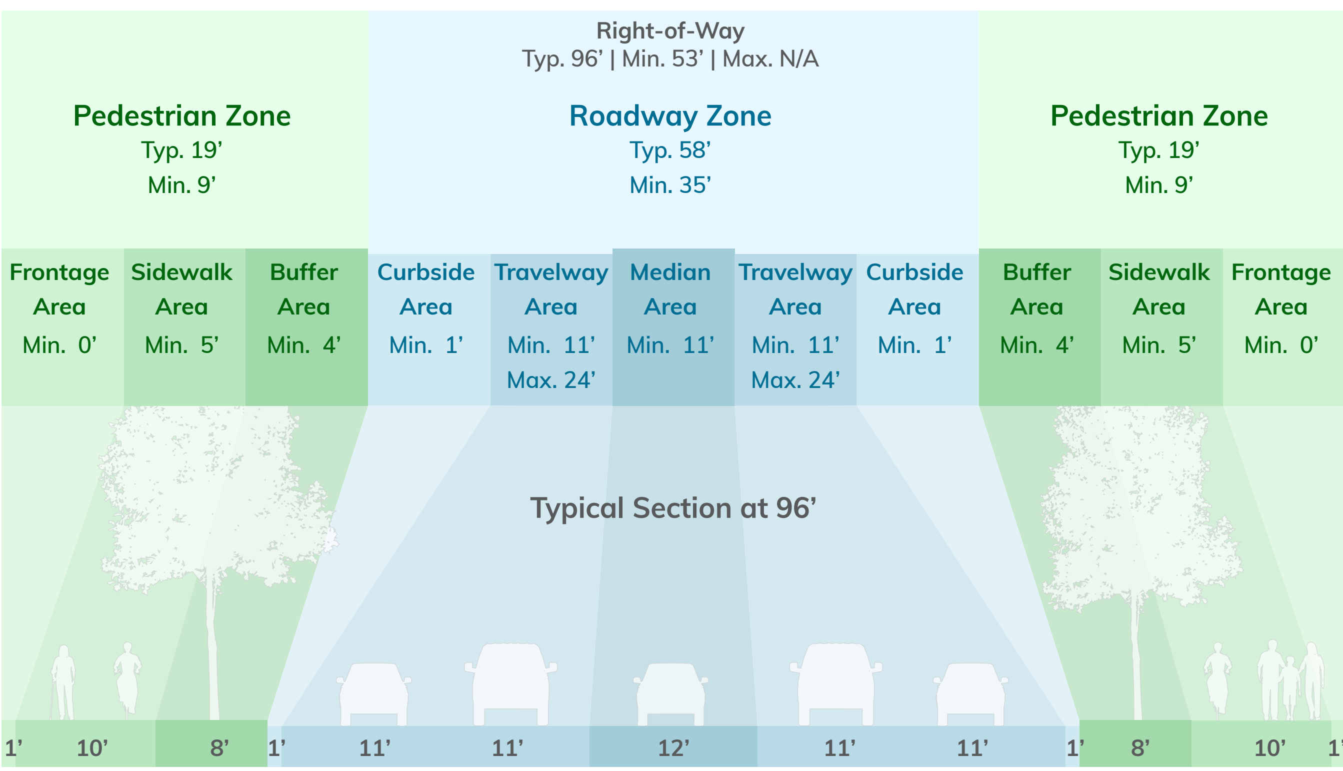
Connectors

Connectors link commercial clusters, employment hubs, major institutional area, and neighborhoods. They also facilitate cross-city travel and sometimes regional travel. As such, Connectors are often State routes. Access management should be a high priority due to moderate vehicle speeds and high volumes. In their existing condition, these corridors are typically auto-oriented and create barriers to walking and biking. Bicycle and pedestrian traffic can be moderate to high, so changes to these corridors should manage vehicle speeds, provide comfortable and continuous sidewalks and bikeways, give frequent opportunities for pedestrians and bicyclists to safely cross the street, and separate people biking and walking from car traffic. In constrained environments, bicycle traffic may be encouraged on parallel and proximate bicycle routes.

Design guidance for Connectors is provided below and in Figure 34.

- Target Speed: 30 miles per hour.
- Travelway: Preferred two designated travel lanes—one in each direction—to discourage fast motor vehicle traffic and limit crossing distance. No more than four travel lanes.
- Bicycling: Shared use path on both sides of the street. In constrained circumstances, the bikeway could be located on a parallel and proximate route.
- Medians: Medians and/or center turn lanes are preferred and centerline is striped.
- Parking: Parking is not preferred.
- Curb Radii: Curb radii are preferred to be 15 feet with a maximum of 30 feet.
- Constrained Situations: The preferred order to reduce areas to minimum in constrained situations is – Travelway Area, Frontage Area, Sidewalk Area (alternate bike route needed), and Buffer Area.

FIGURE 34 Connector Design Guidance



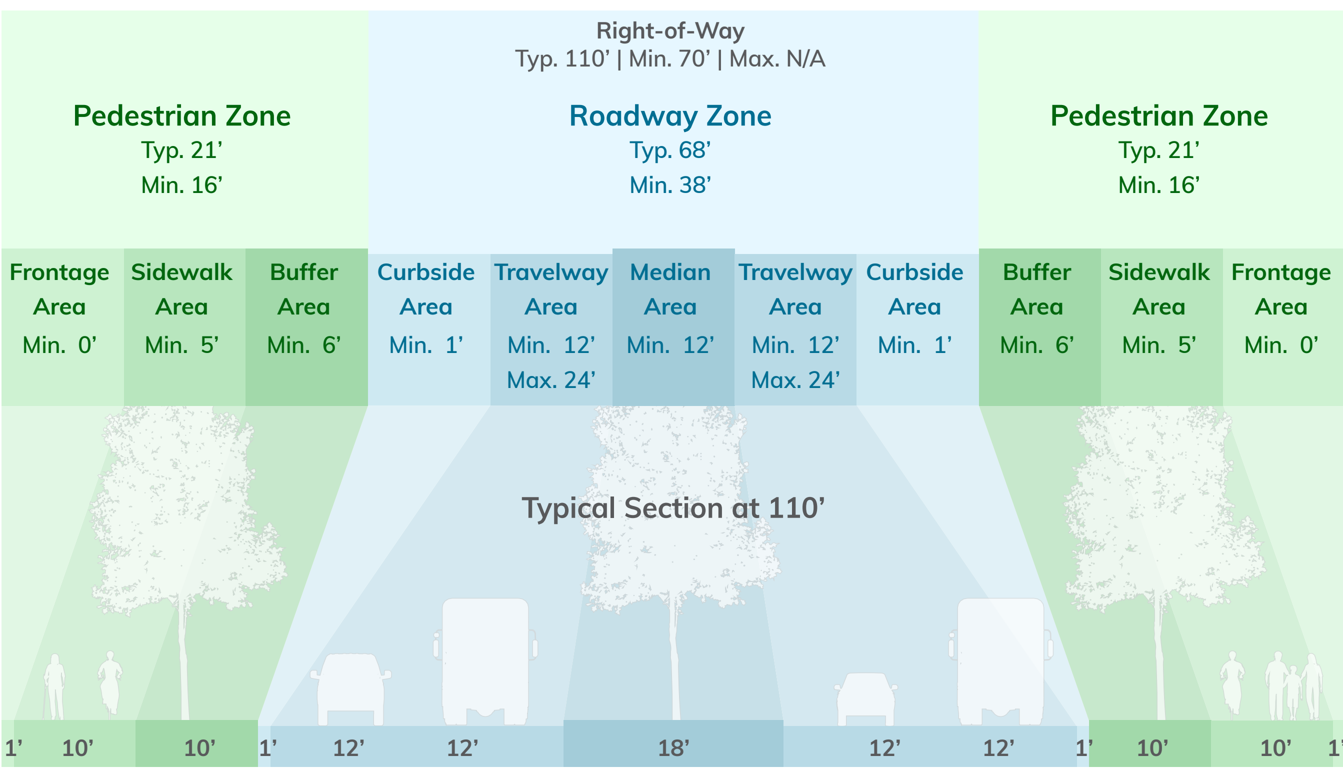
Thoroughfares

Thoroughfares are similar to Connectors, but carry more regional traffic. Thoroughfares serve cross-city travel as well and are often State routes. Thoroughfares also link commercial clusters, employment hubs, major institutional area, and neighborhoods. Access management should be a high priority due to moderate vehicle speeds and high volumes. These auto-oriented corridors often create a barrier to walking and biking. Bicycle and pedestrian traffic can be moderate to high, which should be well-separated from vehicular traffic. Although primarily auto-oriented, Thoroughfares should emphasize safety for pedestrians and bicyclists by managing vehicle speeds, providing comfortable and continuous sidewalks and bikeways, frequent opportunities for pedestrians and bicyclists to safely cross the street, and separation from high speeds and volumes of traffic.

Design guidance for Thoroughfares is provided below and in Figure 35.

- Target Speed: 30 - 35 miles per hour.
- Travelway: Preferred two designated travel lanes—one in each direction—to discourage fast motor vehicle traffic and limit crossing distance. No more than four travel lanes.
- Bicycling: Shared use path on both sides of the street.
- Medians: Medians and/or center turn lanes are standard and centerline is striped.
- Parking: Parking is not compatible.
- Curb Radii: Curb radii are preferred to be 15 feet with a maximum of 30 feet.
- Constrained Situations: The preferred order to reduce areas to minimum in constrained situations is – Travelway Area, Frontage Area, Buffer Area, and Sidewalk Area.

FIGURE 35 Thoroughfare Design Guidance



Rural Roads

Rural Roads occur in low-density areas that are generally on the outskirts of Norfolk or within the extra jurisdictional limits. Compared to Rural Thoroughfares, Rural Roads feature more development activity, more frequent driveways, and lower vehicle speeds. Rural Roads are generally designed with shoulders and roadside ditches. Designs should prioritize safe access for vehicles passing through and turning in/out of driveways, as well as an ample offset from vehicle traffic for pedestrians and bicyclists, as Rural Roads are often popular routes for recreational bicyclists.

Specific design standards are not provided for all elements of Rural Roads. As Norfolk develops streets, they will use an urban standard. However, Norfolk would like partner agencies to consider and incorporate, as appropriate, design features that support City goals. Norfolk recommends that Rural Roads that serve walking and bicycling trips have appropriate design features to support safe and accessible mobility for all people. This can include developing shoulders that meet bicycle design guidance (see the Additional Bikeway Design Guidance and Clarification section), shoulders that are accessible to pedestrians, or potentially sidewalks and/or shared use paths in areas with higher pedestrian and bicycle volumes.

Rural Thoroughfares

Rural Thoroughfares occur in low- to very-low density areas and undeveloped, natural, or agricultural areas that are generally on the outskirts of Norfolk or within the extra jurisdictional limits. Compared to Rural Roads, Rural Thoroughfares feature less development activity, fewer driveways, higher vehicle speeds, and are most often State routes or major county routes. Rural Thoroughfares are generally designed with shoulders and roadside ditches. Designs should emphasize safe and efficient vehicle throughput. Some pedestrian and bicycle traffic may be present, as these can be popular routes for recreational bicyclists. Due to higher speed vehicle traffic, designs should provide an ample offset from vehicle traffic for pedestrians and bicyclists.

Specific design standards are not provided for all elements of Rural Thoroughfares. As Norfolk develops streets, they will use an urban standard. However, Norfolk would like partner agencies to consider and incorporate, as appropriate, design features that support City goals. Norfolk recommends that Rural Thoroughfares that serve walking and bicycling trips have appropriate design features to support safe and accessible mobility for all people. This likely includes separated facilities (due to traffic speeds and volumes) such as shared use paths or trails.

Why provide dedicated space for pedestrians?

Providing dedicated walking space for pedestrians has shown to have a 65-85% reduction in crashes involving pedestrians walking along roadways. (Gan et al. Update of Florida Crash Reduction Factors and Countermeasures to Improve the Development of District Safety Improvement Projects. Florida DOT, (2005).)

Additional Roadway Zone Guidance and Clarifications

This section provides additional and/or supplemental design guidance and considerations for Roadway Zone elements.

Target Speed

- Target speed is the speed at which people are expected to drive and is determined for each street based on land use context and transportation function. Target speeds—and by extension posted speed limits and design speeds—should balance the needs of all anticipated street users based on context.
- Design speed is a tool used to determine the various geometric features of the roadway. It is preferable for the design speed to equal the target speed. However, in some cases a design speed higher than the target speed is necessary, whether due to existing roadway geometric features or design vehicle requirements. For example, a residential street's design speed should typically not exceed its target speed, whereas in an industrial area some leeway should be possible to accommodate turning movements of heavy vehicles.
- Existing roadway geometric features, intersection spacing, or other factors may result in a design speed higher than the target speed. When projects occur on such roadways, measures should be considered to reduce the design speed to match the target speed.
- Descriptions of target speed and other types of speed are included in Figure 36.

Posted Speed Limits

- Nebraska state statute sets standard speed limits based on roadway characteristics and context.
- Deviations from the statutory speed limit are only allowed on the basis of an "engineering and traffic investigation" (speed study), specific to a particular

FIGURE 36 Types of Speed

Target Speed	• The speed that people should drive. • The ideal speed for a street, based on context and function. Guides the selection of design speed.
Design Speed	• Tool to determine the design of the roadway • Determines the design geometric features, which ultimately determines the speed people drive. Should be selected so that the prevailing speed matches the target speed.
Prevailing Speed	• The speed most people drive at or below • Also known as the 85th percentile speed, the prevailing speed is determined largely by the design of the roadway.
Speed Limit	• The legal maximum speed • Should match the target speed, but is also dependent upon the prevailing speed. Lowering speed limits without also making changes to the design is often ineffective at slowing traffic.

FIGURE 37 A

location, which determines the most "reasonable and safe" speed for that roadway segment. The target speeds given in these guidelines are an important component of such a study, but they do not on their own give the city legal authority to set speed limits.
- The 2025 FHWA Speed Limit Setting Handbook contains best practices on how to conduct a speed study. For cities which have adopted a target speed policy, the handbook suggests that posted speed limits should generally be set at or below the target speed, but if operating speeds are higher than the target speed, the agency should modify the roadway to a lower design speed first before lowering the speed limit.
- When possible, install temporary or "quick-build" traffic calming improvements prior to conducting a speed study. This makes the study process more informative by allowing the city to test whether their planned level of traffic calming is sufficient to reduce operating speeds to the desired level.

Number of Travel Lanes

- The number of travel lanes represents the default or typical configuration. Designs can deviate from the parameters if warranted by unique context or constraints.
- Motor vehicle traffic can be restricted to one-way movement, but pedestrian and bicycle traffic should be allowed to travel in both directions.
- The minimum total width for Neighborhood Streets assumes two-way motor vehicle travel. On one-way streets, the minimum traveledway width is 16 feet, which allows an 11-foot lane and a 5-foot counterflow bike lane.

Lane Width

- The Nebraska Board of Classification and Standards limits the minimum lane width for new construction and reconstruction to 11 feet. There are several streets where the preferred width would be less than 11 feet if allowed, including Active Streets, Neighborhood Streets, Active Avenues, and Avenues.
- Narrowing vehicle lane widths opens space for other travel modes like walking and biking.
- Narrower lane widths have been shown to promote slower driving speeds and reduce the severity of crashes. It also reduces crossing distance for pedestrians.
- Active Streets and Neighborhood Streets are not compatible with truck routes. Active Avenues and Avenues may be able to accommodate truck routes with careful consideration of impacts on bicycle and pedestrian modes if expected to be present.
- Designated truck routes should have a minimum 12-foot travel lane.
- For rural streets, paved shoulders should be included. If the shoulder will be accessible for bicyclists, see the Additional Bikeway Design Guidance and Clarification section.

Median Area

- Center turn lanes and medians are not preferred for most access-oriented streets because they increase crossing distances for pedestrians at intersections and take right-of-way that could be used for other elements.
- For typologies in which a median is not preferred or optional, it may still be beneficial to provide crossing islands or non-continuous centerline traffic-calming islands at mid-block crossings and intersections.
- A traffic study should be conducted to establish the need for center turn lanes (and right-turn lanes.

On-Street Parking

- Parallel parking is the preferred configuration. Angled parking can be considered in areas where parking availability is limited and there is sufficient space to accommodate the needs of pedestrians and bicyclists.
- The default width for parallel parking lanes is 8 feet. Narrower lanes (7-foot) lanes may be appropriate in constrained circumstances. When gutter pan is present, it is assumed to be within the parking lane dimension. Decisions regarding parking lane width when adjacent to bike lanes should consider the amount of parking, parking turnover rates, and vehicle types. When parallel parking and bike lanes are provided adjacent to each other, the minimum combined width of the two is 12 feet (minimum 5-foot-wide bike lane), but additional space is desired for a buffer for opening vehicle doors.
- Throughput-oriented streets may include on-street parking in certain contexts (higher density areas).

Additional Pedestrian Zone Guidance and Clarifications

This section provides additional and/or supplemental design guidance and considerations for Pedestrian Zone elements.

Frontage Area

- Where buildings are located against the back of the sidewalk and constrained situations do not provide width for the Frontage Area, the effective width of the Sidewalk Area is reduced by 1 foot as pedestrians will shy away from the building edge.
- Wider Frontage Areas are acceptable where conditions allow (such as in Downtown Norfolk). The preferred width of the Frontage Area to accommodate sidewalk cafes is 6 to 8 feet.

Sidewalk Area

- Also known as the "walking zone," the Sidewalk Area is the portion of the sidewalk space used for active travel. It must be kept clear of any obstacles and be wide enough to comfortably accommodate expected pedestrian volumes including those using mobility assistance devices, pushing strollers, or pulling carts.
- The Sidewalk Area should have a smooth surface, be well lit, provide a continuous and direct path with minimal to no deviation, be adequately maintained, and meet all applicable accessibility requirements.
- In locations with severely constrained rights-of-way, it is possible to provide a narrower Sidewalk Area. The Americans with Disabilities Act (ADA) minimum 4-foot-wide clear zone can be applied using engineering judgment and should account for a minimum 1-foot shy distance from any barriers. If a 4-foot-wide clear zone is used, 5-foot-wide passing zones are required every 200 feet. Driveways can meet the criteria of ADA-compliant passing zones.
- For any sidewalk intended to also convey bicycle traffic (i.e. shared use path), the Sidewalk Area should be a minimum of 10 feet wide. For short segments through constrained environments, 8-foot-wide shared use paths are acceptable.

Buffer Area

- The Buffer Area can provide a temporary emergency repository for snow cleared from streets and sidewalks, although snow storage should not impede access to or use of important mobility fixtures such as parking meters, bus stops, and curb ramps.
- To support street tree installation there should be a minimum of 6 feet of amenity zone.
- Green infrastructure is often located in this zone and should be a minimum of 4 feet of width.
- Utilities, street trees, and other sidewalk furnishings should be set back from curb face a minimum of 18 inches.
- Where on-street parking is not present, a wider Buffer Area should be prioritized over the width of the Frontage Area.
- The preferred width of the Buffer Area to accommodate sidewalk cafes is 6 to 8 feet.
- Curb extensions can extend the Buffer Area and curb into the roadway at key points along a corridor, widening the Pedestrian Zone. Curb extensions can provide additional space needed for pedestrians, bus stops, and various other amenities such as lighting and signal cabinets.

Total Width

- The minimum total width of the Pedestrian Zone for any street with transit service is 8 feet (preferably 10 feet) in order to provide space for a minimum 5-foot wide by 8-foot deep landing zone at bus stops.

Additional Bikeway Design Guidance and Clarifications

This section provides additional and/or supplemental design guidance and considerations for bikeways, which can be located in either the Pedestrian Zone or the Roadway Zone.

Default Bikeway Type

The identified typical bikeway type in the previous design guidance indicates what is typically appropriate for the transportation function and land use context. This does not indicate a minimum or maximum standard. Designers should consider traffic speeds, forecasted volumes, anticipated users, and many other factors for each individual project when selecting the most appropriate bikeway.

Motor vehicle traffic volumes and speeds greatly impact bicyclist comfort and safety. Roadways with speed limits higher than 25 MPH are more stressful and dangerous for bicyclists. As motorized traffic volumes increase above 3,000 vehicles per day, it becomes increasingly difficult for motorists and bicyclists to share roadway space.

As shown in Figure 38, bicyclists' comfort, confidence, and willingness to interact with motor vehicle traffic varies considerably. Most bicyclists have a low tolerance for interacting with motor vehicle traffic. The type of bikeway facility and degree of separation from traffic will determine whether the bike facility will be used by bicyclists of all ages and abilities or only a few experienced enthusiasts.

FIGURE 38 Comfort Typology of Bicyclists

Comfort Typology of Bicyclists

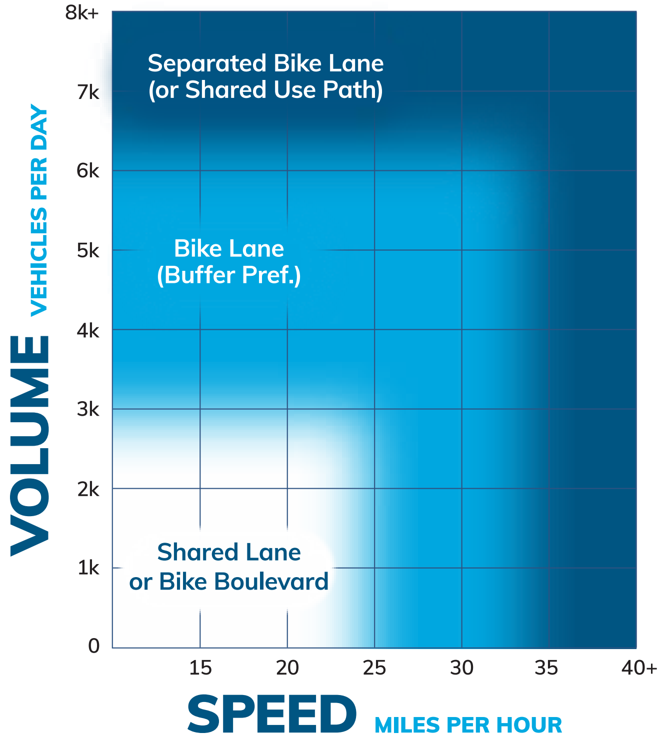
Design User Profile	Non-Bicyclist	Interested but Concerned	Somewhat Confident	Highly Confident
Bicycling Preferences	Uncomfortable bicycling in any condition, have no interest in bicycling, or are physically unable to bicycle.	Often not comfortable with bike lanes, may bike on sidewalks even if bike lanes are provided; prefer off-street or separate bicycle facilities or quiet or traffic-calmed residential roads. May not bike at all if bicycle facilities do not meet needs for perceived comfort.	Generally prefer more separated facilities, but are comfortable riding in bicycle lanes or on paved shoulders if need be.	Comfortable riding with traffic, will use roads without bike lanes.
Percent of General Public	31-37%	51-56%	5-9%	4-7%

Source: AASHTO Guide for the Development of Bicycle Facilities, 2024

Bikeway Type Selection

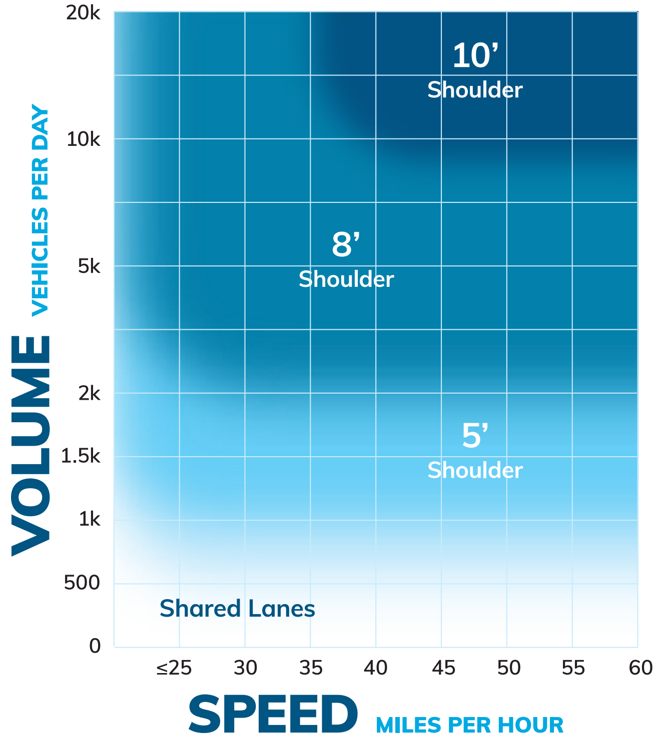
Figure 39 and Figure 40 illustrate standard guidance for how motor vehicle speeds and volumes should be taken into consideration when selecting the preferred bikeway type that is focused on the Interested but Concerned bicyclist. These graphs are a starting point, and additional considerations should be consistent with national guidance from the American Association of State Highway and Transportation Officials (AASHTO) and the National Association of City Transportation Officials (NACTO).

FIGURE 39 Preferred Bikeway Type for Urban, Urban Core, Suburban, and Rural Town Contexts



Source: *FHWA Bikeway Selection Guide, 2019*

FIGURE 40 Preferred Shoulder Widths for Rural Roadways



Source: *FHWA Bikeway Selection Guide, 2019*

Shared lanes or **bicycle boulevards** are generally appropriate on streets with traffic volumes at or below 3,000 vehicles/day and posted speeds at or below 25 mph. It is assumed that posted speeds are approximately the same as operating speeds. If operating speeds differ from posted speeds, then operating speed should be used instead of posted speed. Neighborhood Streets are good candidates for bicycle boulevards, routes that prioritize bicycle travel by including traffic calming to slow motor vehicle traffic, implementing traffic diversion to limit motor vehicle traffic volumes, minimizing stopping at minor intersections, and including safe and comfortable major street crossings. Examples of shared lanes and/or bicycle boulevards are provided in Figure 41.

Bike lanes are the preferred facility type when traffic volumes are between 3,000 to 6,000 vehicles/day and posted speeds are 25 to 30 mph. However, to appeal to more potential bicyclists of all ages and abilities, consider shared use paths or separated bike lanes. Within this traffic volume and speed range, **buffered bike lanes are preferred** over standard bike lanes to provide and delineate spatial separation between modes. Bike lanes should be a minimum of 6 feet wide where adjacent to on-street parking. Bike lanes may be 5 feet wide where on-street parking does not exist or in constrained environments. An additional buffer should be considered between the bike lane and adjacent on-street parking. Examples of buffered bike lanes are provided in Figure 42.

FIGURE 41 Shared Lanes / Bicycle Boulevard Examples

FIGURE 42 Buffered Bicycle Lane Examples

Separated bike lanes and shared use paths are the preferred facility type as traffic volumes exceed 6,000 vehicles/day or vehicle speeds exceed 30 mph. However, because many higher-traffic streets (especially Connectors) often have constrained rights-of-way, it may be infeasible to provide these facilities. Parallel routes or bicycle boulevards on lower speed/traffic streets is recommended in these situations. One-way separated bike lane widths generally range between 5.5 feet to 10+ feet, two-way separated bike lane widths generally range between 9 feet and 16+ feet, and street buffer widths are preferred to be 6 feet or more but can be as little as 2 feet. [2,3] Examples of separated bike lanes are provided in Figure 43.

2 NACTO Urban Bikeway Design Guide

3 AASHTO Guide for the Development of Bicycle Facilities.

Shared use paths can be acceptable design solutions in lieu of separated bike lanes in land use contexts where pedestrian volumes are relatively low and are expected to remain low. The shared use path may be located on one or both sides of the street—preferably both—but dependent upon bicycle and pedestrian network connectivity needs. If pedestrian volumes increase, the need for separation of bicyclists and pedestrians should be considered. The preferred width of a shared use path is 12 feet. Paths narrower than 11 feet do not allow two people traveling side-by-side to be comfortably passed by a person approaching from the opposite direction.. Examples of shared use paths are provided in Figure 44.

There may be conditions under which it is infeasible to provide bicycle facilities that are sufficiently comfortable for most people. Under these conditions, it may be necessary to select the next-best facility type, which may have less separation between bicycle and motor vehicle traffic than the ideal facility. A proximate and parallel route should be included for people of all ages and abilities. Deviations should be documented along with a justification.

FIGURE 43 Separated Bike Lanes Examples

FIGURE 44 Shared Use Path Examples

Additional Intersection and Crossing Design Guidance and Clarifications

This section provides additional and/or supplemental design guidance and considerations for intersections and crossings.

Crosswalks

- By legal definition, there are crosswalks, whether marked or unmarked, at any intersection location where a sidewalk leads to and crosses the intersection, unless pedestrian crossing is explicitly prohibited. Marking crosswalks is beneficial for many reasons, including alerting drivers to pedestrian presence, directing pedestrians to the safest crossing, and discouraging drivers from blocking the pedestrian crossing at intersections.
- Although national crosswalk spacing guidance is ambiguous, NACTO guidance states that "crosswalk spacing criteria should be determined according to the pedestrian network, built environment, and observed desire lines. In general, if it takes a person more than 3 minutes to walk to a crosswalk, wait to cross the street, and then resume his or her journey, he or she may decide to cross along a more direct, but unsafe or unprotected, route. While this behavior depends heavily on the speed and volume of motorists, it is imperative to understand crossing behaviors from a pedestrian's perspective."[4] A three minute walk equates to around 660 feet to 800 feet. Crosswalk placement should consider many elements including surrounding context, land uses, network connectivity, block length, proximity to other crosswalks and intersections, and existing and future pedestrian demand and desire lines. Crosswalk placement should encourage crossings at safe locations.
- Marked crosswalks should be located at most, if not all, access-oriented streets, and on balanced streets and throughput-oriented streets when pedestrian activity is present or expected. Crosswalks may need to be supplemented with pedestrian refuge islands, curb extensions, increased signal cycle length, overhead illumination, warning signs, etc. depending on motor vehicle traffic speeds and volumes.

4 Urban Street Design Guide, National Association of City Transportation Officials.

- Crosswalk markings must comply with the MUTCD standards. Crosswalks should be aligned with the approaching sidewalk and as close as possible to the parallel street.
- High-visibility markings (continental or ladder crosswalks) may be used at any location, but are especially important at midblock crossings, designated school crossings, and near heavy pedestrian generators such as major destinations, transit stops, and parks.
- Agencies should use materials such as inlay or thermoplastic tape, instead of paint or brick, for highly reflective crosswalk markings and a longer life cycle.
- On multi-lane roadways, agencies can use "YIELD Here to Pedestrians" or "STOP Here for Pedestrians" signs 20 to 50 feet in advance of a marked crosswalk to indicate where a driver should stop or yield to pedestrians.
- In-street signing, such as "STOP Here for Pedestrians" or "YIELD Here to Pedestrians" may be appropriate on access-oriented streets that have lower traffic speeds and high pedestrian volumes.
- On-street parking and other obstructions should be prohibited at least 20 feet away from a crosswalk. This is called intersection daylighting. Streets with higher speeds and those without curb extensions at crosswalks should have parking restrictions greater than 20 feet and be based upon sight distance evaluation.

Midblock Crossings

- High visibility (continental or ladder markings) marked crosswalks are recommended at all midblock crossings, especially those without traffic control.
- On-street parking and other obstructions should be prohibited at least 20 feet away from a midblock crossing to improve visibility of pedestrians about to cross.
- Midblock crossings may be needed on throughput streets with infrequent intersections, or where there are large gaps in comfortable crossings. Mid-block crossings can significantly shorten pedestrian and bicycle trips and encourage safer pedestrian and bicycle crossings at designated and highly visible locations.

- Midblock crossings should be considered along streets where intersections are more than 600 feet apart, or more than 400 feet apart in areas with high pedestrian volumes. Extra consideration should be given to streets segments that have a history of midblock pedestrian involved fatal and serious injury crashes and locations near parks, schools, and transit stops.
- Midblock crossings should be considered where there are more than 25 pedestrian crossings per hour within a 4-hour peak observation period, or more than 10 pedestrians per hour at locations with significant numbers of children, the elderly, or disabled pedestrians.

Corner Radii

- Small corner radii are an effective way to make design speed match target speed. Large radii are associated with higher design speeds and small radii are associated with lower design speeds.
- Recommended values provided in the design guidance refer to the actual radii of curb returns. In many cases, the effective corner radii—the curve which motor vehicles follow when turning—will be significantly greater than these values.
- Small curb radii benefit pedestrians by creating sharper turns that require motorists to slow down, increasing the size of waiting areas, allowing for greater flexibility in the placement of curb ramps, and reducing pedestrian crossing distances.
- Ideally, the curb radius should be as small as possible while accommodating the appropriate design vehicle for the intersection.
- Effective corner radii can be increased for large vehicles through the provision of truck aprons, which retain the traffic-calming effect of smaller corner radii for passenger vehicles. Planning for lane encroachment can also allow corner radii to remain small.
- At signalized intersections, corner design should assume that a large vehicle will use the entire width of the receiving lanes on the intersecting street. Where additional space is needed to accommodate large vehicles, consideration can be given to recessing the stop bar on the receiving street to enable the vehicle to use the entire width of the receiving roadway.
- On low volume (less than 4,000 vehicles per day), two-lane streets, corner design should assume that a large vehicle will use the entire width of the departing and receiving travel lanes, including the oncoming traffic lane.
- In some cases, it may be possible to allow a large turning vehicle to encroach on the adjacent travel lane on the departure side (on multi-lane roads) to make the turn.
- Curb radii values provided in the design guidance assume that right-turn slip lanes are not present. If a radius over the maximum value for a street in the throughput-oriented street is deemed necessary, a right-turn slip lane should be provided and a refuge (or "pork chop" island) should be included. The design of right-turn slip lanes should create a 55-to-60-degree angle between motor vehicle flows and should either be stop-controlled or have a raised crossing.

Transitional Intersections

Intersections can often be the most dangerous place in a transportation network, especially for pedestrians and bicyclists as they move from a protected environment like a sidewalk to a shared space with vehicles. This is especially true in Norfolk where 81% of all Fatal and Injury (FAI) crashes were intersection related.

The convergence of two street types should reflect the context including surrounding land uses. Elements of intersections such as crosswalk location, traffic control devices, curb alignment and radius, and bicycle facilities vary in design and configuration depending on the transportation function and surrounding land use context.

Intersections that mark a transition from one street type to another should alert all users of the change in the character of the roadway through obvious and intuitive design features. Elements of street types should override features on other street types. Typically, the intersection design should default to the criteria for the lower-speed street to calm traffic overall.

Two intersection types are described in this section because of their critical transitions, which may be more complicated than intersections between streets with similar functions.

Intersections of Throughput and Balanced Streets

When drivers turn off a higher speed throughput street onto a lower-speed balanced street, the design should alert them of the change and encourage drivers to slow down. Treatments such as pavement texture, tighter curb radii, curb extensions, narrower roadway widths, and even raised crosswalks can help create slower speeds and visually emphasize the change in transportation function.

At these intersections, pedestrian crossings of throughput streets should also be considered. Crosswalks should be highly visible and include enhanced crossing features such as median refuge islands, warning signs, or traffic control like a Pedestrian Hybrid Beacons (PHB) or Rectangular Rapid-Flashing Beacons (RRFB), depending on traffic speed and expected pedestrian volumes.

Intersections of Throughput and Access Streets

Access streets typically have higher pedestrian volumes than throughput or balanced streets. The greater presence of vulnerable road users should be a top design considered, especially when intersecting with a street that prioritizes throughput. Gateway treatments such as traffic calming measures and creating inviting streetscapes should denote locations where these streets of different function intersect.

Intersections of throughput and access streets should prioritize safe pedestrian crossings by shortening crossing distances and enhanced pedestrian signals such as leading pedestrian intervals and countdown timers. Access street crossings may not be needed at every intersection with a throughput street, but enhanced crossings should be prioritized at locations near schools, parks, transit stops, and in locations to minimize distances between safe and comfortable crossings of throughput streets..

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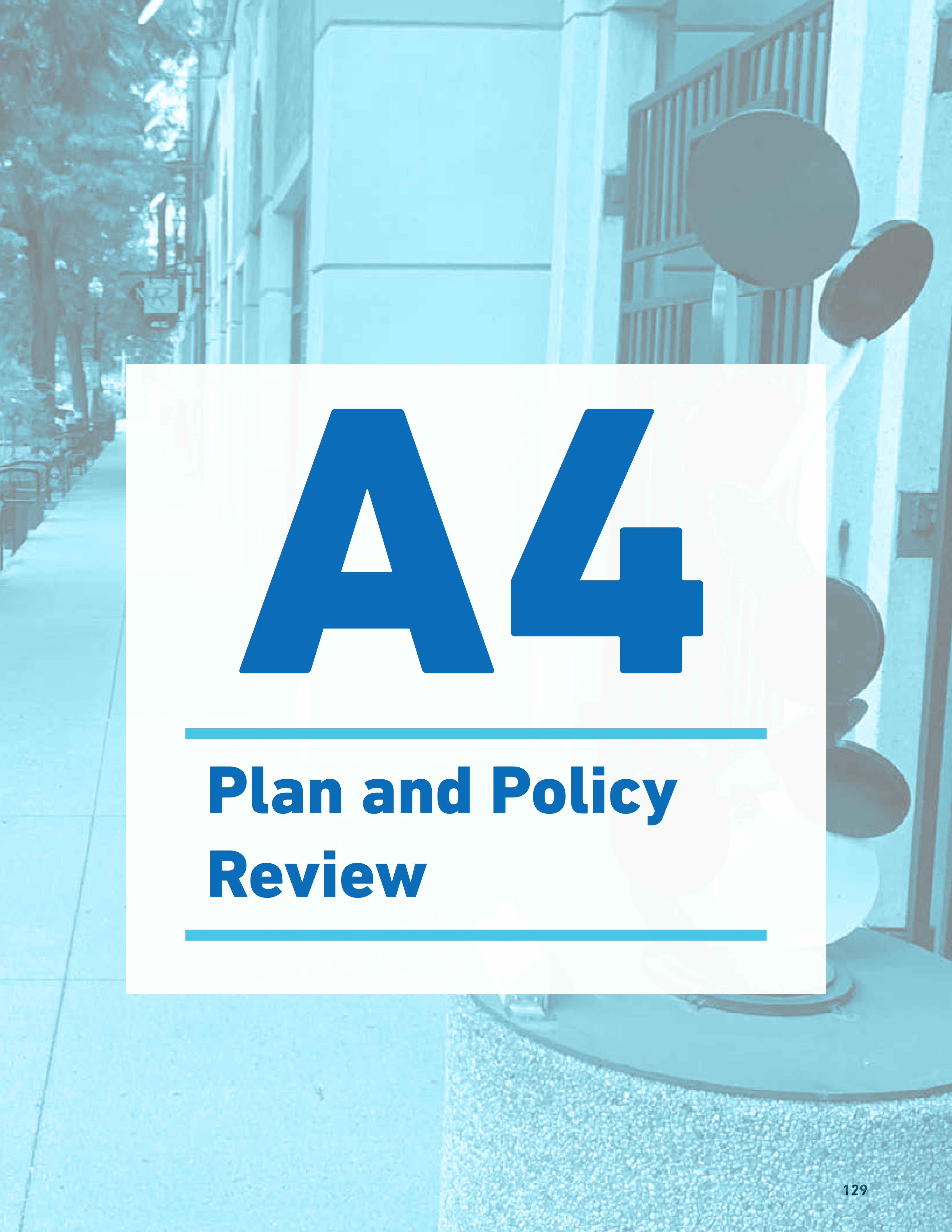

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Plan and Policy Review

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Plan and Policy Review

This Plan and Policy Review Memo (Memo) examines existing plans, policies, and various documents related to transportation safety and Complete Streets in the city of Norfolk. Documents were provided by staff at the city. Information contained in this Memo will be used by the project team throughout the planning process and inform final recommendations within the Multimodal Transportation Action Plan (MTAP).

Plans and policies reviewed include the following:

- Norfolk Comprehensive Plan (2017)
- Transportation Plan 2030 (2006)
- Street Improvement Plan (2022)
- One- and Six-Year Plan (2023-2024)
- Norfolk Bicycling & Walking Network Plan (2020)
- 1st Street Bridge Replacement and Round-A-Bout (2024)
- East Benjamin Connector Trail (2023)
- Johnson Park Development (2024)
- Benjamin Avenue (2024)
- Community Wayfinding (Ongoing)
- Downtown Norfolk Revitalization Grant (Ongoing)
- Downtown Area Study (2023)
- South Norfolk Revitalization – Northwestern and 1st Street (Ongoing)
- RAISE Grant Map and Resolution (2024)
- City Code. Chapter 5. Bicycles and Motor Scooters
- City Code. Chapter 22. Streets and Sidewalks
- City Code. Chapter 23. Subdivisions
- City Code. Chapter 24. Traffic
- City Code. Chapter 18. Parks and Recreation. Article II. Trails
- City Code. Chapter 18. Parks and Recreation. Article I – Parks. Sections 18-21
- City Code. Chapter 21. Railroads
- North Fork Area Transit
- Community Driven Street Repair Survey (2023)
- Parks and Recreation Needs Assessment Survey Findings Report (2023)
- Safe Communities America – Norfolk, Nebraska (Ongoing)
- Lower Elkhorn NRD Multi-Jurisdictional Hazard Mitigation Plan (2020)

Norfolk Comprehensive Plan (2017)

Description:

- The Norfolk Comprehensive Plan addresses community needs and is used as a decision-making tool to guide future development and growth.

Elements for MTAP:

- Includes transportation safety and multimodal goals including:
    - Develop a comprehensive multimodal transportation network including pedestrians, vehicles, rail, and air.
    - Develop and maintain a pedestrian and bicycle network that is integrated with local transportation and recreation master planning efforts, thus creating opportunities for community wide use connecting neighborhoods to essential daily needs and destinations.
    - Investigate the application of complete streets and road diets to enhance downtown, and other select pedestrian and residential oriented areas.
    - Develop context sensitive design criteria for roadways based upon topographic features and development type and character.
    - Promote the development of neighborhood scale institutions (i.e. schools, places of worship), facilities (i.e. parks, community gardens) and amenities whenever possible to support informal and formal recreation activity.
    - Continue implementation efforts related to the Riverfront Trail, and develop a viable network to connect parks, community facilities, and destinations with neighborhoods via designated pedestrian and bicycle trails.
    - Become known as a welcoming and accommodating community in the region offering unique daily recreational experiences for citizens and annual recreational events for visitors with special needs.
    - Continue to strengthen relationships through community programs that reach out to and educate the community regarding public safety and health initiatives.

- Continue efforts to develop a community trail along the riverfront that connects with other community facilities and destinations.
- Continue to expand the attractive qualities of "downtown/main street" with programed aesthetic and functional improvements (e.g. signage, lighting, pedestrian enhancements, multi-functional streetscape, roadway, etc.) beyond Main Street into the Downtown District.

- The transportation section calls for gradual adaptation of major pedestrian corridors to full accessibility will be an important priority for Norfolk's pedestrian system.
- Complete Streets section acknowledges that city transportation plans and projects have focused on vehicles but should include Complete Streets moving forward. It also acknowledges that there are some corridors that consider alternative modes, however, neither pedestrian nor bicycle traffic is provided in such a way as to accommodate travel for these two alternative modes throughout the community.
- States that sidewalks and bicycle facilities should be implemented strategically, especially as they cross major thoroughfares.

Opportunity:

- Include a Vision Zero goal to emphasize safety in the next plan update.
- Add focus for Complete Streets to develop connected and accessible multimodal networks and working towards best practices for providing safe and comfortable facilities for all ages and abilities.

Transportation Plan 2030 (2006)

Description:

- The Norfolk 2030 Plan aims to provide Norfolk with a safe, efficient, and balanced transportation system that provides mobility for all, promotes clean air, conserves energy, preserves neighborhood livability, and enhances the quality of life for its citizens and guests. Norfolk's transportation system will be safely used by people of all ages and income classes, and be supported by a dedicated, sustainable transportation-funding source.

Elements for MTAP:

- Safety is a goal of the plan - increase the safety and security of the transportation system for motorized and non-motorized users, minimizing the occurrence of crashes that might result in the loss of health, life, and property.
- There is a connectivity/compatibility goal that includes minimize conflicts between and within vehicular roadways, rail, public transit, bicycle, and pedestrian facilities.

Opportunity:

- Update the plan, as the current plan is almost 20 years old.
- Add a focus on Vision Zero – eliminating fatal and serious injury crashes.
- Add a focus on Complete Streets – expanding the network of safe, connected, and accessible multimodal networks.

Street Improvement Plan (2022)

Description:

- Norfolk has identified several planned repairs and renovations to existing streets and intersections. Project funding would stem from a local option sales tax subject to Norfolk voter approval in November 2022. This includes $12 million for street improvements.

Elements for MTAP:

- Contains a pdf map of planned street improvements by surface type.
- Contains a map of planned intersection repairs.

Opportunity:

- Introduce a formal process where roadway improvement projects must incorporate, or at least consider or assess feasibility, safety and Complete Streets design elements.
- Include bicycle and pedestrian safety and access enhancements to intersection into intersection repair plans such as high visibility crosswalks and stop bars.

One- and Six-Year Plan (2023-2024)

Description:

- This plan from the Norfolk's Public Works Dept. outlines roadway projects slated for implementation with costs of construction. It provides brief details for some projects.

Elements for MTAP:

- Traffic signal system received upgrades including pedestrian activation.
- 25th St redesigned with 8 ft walking paths on each side.
- Intersection studies at Benjamin Ave & Victory Rd and at 7th & Madison.

Opportunity:

- Establish and follow a transparent project selection process that incorporates roadway safety (inclusion in the HIN or HRN) and Complete Streets into project scoring.
- Include safety and Complete Streets design into future roadway projects.

Norfolk Bicycling & Walking Network Plan (2020)

Description:

- This plan focuses on identifying bicycling and walking needs citywide, developing recommendations for expanding the biking and walking network, and conceptualizing how Norfolk streets could be reconfigured to better accommodate active transportation.

Elements for MTAP:

- Community engagement focused on existing trail facilities, connectivity, and bike/ped destinations as well as future corridors.
- Problem areas and network gaps for walking, biking and popular destinations were identified in this process.
- Complete Streets design concepts were created for Norfolk Avenue and Riverside Boulevard.
- Key recommendations included enhancing facility design (especially along Benjamin Avenue), working towards Complete Streets, and developing wayfinding for pedestrians and bicyclists.

Opportunity:

- Analyze pedestrian and bicyclist FSI crash history to identify hotspot locations and roadway characteristics that lead to these crashes.
- Create a matrix that recommends safety countermeasures based on crash history and context.

1st Street Bridge Replacement and Round-A-Bout (2024)

Description:

- This project will be complete in summer of 2024. The project consists of a new bridge, a roundabout, sidewalks trails, pedestrian bridge over the river, new street lighting, and recreational improvements to the river.

Elements for MTAP:

- The project offers a recreational destination in the center of Norfolk with walking path connections and a new roundabout and lane reductions to calm traffic.

Opportunity:

- Use lessons learned from this project to implement similar traffic calming, accessibility, and safety improvements throughout the city.

East Benjamin Connector Trail (2023)

Description:

- Completed in 2023, this trail project included construction of a new 10' wide trail from Victory and Benjamin Ave to Hwy 35.

Elements for MTAP:

- Local pedestrian/biking trail connecting to existing trails.

Opportunity:

- Improve crossings and pedestrian and bicyclist visibility at rural road intersections along E Benjamin Ave and crossings at N Victory Rd and Hwy 35.
- Add pedestrian comfort elements to paths such as shade trees and benches.

Johnson Park Development (2024)

Description:

- This project will be completed in 2024. It renovates Johnson Park to add new sidewalks, a playground, off street parking, lighting improvements, ice skating rink, amphitheater, nature playground, picnic shelters, and a fountain. It will also add ADA accessibility to the river.

Elements for MTAP:

- This project improves the river access and several other elements in Johnson's park, which is directly adjacent to the 1st Street bridge replacement and roundabout project. It should greatly improve pedestrian access and interest in the area.

Opportunity:

- Use lessons learned from this project to implement similar improvements where needed in the city.
- Perform a before and after safety analysis to estimate crash reduction benefits.
- Continue to improve pedestrian and bicycling access to the park and river.

Benjamin Avenue (2024)

Description:

- This project will be completed in summer 2024. It includes the reconstruction of the 5-lane concrete paved roadway, new street lights, bike path, sidewalks, new traffic signals at riverside, and landscaping.

Elements for MTAP:

- This project improves pedestrian and bicyclist improvements along the corridor, extending on to Riverside Boulevard.

Opportunity:

- Consider narrower lane widths to calm traffic and create buffer space for areas where the sidewalk is close to the roadway.
- Improve pedestrian crossing infrastructure at intersections and potentially a mid-block crossing near First Baptist Church and the YMCA.

Community Wayfinding (Ongoing)

Description:

- This plan will help guide visitors into the community, so they are able to enjoy the many opportunities offered by local businesses and the community at large. Phase 1 of this project started in 2019 and phase 2 in 2020. Downtown parking signs are in place, but there is additional work that will be put in place in the next year.

Elements for MTAP:

- Wayfinding can prevent driver, pedestrian, and bicyclist confusion.
- Elements like well-marked or decorative crosswalks can provide safer crossing opportunities by highlighting an intersection or slowing down traffic.
- Signs pointing to trails, bike routes, and parks can increase pedestrian and cyclist activity, comfort, and confidence.

Opportunity:

- Involve local artists to help paint any decorative crosswalks after developing guidelines for them to follow.
- Consider having the public input on design selection.

Downtown Norfolk Revitalization Grant (Ongoing)

Description:

- Norfolk received a Community Development Block Grant (CDBG) that included funds to improve three midblock crossings to make them more ADA accessible. These locations are all on Norfolk Ave and the project is ongoing.

Elements for MTAP:

- This grant will improve three pedestrian crossings on Norfolk Ave, along with façade improvements in downtown Norfolk.

Opportunity:

- Based on crash history, additional safety countermeasures may be needed at these locations, such as a Rectangular Rapid Flashing Beacon (RRFB) or crossing enhancements.

Downtown Area Study (2023)

Description:

- The Norfolk Downtown Area blight and substandard study is intended to give the Community Development Agency and City Council the basis for considering the existence of blight and substandard conditions and then working to improve conditions.

Elements for MTAP:

- The plan's definition of a blighted area includes the "existence of defective or inadequate street layout", and can include street conditions, dead ends, railroad crossings, narrow alleyways, blind crossings, and sidewalk conditions.

- The plan notes a lack of crossing gates to prevent vehicular and pedestrian crossings at railroad tracks.

Opportunity:

- Streets were checked for how they might contribute to blighted conditions but only with regards to dead ends, improperly recorded street vacancies, etc. A study of the street surface conditions was outside of the plan scope, as were sidewalk conditions. The city could conduct a city-wide street and sidewalk conditions study to better understand road, bike path, and sidewalk conditions to prioritize reconstruction projects.

South Norfolk Revitalization – Northwestern and 1st Street (Ongoing)

Description:

- The goal of the South Norfolk Revitalization is to discuss priority areas for improving South Norfolk, identify tools and strategies for implementation, communicate programs, and unify the district. This project will also explore the feasibility of a business improvement district (BID) for South Norfolk.

Elements for MTAP:

- In a SWOT analysis, infrastructure such as sidewalks and curbs are listed as a weakness.
- In a needs assessment, gaps between trail systems were identified as a need. Bike boulevards and bike lanes were identified to help fill those gaps. Street, curb, and sidewalk repairs are also highlighted as needs for the area.
- The community also wants to improve connections to Ta Ha Zouka Park.

Opportunity:

- Use this revitalization project as an opportunity to improve safety and accessibility in the South Norfolk area by improving street conditions and adding trail and sidewalk connections where gaps or poor infrastructure currently exist.
- Consider adding lighting and landscaping.
- Improve pedestrian crossings in the area by adding high visibility crossings at intersections.

RAISE Grant Map and Resolution (2024)

Description:

- The Local Intermodal Network Connection (LINC) project was submitted to provide a 60% design on a 4.8-mile multimodal path and other infrastructure to accommodate a 10' wide path. A resolution was also written to support this grant application.

Elements for MTAP:

- The path will provide a safe, accessible route for the active transportation network in the community and will connect Skyview Park, from the northwest area of town to the Cowboy Trailhead and Ta-Ha-Zouka Park in the southeast area of town, passing through the heart of Norfolk to provide a vital connection to the historically disadvantaged areas of town.
- 4 out of 5 census tracts that this project goes through are historically disadvantaged.

Opportunity:

- Conduct a road safety analysis as part of this project to identify specific safety countermeasures that can improve safety at locations that appear on the High Injury Network and/or High Risk Network.

City Code. Chapter 5. Bicycles and Motor Scooters

Description:

- Chapter 5 of the city code details requirements for bicycle ownership and operation within city limits of Norfolk. It includes requirements for carrying passengers, riding on roadways, paths, and sidewalks, and bike parking. The ordinance outlines similar requirements for motor scooters.

Elements for MTAP:

- Bicycles operated within the city need to be registered and licensed to the owner.
- Bicycles operated after dark must be equipped with a white light on the front and red light or reflector on the back of the bike.
- Motor scooters are allowed on city sidewalks/paths as long as they are less than 20 mph max speed. Pedestrians are to be given ROW on sidewalks.

Opportunity:

- Improve lighting along bicycling paths and routes to improve visibility of bicyclists at night.
- Improve bicyclist and scooter infrastructure to prevent people from breaking laws out of necessity due to having no better options.
- While requiring bicycle licenses and registrations may serve a legitimate purpose, it can also act as barrier to those considering bicycling for trips. Research has shown that bike licensing laws and requiring bike lights can be applied inequitably. Place limits on pre-textual stops to reduce potential for profiling issues.

City Code. Chapter 22. Streets and Sidewalks

Description:

- Chapter 22 of the city code outlines requirements to clear snow and other environmental or personal obstructions from sidewalks. It also sets minimum design requirements for different zones including widths (which were raised to five feet), slope, gradient, and thickness.

Elements for MTAP:

- The ordinance prohibits the use of bicycles and other conveyances in certain areas of the city.
- Property owners are responsible for the upkeep and replacement of sidewalk infrastructure on their property.

Opportunity:

- Add language that says while 5 ft width is the minimum, the city will make efforts to build wider sidewalks where many people are or will be walking.
- Consider treating sidewalk maintenance and repair the same as street maintenance and repair.
- Consider prioritizing sidewalk construction and maintenance in disadvantaged areas to ease the burden of costly repairs on property owners who may not be able to afford them.
- Consider a robust and publicly transparent sidewalk repair prioritization process so property owners understand how sidewalk issues are identified for repair and how repairs are made.

City Code. Chapter 23. Subdivisions

Description:

- Chapter 23 of the city code provides guidelines and requirements for the development of subdivisions, including sidewalks and streets within the development.

Elements for MTAP:

- Sidewalks must be included on both sides of the roadway and designed in accordance with Chapter 22 of the city code, unless an exception is approved by the city council.
- Minimum street width for new streets within a subdivision is 60 ft unless the planning commission deems that is not feasible.
- Block lengths limited to a maximum of 1,320 ft in length.

Opportunity:

- Consider setting standard street types and developing standard right-of-way widths for each type.
- Decrease the minimum street widths for new subdivided streets, or mandate that lane widths on these streets be marked at no more than 11 ft in width with 10 ft being preferred. Narrower street widths and narrower lanes have been shown to naturally calm traffic and reduce vehicle speeds.
- Decrease the maximum block length allowed in new subdivisions. Shorter block lengths provide more access for bicyclists and pedestrians. In locations where block lengths are longer, require a walking/biking path to be built to allow pedestrian and bicyclist access between blocks.

City Code. Chapter 24. Traffic

Description:

- Chapter 24 of the city code provides requirements to safely operate a motor vehicle and other modes of conveyance on Norfolk public streets. This chapter includes requirements for traffic control devices and signals such as – crosswalks and pedestrian controls.

Elements for MTAP:

- Provisions for child passengers are included, requiring age-appropriate child seats and seat belts for those up to the age of 8.
- Helmets are required for motorcyclists and scooters.

- The Speed division of the code sets a 25 mph limit in residential districts and 20 mph in business districts.

Opportunity:

- Responsibility for the inclusion, designation, and maintenance of crosswalks should move from the Chief of Police to the city's public works department so that they can better incorporate crosswalks in projects if this is not already informally the case.
- Under general rules of vehicle operation, add a section to address distracted driving which meets or exceeds the state law.
- Consider lowering speed limits on roadways with higher speed limits where pedestrians and bicyclists are likely where possible. Studies have shown lower vehicle speeds result in fewer fatalities and higher comfort for pedestrians and bicyclists.

City Code. Chapter 18. Parks and Recreation. Article II. Trails

Description:

- The trails section of the city code is within Chapter 18: Parks and Recreation

Elements for MTAP:

- This section establishes an advisory board that advises the mayor and city council on trail policies, advocates for projects, identifies funding sources for trail development, and recommends trail projects in the city, among other tasks.

Opportunity:

- Require within the city code that the advisory board work with the public works department or other entity to develop a long term and comprehensive plan for how trails will be developed and connect with one another city-wide.

City Code. Chapter 18. Parks and Recreation. Article I – Parks. Sections 18-21

Description:

- This section of Chapter 18 of the city code prohibits skates, bicycles, and other means of conveyance in Riverpoint Square.

Elements for MTAP:

- Scooters, wheelchairs, and other equipment for those with limited mobility are allowed in Riverpoint Square.

Opportunity:

- No identified opportunities

City Code. Chapter 21. Railroads

Description:

- Chapter 21 of the city code addresses railroad guidelines within the city.

Elements for MTAP:

- Railroad companies are responsible to maintain, at their own expense, railroad crossings and provide and maintain gates at each crossing. They are also responsible for lighting at crossings.

Opportunity:

- Add provisions for safe pedestrian and bicyclist crossings at each railroad crossing within the city.

North Fork Area Transit

Description:

- Norfolk maintains a scheduled curb-to-curb transit service called Telelift and a regional bus service that travels between the Hy-Vee in Norfolk to the Great Dane, a major employer in Wayne, NE.

Elements for MTAP:

- The Telelift service are scheduled 24 hours in advance and is wheelchair accessible. It operates from 6 AM to 6 PM during the week and at reduced hours on weekends. The regional bus service operates between Norfolk and Wayne Tuesdays-Fridays, with trips very early in the morning and in the afternoon. This service costs $5 one-way.

Opportunity:

- Study opportunities to expand the service to additional major employers and/or expand service hours.

Community Driven Street Repair Survey (2023)

Description:

- A survey was conducted to obtain feedback from Norfolk residents to prioritize street repairs throughout the city.

Elements for MTAP:

- The survey included 73 street segments that could be selected for repairs, or residents could write-in a roadway segment of their choosing.
- Survey responders were asked to select or write-in their top 15 corridors for repair.
- The top results would be taken to the City Council Infrastructure Subcommittee for review. $5 million would then be sent for survey and design and repairs over the next two fiscal years.

Opportunity:

- Consider repeating this community driven survey process for sidewalks and paths.

Parks and Recreation Needs Assessment Survey Findings Report (2023)

Description:

- A community survey was complete to assess community needs related to parks and recreation priorities, which includes walking and biking.

Elements for MTAP:

- Multi-use paved trails had the 5th highest percent of householders with unmet needs behind 1) indoor swimming pools, 2) swimming beach, 3) natural areas, and 4) sledding hill.
- Multi-use paved trails had the highest importance to residents of all amenities/facilities. These were in the top four choices for 32% of households. The next highest was indoor swimming pool with 23%.
- The Priorities for Facility Investment (PIR) tool shows that multi-use paved trails are the highest priority for investment.

Opportunity:

- The community clearly needs and desires more trails and the community should be investing in its trails.

Safe Communities America – Norfolk, Nebraska (Ongoing)

Description:

- The Norfolk Safe Community Steering Committee is composed of representatives from Norfolk's schools, law enforcement, first responders, human services, service organizations, disaster services, health care, government, and local businesses and industry. The mission of the Norfolk Safe Community Steering Committee is to establish a community partnership dedicated to educating and preventing intentional and unintentional injuries in all parts of the community.
- This effort is currently inactive.

Elements for MTAP:

- Motor vehicle crashes are one of the issues this committee is trying to prevent.
- They work with a fire station to do car seat inspections once a month.

Opportunity:

- The committee could work to address issues within the community that relate to pedestrian and bicyclist safety.

Lower Elkhorn NRD Multi-Jurisdictional Hazard Mitigation Plan (2020)

Description:

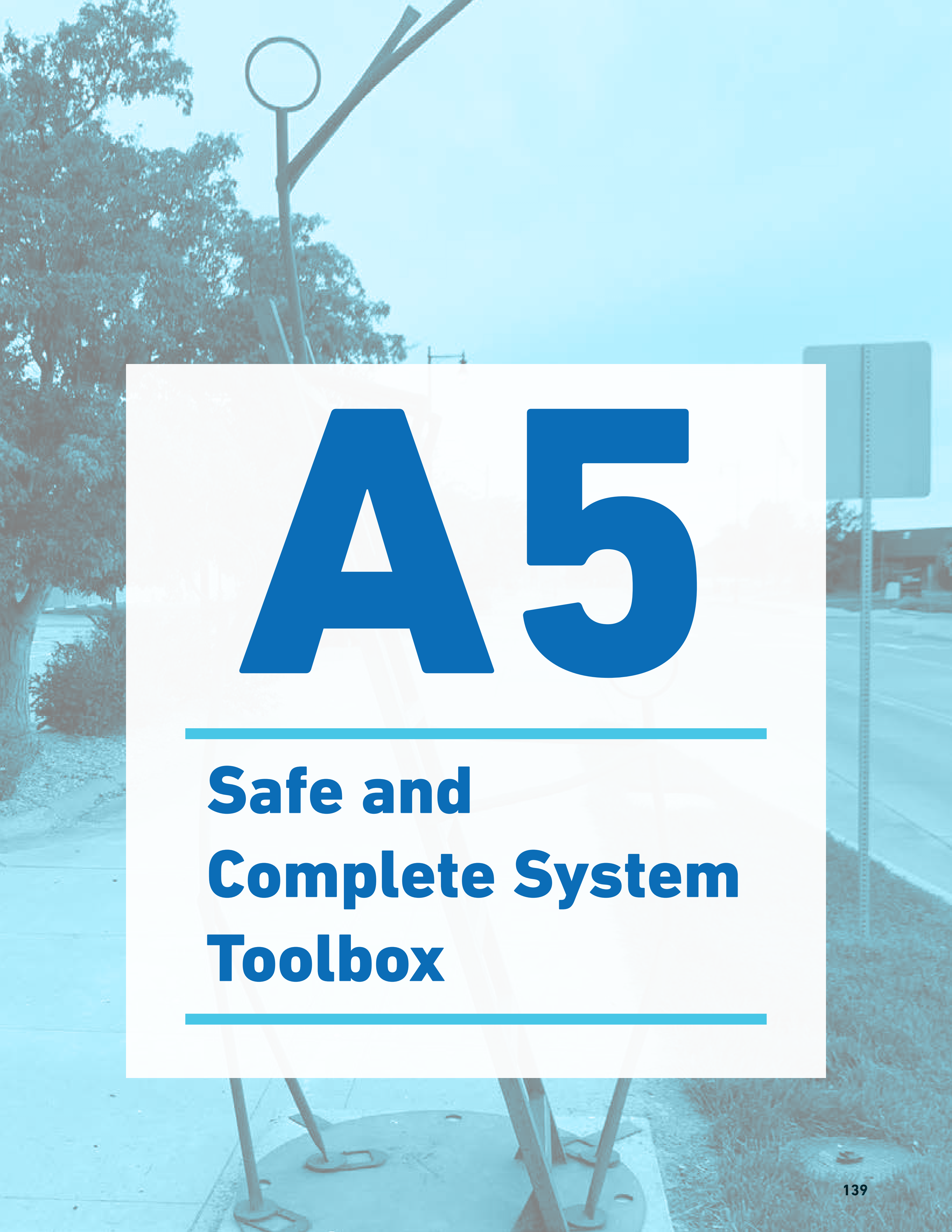
- This plan is an update to the Lower Elkhorn Natural Resources District (LENRD) Multi-Hazard Mitigation Plan (HMP) approved in 2015. Hazard mitigation planning is a process in which hazards are identified and profiled; people and facilities at-risk are identified and assessed for threats and potential vulnerabilities; and strategies and mitigation measures are identified.

Elements for MTAP:

- The goals of the plan include protecting the health and safety of residents.
- The plan includes a risk assessment for hazardous material spills on the roadway network, flooding events, and severe storms.

Opportunity:

- Consider any potential threats to pedestrians and bicyclists posed in these scenarios when it is time to update the plan.



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Safe and Complete System Toolbox

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Purpose of the Toolbox

The Toolbox is intended to be a menu of options to be used by the City to create safe and accessible streets for all people, no matter the mode of transportation used.

Contents

ADDITIONAL SIGNAL HEADS

Purpose:
Dedicated signal heads for each travel and turn lane provide easy to understand guidance at signalized intersections and improve visibility of the signal to oncoming drivers.

Description:
Signalized intersections should typically have one signal head for each travel lane, including dedicated turn lanes. Dedicated arrow signals for left turn lanes are used to indicate to motorists when it may be safe to make a left turn.

Estimated Relative Cost:

$ $$ $$$

Applicable Street Types

- All street types.

Applicable Locations

- All signalized intersections.

Design Guidance Notes

- The intersection should be studied to determine correct phasing if adding turn arrows for turn lanes.
- Consider the need for protected left turns or leading pedestrian intervals when introducing left turn signals.
- If adding a right turn signal, consider no right turn on red signage and phasing if in a high pedestrian location.

Systemic Deployment

- Should be deployed at signalized intersections systemically but prioritized at locations with a history of left- turn or angle crashes.

Considerations

- Introducing new turn phasing can change traffic patterns and either increase or decrease throughput and capacity. However, safety should be considered foremost when deciding appropriate turn phasing.
- NDOT has been implementing flashing yellow left-turn signal displays due to studies showing crash reductions in these crashes at intersections that use them.

Additional Information

- NDOT. ndot_piassist_factsheets_trafficsignals_draft_20210127.pdf

ADVANCE STOP LINES

Purpose:
Increase the likelihood that motorists stop for pedestrians and bicyclists at uncontrolled crossings by making the crossings more visible.

Description:
Pavement markings placed between 20 and 50 feet in advance of uncontrolled crossings.

Estimated Relative Cost:

$ | $$ | $$$

Applicable Street Types

- All street types.

Applicable Locations

Advance stop markings are an option at many uncontrolled or unsignalized crossings, including:

- At intersection and mid-block crossings.
- Uncontrolled multi-lane crossings, with at least two lanes in one direction.

Design Guidance Notes

- Place on all approaches to the uncontrolled crossing.
- Mark crossing with high-visibility crosswalk markings.
- Install pedestrian warning signs (MUTCD W11-1, W11-2, W11-15, or S1-1).
- Restrict parking within 20 to 50 feet of the crosswalk to improve visibility.
- Use markings in conjunction with an appropriate regulatory sign (e.g. Stop Here for Pedestrians MUTCD R1-5 series).

Systemic Deployment

- Potential for systemic implementation at all uncontrolled or mid-block marked crossings of roadways with at least four lanes and posted speeds of at least 30 mph.

Considerations

- Motorists may ignore markings placed too far in advance of the crosswalk.
- Use a regulatory sign with the advanced stop markings to aid with compliance.

Additional Information

- FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations
- Manual on Uniform Traffic Control Devices

ADVISORY BIKE LANES

Purpose:
Allow motorists to temporarily enter bike lane to provide sufficient space for oncoming traffic to safely pass.

Description:
Dashed bike lanes on narrow, un-laned residential roads.

Estimated Relative Cost:

$ | $$ | $$$

Applicable Street Types

- Access streets.

Applicable Locations

- Roadways with one or two travel lanes.
- Streets with speed limits of 30 mph or lower.
- Streets with infrequent parking turnover.
- Where vehicle volumes are fewer than 6,000 vehicles per day (fewer than 3,000 daily vehicles preferred).
- Streets with adequate passing sight distance for motorists.
- Not appropriate on designated truck or bus routes.

Design Guidance Notes

- The recommended width of an advisory bike lane is 6-7 feet adjacent to parking (minimum 5 feet), or 5-7 feet curb adjacent exclusive of gutter (minimum 4 feet).
- The designer should choose from two distinct cross sections for the central motor vehicle operation space: 16-18 feet or 10-13.5 feet.
- See Section 9.8 of the AASHTO Guide for the Development of Bicycle Facilities for additional layout recommendations and guidance.

Systemic Deployment

- Best suited as an individual corridor treatment.
- Should be considered on designated bike routes where roadway widths do not allow for dedicated bike lanes and speeds and volumes are appropriately low.

Considerations

- Requires FHWA permission to experiment.
- For use on streets too narrow for both bike lanes and normal-width travel lanes.
- Motorists must yield to oncoming motor vehicles by pulling into the bike lane.
- This treatment should only be used on streets with greater than 60 percent continuous daytime parking occupancy. Where parking occupancy is continuously less than 50 percent, consolidate the parking to one side of the street.
- A two-way traffic warning sign (W6-3) may increase motorists' understanding of the intended two-way operation of the street.
- The combined bike lanes and un-laned travel area must meet the minimum requirements set out by the fire code.

Additional Information

- AASHTO Guide for the Development of Bicycle Facilities
- FHWA Bikeway Selection Guide

BACKPLATES WITH RETROREFLECTIVE BORDERS

Purpose:
Enhance traffic signal visibility, especially for older drivers and drivers with color vision deficiencies.

Description:
Adding a backplate with retroreflective borders to a traffic signal to introduce a controlled contract background.

Estimated Relative Cost:

$ | $$ | $$$

Applicable Street Types

- All street types.

Applicable Locations

- Potential for systemic deployment at all intersections.

Expected Crash Reduction

- 15% reduction of total crashes (FHWA-SA-21-039).

Design Guidance Notes

- Existing signal heads can be upgraded by adding retroreflective tape. New or replacement signal heads can have retroreflective material pre-installed.
- The most effective way to implement this is to apply it as a standard treatment across all signalized intersections in the jurisdiction.

Systemic Deployment

- Potential for systemic safety application at all signalized intersections. Can be prioritized at intersections with a history of red-light running and/or angle and rear end crashes.

Considerations

- Generally a low-cost, rapid installation process. Temporary traffic control setup is needed to access existing signal heads.

Additional Information

- FHWA Proven Safety Countermeasure

BICYCLE CROSSINGS

Purpose:
Provide designated crossing space for bicyclists and alert vehicles that bicyclists may be crossing at that location.

Description:
Marked crossings specifically for bicycles.

Estimated Relative Cost:

$ | $$ | $$$

Applicable Street Types

- All street types.

Applicable Locations

- Where bike lanes (separated, conventional, etc.) cross intersections.

Design Guidance Notes

- Should be separate from pedestrian crossings.
- Use green pavement markings to indicate the path of travel for bicyclists through an intersection. All markings should follow the standards of the Nebraska MUTCD.

Systemic Deployment

- Potential for systemic safety application at intersections along roadways with separated bike lanes, buffered bike lanes, or conventional bike lanes.

Considerations

- At signalized intersections, consider alongside implementation of a bicycle signal.

Additional Information

- NACTO Urban Bikeway Design Guide
- AASHTO Guide for the Development of Bicycle Facilities
- FHWA Bikeway Selection Guide

BIKE BOXES

Purpose:
Provides bicyclists with a safe and visible way to get ahead of queuing traffic during the red signal phase.

Description:
A designated area at the head of a traffic lane at a signalized intersection.

Estimated Relative Cost:

$ $$ $$$

Applicable Street Types

- All street types.

Applicable Locations

- Where through-bicyclists and right-turning vehicles conflict at signalized intersections.
- Where a bicycle lane does not continue across an intersection.

Design Guidance Notes

- Bike boxes are primarily installed at signalized intersections.
- Bike boxes should be a minimum of 10 feet deep from the stop bar.
- A bike box should only extend across one travel lane.
- Bike boxes should not be used to facilitate bicycle left turns. A two-stage turn queue box is the preferred method of accommodating left turns.
- Green pavement can be used within the bicycle box to deter motor vehicles from encroaching.
- At least 50 feet of bicycle lane should connect the approach leg of the intersection to the bike box so bicyclists do not have to weave between queuing motor vehicles to access it.
- Turns on red shall be prohibited.
- Stop Here on Red sign with an Except Bicycles sign should be installed coincidental with the stop bar for motorists.

Systemic Deployment

- Best suited as a spot treatment.

Considerations

- Bicyclists waiting in front of stopped motorists gain a head start by being 10-15 feet in front of stopped vehicles. This head start can be extended with a leading bicycle and/or pedestrian phase.
- Motorists should be discouraged from merging into the bicycle lane with a solid bicycle lane line to ensure bicyclists can enter the bike box.
- At locations where there are high volumes of turning traffic or frequent conflicts between turning motorists and bicyclists during stale green portions of the signal phase, it may be advisable to consider a right turn lane or separate phasing to mitigate conflicts in lieu of or in addition to a bike box.
- Where provided across multiple lanes of an approach, countdown pedestrian signals shall be provided for the crosswalk across the approach where the bike box is located.

Additional Information

- AASHTO Guide for the Development of Bicycle Facilities
- NACTO Urban Bikeway Design Guide
- FHWA Bikeway Selection Guide

BUFFERED BIKE LANES

Purpose:
To increase the comfort of bicyclists by increasing the distance between the bike lane and travel or parking lanes.

Description:
Conventional bike lanes paired with a designated buffer space separating the bike lane from the adjacent motor vehicle travel lane and travel or parking lanes.

Estimated Relative Cost:

$ $$ $$$

Applicable Street Types

- All street types.

Applicable Locations

- Roadways with three or fewer travel lanes.
- Streets with speed limits of 30 mph or lower.
- Streets with infrequent parking turnover.
- Where vehicle volumes are fewer than 6,000 vehicles per day.
- Buffered bike lanes are appropriate where a separated bike lane or sidepath is infeasible or undesirable.

Design Guidance Notes

- Minimum buffered bike lane width, exclusive of buffer, is 4 to 5 feet and the desirable width is 6 feet.
- Minimum buffer width is 2 feet. There is no maximum.
- Diagonal crosshatching should be used for buffers less than 4 feet wide. Chevron crosshatching should be used for buffers 4 feet or wider.
- See Street Design Guidelines for design guidance and bikeway facility type selection.

Systemic Deployment

- Best suited as a corridor treatment. Should be considered along the High Injury Network, High Risk Network, areas with heightened active transportation need and opportunity, and along the planned walking and biking network.

Considerations

- A buffer between the bike lane and parking lane may be appropriate where parking turnover is high.
- A buffer between the travel lane and bike lane may be appropriate where speeds are 30 mph or faster, or when traffic volume exceeds 6,000 vehicles per day..
- Preferable to conventional bike lanes when used as a contra-flow bike lane on one-way streets.
- Can be used on one-way or two-way streets.
- Where there is 7 feet of roadway width available, a buffered bike lane should be installed instead of a conventional bike lane.
- If there is sufficient width and a separated bike lane is not being considered, buffers may be installed on both sides of the bike lane.

Additional Information

- [FHWA Bikeway Selection Guide]
- AASHTO Guide for the Development of Bicycle Facilities

BUFFER AREAS

Purpose:
To increase the comfort and safety of pedestrians and bicyclists.

Description:
The space that horizontally separates off-street walkways or shared use path and the adjacent travel lanes.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- All street types.

Applicable Locations

- Streets with walkways or shared use paths.

Design Guidance Notes

- A minimum of a 2-foot wide buffer should be provided on all curbed roadways.
- Wider buffer areas should be considered on streets with higher motor vehicle speeds.
- Buffer areas are often spaces for utilities, signs, poles, street trees, transit stops, and other roadside elements and they should be wide enough to accommodate these elements.

Systemic Deployment

- Buffer areas should be implemented systemically through the implementation of the street design guidelines.

Considerations

- Buffer areas often serve as snow storage.
- On low-speed urban streets, providing trees and street furniture in a buffer can provide traffic calming effects and reduce excessive speeding.

Additional Information

- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- AASHTO Guide for the Development of Bicycle Facilities
- NACTO Urban Street Design Guide

CHICANES / ROADWAY CURVATURE

Purpose:
Slow motor vehicles speeds by physically diverting the path of travel.

Description:
Horizontal treatments to restrict vehicle movement and reduce speeds. Chicanes are often made of curb extensions or islands that create “S” curves along a roadway.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- All street types.

Applicable Locations

- Most effective at mid-block locations.

Design Guidance Notes

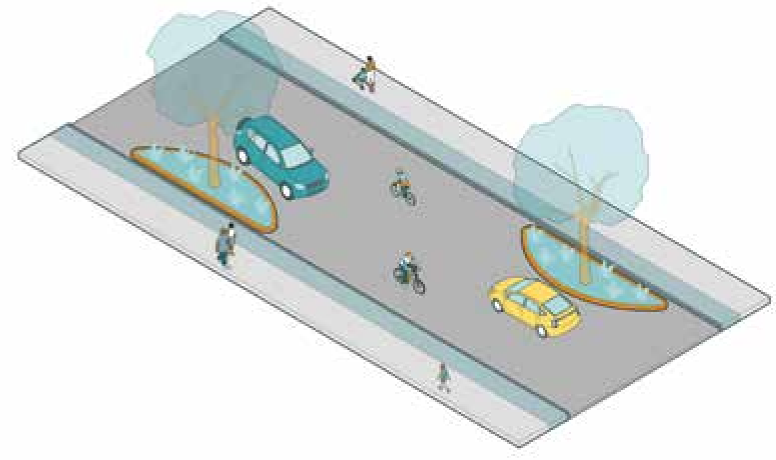
- Interim treatments use striping and flexible delineators (flex posts).
- Permanent treatments use curb extensions or islands and may include vegetation.
- Maintain sight lines by landscaping chicanes with lower shrubs and plants.
- Multiple treatments may be placed on alternating sides of the roadway.
- Drainage and utility location should be considered when implementing.
- Additional signing or pavement markings may be needed to ensure drivers are aware of the bend in the roadway.

Systemic Deployment

- Best suited as a spot treatment.

Considerations

- Vehicles and bicyclists must carefully maneuver around fixed objects. Traffic may be slowed when vehicles attempt to pass bicyclists.
- If drainage impacts are a concern, curb extensions may be designed as edge islands with a 1–2-foot gap from the curb (see top right image).
- May reduce on-street parking depending on the design.
- Emergency vehicle access must be maintained.
- Not appropriate on designated truck or bus routes.



Additional Information

- PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System
- NACTO Urban Street Design Guide
- AASHTO Guide for the Development of Bicycle Facilities

CONVENTIONAL BIKE LANES

Purpose:
To designate street space for bicyclists separate from motor vehicles.

Description:
A portion of a street designated for the exclusive use of bicycles and distinguished from traffic lanes by striping, signing, and pavement markings.

Estimated Relative Cost:

$ $$ $$$

Applicable Street Types

- Access streets.
- Balanced streets.

Applicable Locations

- Roadways with three or fewer travel lanes.
- Streets with speed limits of 30 mph or lower.
- Streets with infrequent parking turnover.
- Where vehicle volumes are fewer than 6,000 vehicles per day.
- Conventional bike lanes are appropriate where a separated bike lane or sidepath is infeasible or undesirable.

Expected Crash Reduction

- Bicycle Lane - 30 to 49% total crashes on urban streets depending on configuration (FHWA-SA-21-051).

Design Guidance Notes

- The minimum width of a bike lane adjacent to parking is 5 feet, a desirable width is 6 feet.
- The minimum width of a bike lane adjacent to a curb is 5 feet exclusive of a gutter, a desirable width is 6 feet.
- Parking Ts or hatch marks can highlight the vehicle door zone on constrained corridors with high parking turnover to guide bicyclists away from doors.
- See Street Design Guidelines for design guidance and bikeway facility type selection.

Systemic Deployment

- Best suited as a corridor treatment.

Considerations

- Conventional bike lanes adjacent to parking lanes place bicyclists in the "door zone", where motorists may open their door into the path of a bicyclist unexpectedly.
- When streets are reconstructed, lower-stress designs such as separated bike lanes or sidepaths are generally preferable to conventional bike lanes due to their appeal to a broader segment of the public.

Additional Information

- AASHTO Guide for the Development of Bicycle Facilities
- FHWA Bikeway Selection Guide
- NACTO Urban Bikeway Design Guide

CORNER RADIUS REDUCTION

Purpose:
Reduce motor vehicle turning speeds, reduce pedestrian crossing distances, increase pedestrian visibility, and expand waiting areas for pedestrians crossing.

Description:
Reduced corner radius by changing the curb line or using temporary materials such as paint and bollards. Motorists will generally reduce their speed to navigate a sharper turn.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- All street types.

Applicable Locations

- Corner radius reduction can be applied to intersections an urban, suburban, or rural context.
- Intersections with low truck volumes can also make use of corner radius reduction.

Design Guidance Notes

- Implementation should tailor design to the largest design vehicle size that frequently uses the intersection.
- Install with curb ramps and high-visibility crosswalk markings. Corner radius reduction allows for better placement of curb ramps and crosswalks.
- Mountable truck aprons can be implemented to encourage a smaller effective radius for passenger cars or small trucks, while accommodating larger vehicles as well.

Systemic Deployment

- Suitable for spot treatment at intersections or driveways with an existing wide turning radii and pedestrian crash history or risk. Prioritize in locations near schools.
- Suitable for systemic deployment along higher-speed corridors that transition at intersections to low-speed streets.

Considerations

- The corner radius should make intersections as compact as possible while accommodating large vehicles that frequent the intersection.
- Corner radii that are too small may encourage motor vehicles to drive over the curb and onto sidewalks and bikeways.
- In some instances, large vehicles may encroach on the opposing travel lane when turning.

Additional Information

- Street Design Guidelines

CORRIDOR ACCESS MANAGEMENT

Purpose:
Enhance safety for all modes, facilitate walking and biking, and reduce trip delay and congestion.

Description:
The design, application, and control of entry and exit points along a roadway (includes intersection with other streets and driveways that serve adjacent properties).

Estimated Relative Cost:

$ | **$$** | $$$

Applicable Street Types

- Throughput streets.
- Balanced streets.

Applicable Locations

- Commercial corridors with high-volume driveways- Within the historic urban grid, where intersection density is highest.
- At locations where land use has changed and can support fewer driveway access points.

Design Guidance Notes

Consider the following access management strategies:

- Reduce density through driveway closure, consolidation, or relocation.
- Limit allowable movements at driveways (such as right-in/right-out only).
- Place driveways on an intersection approach corner rather than a receiving corner, which is expected to have fewer total crashes.
- Implement raised medians that preclude across-roadway movements.
- Use intersection designs with fewer conflict points, such as roundabouts, Median U-Turn (MUT) intersections, and Restricted Crossing U-Turn (RCUT) intersections.
- Provide turn lanes (i.e., left-only, right-only, or interior two-way left).
- Use cross-property access and other alternative access strategies.

Systemic Deployment

- Suitable as a corridor or spot treatment, especially along the High Injury Network, High Risk Network, areas with heightened active transportation need and opportunity, and along the planned walking and biking network.

Considerations

- Consider land use adjacent to the corridor, area types, roadway characteristics, and traffic volume. Solutions and costs can vary from relatively low cost solutions like concrete barriers to prevent access to high cost solutions like full reconstruction of an access point.
- Left turns from minor roads onto major roads are the highest-risk turn movement. "Three-quarter" or right in-right-out access points restrict this movement without fully removing access to a property

Additional Information

- FHWA Proven Safety Countermeasures

CROSSING ISLANDS

Purpose:
Protect pedestrians and bicyclists crossing by slowing motor vehicle speeds, increasing motor vehicle yielding, increasing pedestrian visibility, providing a pedestrian waiting area, and allowing two-stage crossings for slower pedestrians.

Description:
Median crossing islands have a cut-out area for pedestrian and bicyclist refuge and are used as a supplement to a crosswalk. Also known as pedestrian refuge islands or raised refuge islands.

Estimated Relative Cost:

$ | **$$** | $$$

Applicable Street Types

- All street types.

Applicable Locations

- Mid-block and intersection crossings.
- Most beneficial at uncontrolled crossings, multi-lane streets, wide signalized crossings, or complex intersections.
- On streets with two or more lanes of through traffic.
- Streets with insufficient gaps in traffic.
- Streets with high pedestrian crossing volumes.

Expected Crash Reduction

- Pedestrian Refuge Islands - 56% reduction in pedestrian crashes (FHWA-SA-21-044).

Design Guidance Notes

- Median crossing islands should be a minimum of 6 feet wide. To provide bicyclist refuge or for high pedestrian volumes, crossing islands should be a minimum of 8 feet wide.
- Ramps or island cut-throughs are required for accessibility. They should be the full width of the crosswalk, 5 feet minimum.
- All medians at intersections should have a "nose" which extends past the crosswalk. The nose protects people waiting on the median and slows turning drivers.
- At mid-block locations:
  - Install advance stop lines on multi-lane approaches.
  - Install with applicable warning sign (MUTCD W11-1, W11-2, W11-15, or S1-1).
  - On multi-lane approaches, place "Stop Here for Pedestrians" or "Yield Here to Pedestrians" signs (MUTCD R1-5 series).
  - Mark with a high-visibility crosswalk.

Systemic Deployment

- Suitable for systemic deployment or as a spot treatment, especially along the High Injury Network, High Risk Network, areas with heightened active transportation need and opportunity, and along the planned walking and biking network.
- Potential for systemic safety application at mid-block crossings and at intersections along corridors with poor motor vehicle yielding, operating speeds over 30 mph, or motor vehicle volumes above 9,000 vehicles per day.

Considerations

- Pedestrians may get caught on the crossing island if motorists do not yield or signal timing is too short.
- Crossing islands at intersections may restrict left turning.
- Curb extensions can be built along with crossing islands to restrict on-street parking and reduce crossing distance.
- Temporary crossing islands can be constructed with temporary curbing or flex posts.
- Crossing islands typically do not impact roadway drainage, so they can be a less costly method of shortening crossing distance compared to curb extensions.

Additional Information

- Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities
- FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations
- FHWA Proven Safety Countermeasures

CROSSWALK VISIBILITY ENHANCEMENTS

Purpose:
Make crosswalks and their users more visible to drivers and help users in deciding where to cross.

Description:
Use paint markings, lighting, and signage to better inform both pedestrians and drivers of incoming crossings.

Estimated Relative Cost:

$ | $$ | $$$

Applicable Street Types

- All street types.

Applicable Locations

- High-visibility crosswalks are appropriate at all controlled intersections.
- Uncontrolled intersections should meet requirements in MUTCD Section 3B.18.
- Especially on multi-lane roadway crossings with more than 10,000 vehicles per day.

Expected Crash Reduction

- Crosswalk Visibility Enhancements can reduce pedestrian injury crashes up to 40%.
- Intersection lighting can reduce pedestrian crashes up to 42% ().
- Advance stop or yield markings and signs can reduce pedestrian crashes up to 25%.

FHWA-SA-21-049

Design Guidance Notes

- Marking pattern should be continental - a series of wide stripes parallel to the travel lanes for the entire length of the crossing.
- Crosswalks should be a minimum of 10 feet wide. If the sidewalk or sidepath is wider than 10 feet, the crosswalk should match the width of the sidewalk or sidepath.
- Use materials such as inlay or thermoplastic tape instead of paint or brick.
- Place signs 20-50 ft ahead of a marked crossing. Use in conjunction with Stop or Yield bars.
- At signalized intersections, install a stop bar in advance of the crosswalk at least four feet from the nearest edge of the crosswalk.
- Parking should be restricted in advance of a crosswalk to provide adequate sight distance.

Systemic Deployment

- Suitable for systemic deployment or as a spot treatment, especially along the High Injury Network, High Risk Network, areas with heightened active transportation need and opportunity, and along the planned walking and biking network.
- Can be applied as a systemic countermeasure at all controlled crossings. At uncontrolled crossings, apply in accordance with FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations, Table 1.

Considerations

When installing other crosswalk treatments (e.g. raised crossing, curb extension), include visibility enhancements as part of the project scope.

- Crosswalk location should be convenient for pedestrian access.
- Width may be wider than 10 feet at crossings with high pedestrian or bicycling demand.

Additional Information

- [FHWA Proven Safety Countermeasure]
- [FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations]
- Manual on Uniform Traffic Control Devices

CURB EXTENSIONS / BULB OUTS

Purpose:
Shorten crossing distances and increase pedestrian comfort and visibility.

Description:
Also called bulb outs or neck downs, curb extensions extend a section of sidewalk into the roadway at intersections and other crossing locations.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- All street types.

Applicable Locations

- Curb extensions can make crossings safer and more comfortable everywhere from a mid-block crosswalk to a large signalized intersection.
- Curb extensions can be built in all-day parking lanes or wide shoulders.
- Transitions to lower-speed areas.

Design Guidance Notes

- Limit planting and street furniture height within curb extensions to preserve sight lines.
- Consider expanding curb extensions at bus stops to produce bus bulbs.
- Where curb extension installation on one side is infeasible or inappropriate (i.e., no parking lane), this should not preclude installation on the opposite side.
- Maximum length can vary to accommodate sight lines, manage stormwater, facilitate transit loading, or restrict parking. Minimum length is the width of the crosswalk.

Systemic Deployment

- Spot treatment or systemic safety improvement. Consider at all locations with on-street parking.

Considerations

- If funding for permanent curb extension construction is unavailable, use lower cost alternatives, such as bollards, temporary curbs, planters, or paint and striping.
- Curb extensions should not extend into travel lanes or bicycle lanes. Generally designed with one foot of shy distance between the face of curb and the edge of travel lane.
- When designing the corner radius on a curb extension, consider the appropriate large vehicle turning path to prevent encroachment into the pedestrian space.
- Curb extensions can require modifications to or relocation of drainage structures. Consider drainage slots with solid surface plating at pedestrian crossings as an alternative.

Additional Information

- NACTO Urban Street Design Guide
- FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations

DEDICATED RIGHT & LEFT TURN LANES

Purpose:
Reduce the potential for crashes involving a vehicle turning (across opposing through traffic, rear-end collisions due to deceleration at turn, etc.).

Description:
Provide separation between through traffic and traffic that is stopping, slowing, and turning.

Estimated Relative Cost:

$ | **$$** | $$$

Applicable Street Types

- All street types.

Applicable Locations

- "Major road approaches" at 3- and 4-leg intersections.

Additional Information

- FHWA Proven Safety Countermeasures
- CMF Clearinghouse

Expected Crash Reduction

- Left-Turn Lanes: 28-48% reduction in total crashes.
- Positive Offset Left-Turn Lanes: 36% reduction in fatal and injury crashes.
- Right-Turn Lanes: 14-26% reduction in total crashes.

Design Guidance Notes

- Consider offset turn lanes - they can improve visibility, and is preferable at intersections with higher speeds.
- Consider effects on pedestrian crossings and presence of bike lanes. Adding turning lanes can decrease pedestrian comfort and safety while crossing.

Systemic Deployment

- Consider roadway characteristics when implementing.

Considerations

- Offset turn lanes can extend crossing distances and difficulty for pedestrians.
- Evaluate trade-offs for available right-of-way and potential to include pedestrian refuge island.

DRIVEWAY CROSSINGS

Purpose:
Improves pedestrian and bicyclist visibility to motorists at driveways.

Description:
Provide visual cues of the presence of a sidewalk or bikeway as it crosses a driveway. This could include signs, pavement striping, pavement color, raised crossing, street offset, and/or small curb radii.

Estimated Relative Cost:

$ | $$ | $$$

Design Guidance Notes

- Provide consistent material choices or colored pavement to make the bikeway and sidewalk appear to continue through the driveway and not end at the driveway.
- Apply a consistent approach to the use of pavement markings to identify driveway locations and bikeway conflict areas.
- Provide appropriate assignment of restrictive traffic controls following MUTCD guidance where an uncontrolled crossing is not desirable.
- Consider need for motorist stop/yield signs and signs warning motorists of pedestrian / bicycle route, such as MUTCD R1-5, MUTCD R1-5b, or MUTCD W11-15 with MUTCD W16-7P.

Applicable Street Types

- All street types

Applicable Locations

- Driveways that cross sidewalks or bikeways. Higher volume driveways are more likely to benefit from enhanced driveway crossings. Driveways with minimal vehicle volumes, such as residential driveways with fewer than 25 vehicle crossings per day, may not need enhanced treatments such as signage and markings.

- Consider offsetting the sidewalk or sidepath from the street, especially where the adjacent roadway speeds are higher.
- Consider a raised crossing to create a continuous surface through the driveway with grade breaks to require slower motorist crossings. Raised crossings also provide safety and right-of-way clarity to pedestrians walking on adjacent sidewalks, improve accessibility, and simplify the driveway design.
- Lighting the driveway entrance may be helpful in some situations to illuminate vehicles entering the roadway as well as making the driveway more visible to traffic on the roadway.
- Additionally, the installation of delineators marking the driveway entrance could be appropriate to improve the visibility of driveway edge lines.
- Consider Corner Radius Reduction countermeasure to reduce turning vehicle speeds.

Systemic Deployment

- Potential for systemic implementation along corridors with busy driveways, along primary walking and biking routes, and spot locations, especially those where turn speeds are high or motorists are not yielding.

Considerations

- Number of driveways.
- Driveway spacing and frequency along a corridor.
- Volume of motor vehicles using the driveways.
- Speed of the adjacent roadway.
- Volume and mode split on the roadway (bicyclists, pedestrians, heavy vehicles).
- Traffic impacts generated by the property.

Additional Information

- [Michigan DOT Sidepath Intersection and Crossing Treatment Guide (2018)]
- [Transportation Research Board. 2025. On-Street Bicycle Facility Design Features: A Guide. Washington, DC: The National Academies Press.]
- [FHWA Access Management (Driveways)]

ENHANCED CURVE DELINEATION

FHWA

Purpose:
Alert drivers of incoming curves, the direction and sharpness of the curve, and appropriate operating speed.

Description:
Enhanced delineation at horizontal curves includes a variety of potential strategies that can be implemented in advance of or within curves in combination or individually.

Estimated Relative Cost:

$ $$ $$$

Applicable Street Types

- Access streets.

Applicable Locations

- Most commonly used for streets in rural areas, but can be used on urban streets with horizontal curves as well.

Expected Crash Reduction

- Depending on the strategy chosen and type of roadway and crash:
  - Chevron signs: 16% to 25% in crash reduction.
  - Oversized Chevron Sign: 15% reduction in FSI crashes.
  - In-Lane Curve Warning Pavement Markings: 35-38% reduction in all crashes.
  - New Fluorescent Curve Signs or upgrades to existing Fluorescent Curve Signs: 18% reduction in rural roadways.

Design Guidance Notes

- Refer to the [FHWA Proven Safety Countermeasure Guides]() to identified appropriate placement for strategies.
- Refer to MUTCD to ensure traffic control devices are in compliance.

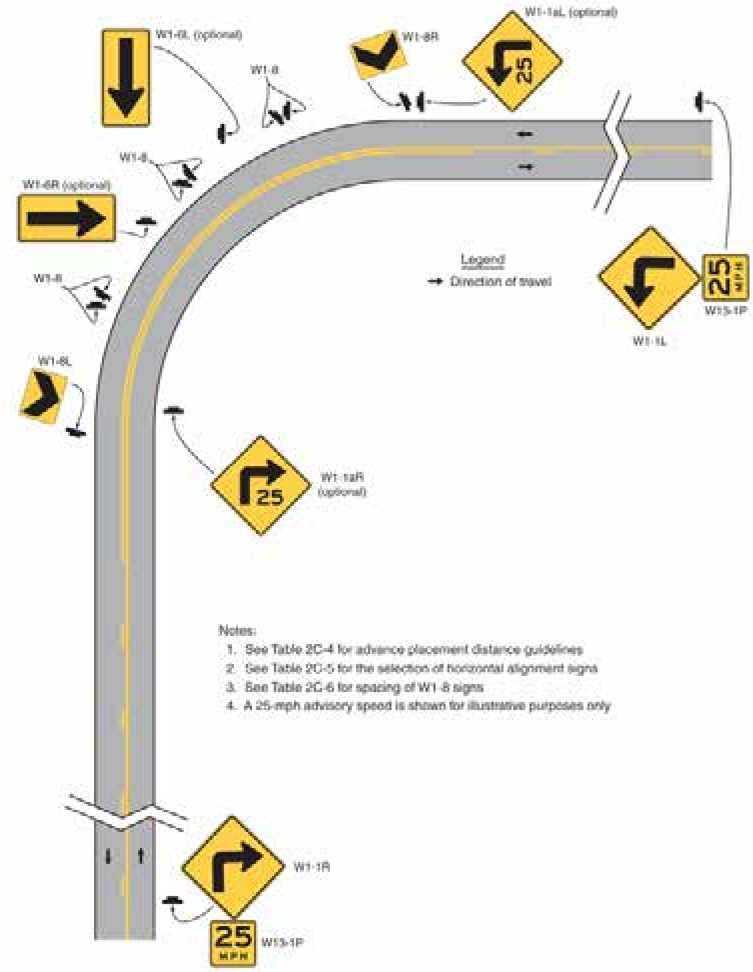
Systemic Deployment

- Use the systemic approach to identify and treat problem curves. For example, consider identifying curve locations based on crash history, curve radii, traffic volume, presence on an intersection in the curve, and any visual or line of sight limitations.

Considerations

- Match the appropriate strategy to the identified problem(s), considering the full range of enhanced delineation treatments.
- Once the MUTCD requirements and recommendations have been met, an incremental approach is often beneficial to avoid excessive cost.
- For example, enhanced delineation can be used in combination with Pavement Friction Management and roadside design treatments to greatly improve safety.

Figure 2C-2. Example of Warning Signs for a Turn



FHWA: MUTCD

Additional Information

- [FHWA Proven Safety Countermeasure]()

GATEWAY TREATMENTS

Purpose:
Reduce motor vehicle speeds and yielding at uncontrolled crosswalks.

Description:
"Stop for Pedestrian" signs (MUTCD R1-6a) are placed on left and right sides of all travel lanes approaching a crosswalk to improve motorist awareness of pedestrians crossing.

Estimated Relative Cost:

$ $$ $$$

Applicable Street Types

- Access streets.

Applicable Locations

- Gateway treatments are appropriate at uncontrolled crossings on streets with speed limits of:
  - 30 mph or less.
  - 35 mph and below 12,000 daily vehicles.
- Not applicable on streets with speed limits of 40 mph and above.

Design Guidance Notes

- All approaching travel lanes should have signs placed on both the left and right sides. Signs should be placed on center line, median, crossing island, lane line, or near the curb.
- Install with curb ramps and high-visibility crosswalk markings.
- On multi-lane approaches, install with advance stop/yield markings.
- Signs and delineators should be installed between 1.5 feet and 50 feet advance of the crosswalk. On multi-lane approaches, place Stop Here for Pedestrians signs (MUTCD R1-5 series).
- Double-sided signs are recommended because they increase the likelihood that drivers will see a sign in heavy traffic.

Systemic Deployment

- Spot treatment or systemic safety improvement. Consider at all locations with on-street parking.

Considerations

- Signs should not be placed within the crosswalk.
- More effective when gaps between signs are smaller.
- Edge line and curb line placement require FHWA permission to experiment.
- Placing signs farther back from crosswalks at intersections (e.g. 30 feet) can reduce sign damage.
- A refuge island and advance yield lines are recommended where daily vehicle volume is 12,000 or greater.

Additional Information

- [User Guide for R1-6 Gateway Treatment for Pedestrian Crossings]
- Manual on Uniform Traffic Control Devices

HARDENED CENTERLINES

Purpose:
Reduce motor vehicle turning speed and increase motor vehicle yielding to pedestrians.

Description:
Hardened centerlines are flexible delineators placed between opposing travel lanes.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- Access streets.
- Balanced streets.

Applicable Locations

- Hardened centerlines can be installed at intersections of mid-block crossing locations.
- Where left turning vehicles do not yield sufficiently.

Design Guidance Notes

- Hardened Centerlines:
  - Raise centerline with flexible delineators and separators (e.g. Leitboy Bollard with Guide Curb separator).
  - Install a rubber speed bump, mountable curb, or flexible delineators and separators along the centerline, on one or both sides of the crosswalk.
  - Paint lane extensions through the intersection with yellow markings.
  - Vertical elements should not be present in the crosswalk.
- Turn wedges:
  - Have similar geometry and materials as a curb extension – typically placed in line with a parking lane. See curb extension treatment for design guidance.
  - Reduce the effective turning radius for vehicles.

Systemic Deployment

- Both hardened centerlines and turn wedges slow left turning vehicles. Potential for systemic implementation at intersections where turn speeds are high or motorists are not yielding.

Considerations

- Can be constructed rapidly and inexpensively using paint and flexible bollards.
- The turning radius of trucks and buses should be considered when installing turn wedges.

Additional Information

- The Effect of Left-Turn Traffic-Calming Treatments on Conflicts and Speeds in Washington, DC. Journal of Safety Research.

LEADING BICYCLE & PEDESTRIAN INTERVALS

Purpose:
Extends crossing time for pedestrians and bicyclists at signalized intersections.

Description:
Leading bicycle intervals (LBIs) or leading pedestrian intervals (LPIs) are adjustments to traffic signals to give bicyclists or pedestrians a three-to-seven-second head start before motorists enter the intersection.

Estimated Relative Cost:

$ | **$$** | $$$

Applicable Street Types

- All street types.

Applicable Locations

- LBIs are a treatment option at:
  - Intersections with high bicycle volumes.
  - Intersections with separated bike lanes or contraflow bike lanes.
  - Intersections where shared-use paths or other bicycle routes cross a major, signalized intersection.
- LPIs are a treatment option at:
  - Signalized intersections.
  - Intersections with a significant number of turning vehicles and pedestrian volumes.

Expected Crash Reduction

- 13% reduction in pedestrian-vehicle crashes at intersections (FHWA-SA-21-032).

Design Guidance Notes

- LBIs should be installed with:
  - Bicycle Signal sign (MUTCD R10-10) if bicycle signal is present, otherwise, direct bicyclists to follow pedestrian signal (MUTCD R9-5).
  - No Right Turn on Red" sign (MUTCD R10-11).
- LPIs should be installed with:
  - High-visibility crosswalk markings, curb ramps, accessible pedestrian signals, and "No Right Turn on Red" sign (MUTCD R10-11).

Systemic Deployment

- LBIs are best as a spot treatment, or on corridors with high bicycle volumes and vehicle turning.
- LPIs are suitable for rapid systemic deployment at existing signals with pedestrian crossings. Existing signal controllers often have the ability to implement LPIs, so no capital expense is needed to implement.

Considerations

- LBIs or LPIs can be provided actively or provided only when actuated. Active detection requires an accessible pushbutton.
- The length of LPIs or LBIs can be increased where pedestrian or bicyclist volumes are high.
- LPI may be accompanied with an audible noise for visually-impaired pedestrians.

Additional Information

- [Bicycle Safety Guide and Countermeasure Selection System (BIKESAFE)]
- [FHWA Proven Safety Countermeasures]

LIGHTING

Purpose:
Increase visibility for all road users night, dawn, and dusk, especially at crossings.

Description:
Well-placed lighting improves visibility for all road users. Pedestrian-scale lighting illuminates sidewalks and crossings with light fixtures shorter than roadway-scale light fixtures.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- All street types.

Applicable Locations

- Controlled and uncontrolled intersections.
- On crossing approaches.
- Along sidewalks.
- Beneficial at intersections in areas with high volumes of pedestrians, such as commercial or retail areas.
- Near schools, parks, and recreation centers.
- On both sides of throughput streets.

Expected Crash Reduction

- Crosswalk Visibility Enhancements - Intersection lighting can lead to 42% decrease in pedestrian crashes (FHWA-SA-21-049).
- 33%-38% decrease in nighttime crashes at intersections (FHWA-SA-21-050).

Design Guidance Notes

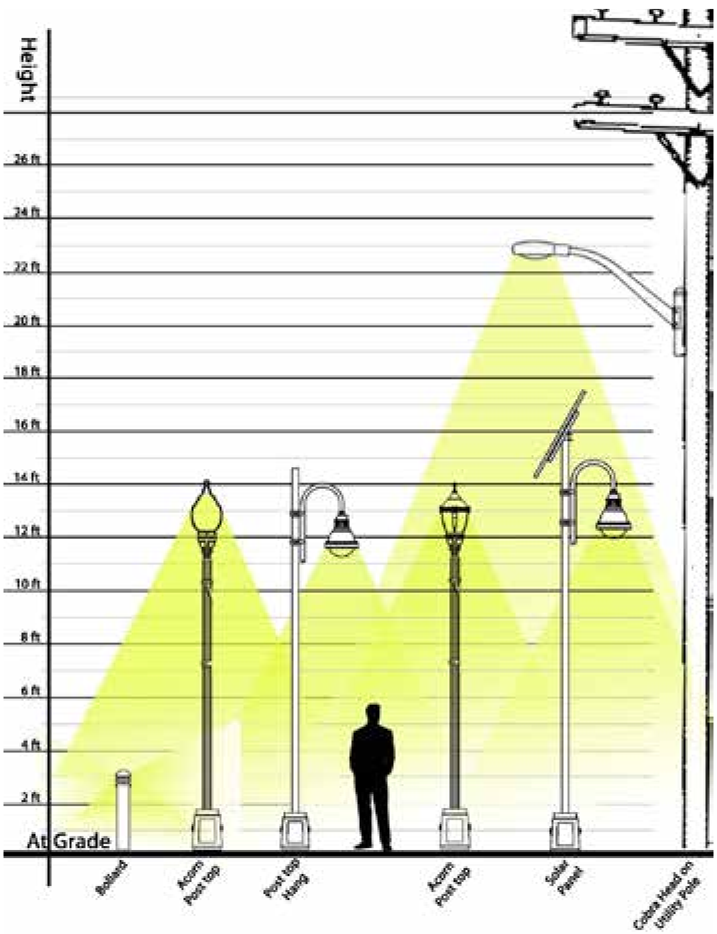
- Use 3000K (warm white) shielded LED lights wherever possible.
- Lighting should be consistent and uniform.
- Consider placement of existing buildings and trees to reduce spillover.
- Install lighting to Illuminating Engineering Society and DarkSky guidelines.

Systemic Deployment

- Potential for systemic safety application at all controlled and uncontrolled crossings.

Considerations

- Lighting should be provided on crosswalk approaches. If a crossing has a crossing island, additional lighting may be provided.
- Consider energy usage and environmental impacts.
- Consistent, high-quality lighting can strongly improve pedestrians' sense of safety and increase their willingness to walk at night.



Additional Information

- FHWA Lighting Handbook
- FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations
- FHWA Proven Safety Countermeasures - Lighting
- FHWA Proven Safety Countermeasures - Crosswalk Visibility Enhancements

LONGITUDINAL RUMBLE STRIPS

Purpose:
Reduces the potential for roadway departure-based fatal crashes by alerting distracted, drowsy, or otherwise inattentive drivers who drift from their lane.

Description:
Elements on the pavement (milled or raised) intended to alert drivers through vibration and sound that their vehicle has left the travel lane. They can be installed on the shoulder, edge line, or at or near the center line of an undivided roadway.

Estimated Relative Cost:

$ $$ $$$

Applicable Street Types

- Throughput streets.

Applicable Locations

- Applicable for a wide variety of facility types in both rural and urban areas.
- Target location-specific safety improvements, as well as reconstruction or resurfacing projects.

Expected Crash Reduction

- Center Line Rumble Strips: 44% reduction in head-on fatal and injury crashes on two-lane rural roads.
- Shoulder Rumble Strips: 13 to 51% reduction in single vehicle, run-off-road fatal and injury crashes on two-lane rural roads.

Design Guidance Notes

See AASHTO Guide for the Development of Bicycle Facilities.

FHWA Design and Construction Guidance

Systemic Deployment

- Rumble Stripes are most effective when deployed systematically.

Considerations

- Where rumble strips cannot be placed due to noise concerns, agencies may consider a design using an oscillating sine wave pattern (also known as “mumble strips”) that reduces noise outside of the vehicle. However, the safety benefits of this design need more study Bicyclists should be taken into consideration when implementing rumble strips on roadways they are allowed.

Additional Information

- FHWA Proven Safety Countermeasure
- FHWA-SA-035: Rumble Strip Implementation Guide: Addressing Bicycle Accommodation Issues on Two-Lane Road

MULTIPLE COUNTERMEASURES

Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections

Purpose:
Increase driver awareness and recognition of the intersections and potential conflicts at a systemic level.

Description:
Systemically deploying a package of multiple low-cost countermeasures at a large number of stop-controlled intersections.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- All street types.

Applicable Locations

- Applicable across the roadway system at locations with similar characteristics.

Expected Crash Reduction

- FSI Crashes at all locations/types/areas: 10% reduction.
- Nighttime crashes: 15% reduction.
- FSI crashes at rural locations: 27% reduction.
- FSI crashes at 2-lane by 2-lane intersections: 19%.

FHWA-SA-21-031

Design Guidance Notes

The low-cost countermeasures for stop-controlled intersections generally consist of the following treatments:

- On the Through Approach
  - Doubled-up (left and right), oversized advance intersection warning signs, with supplemental street name plaques (can also include flashing beacon).
  - Retroreflective sheeting on sign posts.
  - Enhanced pavement markings that delineate through lane edge lines.
- On the Stop Approach
  - Doubled-up (left and right), oversized advance "Stop Ahead" intersection warning signs (can also include flashing beacon).
  - Doubled-up (left and right), oversized Stop signs.
  - Retroreflective sheeting on sign posts.
  - Properly placed stop bar.
  - Removal of vegetation, parking, or obstructions that limit sight distance.
  - Double arrow warning sign at stem of T-intersections.

Systemic Deployment

- Consider roadway characteristics, potential for deployment at roadways without existing countermeasures.

Considerations

- Consider signage improvements according to updated MUTCD guidance.
- Extra consideration should be given to areas surrounding school zones, parks, and locations where pedestrians and bicyclists are expected.

Additional Information

- [FHWA Proven Safety Countermeasures]

NEIGHBORHOOD TRAFFIC CIRCLE

Purpose:
Reduce traffic speeds at low-speed and low volume intersections.

Description:
Circular raised islands in the center of intersections.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- Access streets.

Applicable Locations

- Intersections with one travel lane in each direction.
- Roadways with posted speeds of 30 mph or lower.
- Residential streets.
- Bicycle boulevards.
- Stop-controlled intersections with high delay.

Design Guidance Notes

- Use yield rather than stop controls.
- Install signs to instruct vehicles to proceed to the right of the traffic circle.
- May be used with shared lane markings, (sharrows) to indicate bicyclist usage.
- May also be used with W11-2, W11-2, S1-1, or W11-15 crossing warning sign.
- May be landscaped with low shrubs or vegetation that does not impede visibility.
- Large emergency vehicles will typically be required to go the “wrong way” around the circle to make a left turn.

Systemic Deployment

- Best suited as a spot treatment.
- Can be implemented as quick-build or demonstration projects.

Considerations

- Increasing turn radii for motor vehicles can compromise pedestrian and bicyclist safety.
- Chicanes or other traffic-calming treatments can be installed on adjacent roadways.
- Neighborhood traffic circles do not allow passage of large freight vehicles and should not be used on truck or bus routes.- Should not be confused with compact/mountable roundabouts, which may be similarly sized but have fully traversable islands for truck traffic. Both designs are sometimes referred to as “mini-roundabouts”

Additional Information

- [PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System]
- [Mini-Roundabouts: Technical Summary]
- AASHTO Guide for the Development of Bicycle Facilities

NEIGHBORHOOD SLOW ZONE

Purpose:
Reduce speeds in residential neighborhoods.

Description:
Gateways with speed limit signs on both sides of the street introduce the presence of a Slow Zone. Self-enforcing traffic calming measures such as speed humps are needed to ensure effectiveness.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- Access streets.

Applicable Locations

- Neighborhood streets where speeds could be lowered below the current limit with:
  - A history of serious injury or fatal crashes.
  - A high amount of vulnerable pedestrians such as children and older adults.

Design Guidance Notes

- Place speed limit and slow zone signage on both sides of the roadway at neighborhood slow zone entrances.
- Implement traffic calming measures throughout the slow zone to self-enforce speed limits, such as:
  - Curb Extensions
  - Mini Roundabouts
  - Speed Humps
  - Raised Crossings
- Slow zones can encompass a small neighborhood, with entrances at higher-speed bordering streets.
- Lower-cost temporary materials such as pavement markings and flexible bollards can be applied quickly and broadly.

Systemic Deployment

- Appropriate as a systemic treatment in residential neighborhoods.

Considerations

- Neighborhood application processes can improve public engagement and support for slow zones.
- Equity variables can be assessed in the application process to prioritize locations with high crash history or historic disinvestment.

Additional Information

- [NACTO Urban Street Design Guide]
- [Philadelphia Neighborhood Slow Zone Program Application]

NEIGHBORHOOD YIELD STREETS

Purpose:
Traffic calming on residential streets.

Description:
A narrow, two-way street without centerline lane markings that is designed to be used by motorists, bicyclists, and pedestrians. Parking is permitted on either side of the street and vehicles have to weave though and occasionally yield to oncoming vehicles.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- Access streets.

Applicable Locations

- Neighborhood yield streets are primarily residential streets with low traffic volumes and speeds.

Design Guidance Notes

- Design must communicate that motorists must yield to other road users.
- Neighborhood yield streets do not require lane markings, signage, or striping.
- Sidewalk materials should be maintained across driveways to reduce driveway conflicts.
- Neighborhood yield streets have buffer zones between the sidewalk and roadway, providing opportunities for street trees, street furniture, and other landscaping.

Systemic Deployment

- Most useful as a corridor treatment.

Considerations

- See Street Design Guidance for recommended travelway widths.
- Neighborhood yield streets are "self-enforcing" when parking is heavily utilized, so that vehicles primarily travel in the center of the roadway and slow down to pass each other.
- If parking occupancy is low, additional traffic calming measures will be required to deter speeding.
- Pedestrians and bicyclists may walk or ride on the street.
- Neighborhood yield streets do not have designated crossing locations.

Additional Information

- NACTO Urban Street Design Guide

NO TURN ON RED

Purpose:
Reduces conflicts between turning vehicles and pedestrians and bicyclists.

Description:
A sign or signal used to prohibit motor vehicles turning right when the traffic light is red.

Estimated Relative Cost:

$ (selected) | $$ | $$$

Applicable Street Types

- All street types.

Applicable Locations

- Signalized intersections. Especially important at:
  - Intersections with crossing guards or at school crossings.
  - Intersections with inadequate sight distances.
  - Intersections with bike facilities.

Design Guidance Notes

- Install "No Turn on Red" signs (MUTCD R10-11) on each applicable approach.
- Dynamic electronic signs (blank-out signs) can be used to restrict right turns to certain times of day or during certain signal phases.
- Signs restricting right turns on red should be visible to motorists stopped in the curb lane at the crosswalk.
- May increase the number of right turn on green vehicle-pedestrian conflicts. May be used with a leading pedestrian interval (LPI) to address the increased numbers of vehicles turning right on green.

Systemic Deployment

- Suitable for rapid systemic deployment at signalized intersections. Prioritize signing intersections with a history of right-turn crashes and/or high pedestrian volumes. Consider implementing citywide by ordinance.

Considerations

- Research indicates that dynamic signs may be more effective at reducing motorists turning right on red.
- Restricting right turns on red during times of high pedestrian volumes may be sufficient.

Additional Information

- [Pedestrian Safety Guide and Countermeasure Selection System]()

OFF-STREET TRAILS

Purpose:
Paths outside of the curb designated for bicyclists and pedestrians.

Description:
Shared-use paths that accommodate two-way traffic for bicyclists and pedestrians not located along streets.

Estimated Relative Cost:

$ | $$ | **$$$**

Applicable Street Types

- Off-network.

Applicable Locations

- Off-street trails can be located along railway or utility corridors, land dedicated for planned but unbuilt "paper" streets and through public land.

Design Guidance Notes

- Preferred width is 12 feet to allow side-by-side travel and passing.
- The minimum paved width for a trail is 10 feet. Anticipated future traffic volumes should be used to guide design decisions. The minimum width to enable side-by-side travel and passing is 11 feet.
- Maximum grade should not exceed 5 percent. Grades less than 0.5 percent should be avoided.
- Ideally, provide a graded shoulder area of 3-5 feet.
- Lighting should be provided at path/roadway intersections at a minimum and at other locations where personal security may be an issue or where nighttime use is likely to be high.
- Sight distances are based on site conditions and user based factors. Ensure sight distances are designed per the AASHTO Bike Guide.
- Provide protective railings/fences at 42 inches high if the trail is adjacent to a steep slope.
- See Street Design Guidelines for design guidance and bikeway facility type selection.

Systemic Deployment

- Can be developed as a system of off-street trails.

Considerations

- Trails expected to serve a high percentage of pedestrians (30 percent or more) or be used by large maintenance vehicles should be wider than 10 feet.
- Trails with high use may require pedestrian and bicycle separation. This separation can take the form of pavement markings or separate parallel paths for each user group. If separation is achieved by pavement markings, the bicycle side of the pathway should be no less than 10 feet wide and the pedestrian side should be no less than 5 feet wide.
- Trails on steep grades (3-5 percent) should be wider to account for higher bicycle speed in the downhill direction and additional space for faster bicyclists to pass slower bicyclists and pedestrians in the uphill direction.
- On sections with long steep grades, provide periodic sections with a flat grade to permit users to stop and rest.

Additional Information

- [FHWA Bikeway Selection Guide]
- AASHTO Guide for the Development of Bicycle Facilities

PARKING RESTRICTIONS / DAYLIGHTING

Purpose:
Improve sightlines between motorists and pedestrians or bicyclists crossing the street.

Description:
Signs, pavement markings, curb extensions, or vertical delineators that restrict on-street parking near a crossing.

Estimated Relative Cost:

$ | $$ | $$$

Applicable Street Types

- All street types.

Applicable Locations

- Approaches to crossings where parked vehicles block sightlines.
- Approaches to crossings with high pedestrian volumes.

Design Guidance Notes

- Parking shall be restricted at least 20 feet from the back of the crosswalk on all sides. Parking may be restricted up to 40 feet on all sides.
- In locations with sight distance obstructions or higher design speeds, the parking restriction should be extended as necessary.
- Area with parking restriction can be defined using curb extensions, planters, painted curb, or flexible delineators.
- Install a “No Parking” sign (MUTCD R7 series).
- Strongly consider installing a high-visibility crosswalk or other enhancements in coordination.

Systemic Deployment

- Potential for rapid systemic implementation at all intersections.
- Consider implementing citywide by ordinance. Prioritize marking & signing intersections with high pedestrian volumes.

Considerations

- Parking removal should be discussed with community stakeholders, such as businesses and property owners.
- Converted parking spaces can be reallocated for green infrastructure or bicycle parking.
- Parking restrictions without physical barriers are less effective and may require enforcement.
- Parking restrictions may be tailored to certain times of day.
- May require removal of existing parking space markings and possibly meters.

Additional Information

- NACTO Urban Street Design Guide
- Unsignalized Intersection Improvement Guide

PAVEMENT FRICTION MANAGEMENT

Purpose:
Can prevent many roadway departure, intersection, and pedestrian-related crashes.

Description:
Measuring, monitoring, and maintaining pavement friction—especially at intersections and locations where vehicles are frequently turning, slowing, and stopping.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- All street types.

Applicable Locations

- Applicable at all locations.

Expected Crash Reduction

High-Friction Surface Treatment can reduce crashes up to:

- Injury Crashes at ramps: 63%
- Injury Crashes at Horizontal Curve: 48%
- Total crashes at intersections: 20%

Design Guidance Notes

Measuring friction data for safety performance:

- Continuous Pavement Friction Measurement Equipment (CPFM). Provides both network and segment level data, which accurately measures friction at curves or intersections (where pavement polishes more quickly, and adequate friction is more physical).
- Treatment: High Friction Surface Treatment (HFST).

Systemic Deployment

This treatment should be applied at:

- Horizontal curves.
- Interchange ramps.
- Intersection approaches.
- Locations with a history of rear-end, failure to yield, wet-weather, or red light-running crashes.
- Crosswalk approaches.

Considerations

- Consider implementing HFST at locations where vehicles may need additional friction to stop more quickly or stay on the road. Locations like horizontal curves, locations with a history of rear end and/or weather related crashes, and where vehicles may need to reduce speed or yield right of way.

Additional Information

- FHWA Proven Safety Countermeasure

PEDESTRIAN HYBRID BEACON

Purpose:
Signalized crossing for pedestrians allowing motor vehicles to proceed unless pedestrians are present.

Description:
Signals at major street crossing locations that remain dark until pedestrian activates via a pushbutton. Also called High Intensity Activated Crosswalks, or HAWKs.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- Access streets.
- Balanced streets.

Applicable Locations

- May be used mid-block or at uncontrolled approaches of an intersection.
- On streets with three or more lanes and more than 9,000 daily vehicles.
- On streets with speed limits of 40 mph or greater.
- Along bicycle routes, school crossings, or other high-volume crossings of a major street that do not meet warrants for a traffic signal.

Expected Crash Reduction

- 55% reduction in pedestrian crashes.
- 295 reduction in total crashes.
- 15% reduction in fatal and serious injury crashes.

FHWA-SA-21-045

Design Guidance Notes

- Install pedestrian signal heads and pedestrian pushbuttons on either side of the crossing.
- Mark crosswalk with high-visibility markings.
- May be installed with pedestrian warning sign (MUTCD W11-2 or MUTCD R1-5 series).

Systemic Deployment

- Pedestrian Hybrid Beacons have the potential for systemic implementation at crossings on multi-lane roadways with higher traffic volumes, speed limits at 30 mph or more, and longer intervals between crossings.
- Can be a systemic treatment for all mid-block crossings where roadway speed limits are 40 mph or higher.

Considerations

- Beacons are preferably placed above the crosswalk, rather than the side of the road.

Additional Information

- [FHWA Proven Safety Countermeasure]
- AASHTO Guide for the Development of Bicycle Facilities

POSITIVE OFFSET LEFT-TURN LANES

Image Source: FHWA

Purpose:
Providing better visibility for vehicles turning left at an intersection by offsetting the turn lanes.

Description:
Left-turn lanes are shifted to the left, off-set from opposing left-turn lanes to limit obstructed views of oncoming vehicles for left-turning vehicles.

Estimated Relative Cost:

$ $$ $$$

Applicable Street Types

- Balanced streets.
- Throughput streets.

Applicable Locations

- Signalized intersections where permissive left turns are allowed.
- Two-way stop controlled intersections with high left-turn volumes off the major road.

Expected Crash Reduction

- 36% reduction in injury crashes.
- 34% reduction in total crashes.
- 38% reduction in left-turn crashes.

FHWA-HRT-09-036

Design Guidance Notes

- Changes to pavement markings should follow MUTCD standards.
- Intersections along a curve commonly have poor sightlines that can be improved with positive-offset turn lanes.
- When the turn lane is offset by more than 6 feet, consider adding a pedestrian refuge island.

Systemic Deployment

- Best suited as a spot treatment on individual intersections or corridors because of the additional space required to implement offset turn lanes.
- Should be considered on roadway reconfiguration projects that remove travel lanes and reconstruction projects where right-of-way is available.

Additional Information

- Safety Evaluation of Offset Improvements for Left-turn Lanes, FHWA

POSTED SPEED LIMITS

Purpose:
Reduce motor vehicle speeds to prevent severe and fatal crashes.

Description:
Using speed limit signs, pavement markings, and other speed reduction measures to achieve target speeds on roadways that are appropriate for the context and support the city's goal of zero roadway deaths and serious injuries.

Estimated Relative Cost:

$ $$ $$$

Applicable Street Types

- All street types.

Applicable Locations

- Posted and target speeds should be considered for all roadways. Lower posted and target speeds are especially effective at reducing pedestrian crash risk in areas of high expected activity, such as:
  - Near schools.
  - Downtown commercial areas.
  - Near senior living centers.
  - Residential neighborhoods.

Expected Crash Reduction

- Appropriate Speed Limits for All Road Users lead to a 26 percent decrease in traffic fatalities in the City of Seattle (FHWA-SA-21-034).

Design Guidance Notes

- Define the priority user when identifying appropriate speed limit. Within school zones, pedestrians and bicyclists should always be given priority.
- Indicate school speed zones with signs (including MUTCD S4-5 series, S5-1, S5-3, R2-1).
- Pavement markings indicating the speed limit can supplement signs.
- Most effective when used in conjunction with other traffic calming treatments.

Systemic Deployment

- Systemic deployment of lower speed limits is not allowed under Nebraska law. Speed limits are set by state statute (20 mph in a business district, 25 mph in a residential area, 35 mph on other urban streets). Deviations from these speed limits are only allowed based on an “engineering and traffic investigation” of a specific location.
- Areas near schools should be prioritized for traffic studies to establish school zone speed limits.

Considerations

- School speed zones can be implemented for certain hours throughout the day, such as around arrival and dismissal times.
- Signs should be used carefully. Overuse can lead to drivers ignoring them.

Additional Information

- Manual on Uniform Traffic Control Devices 2009, Sec. 7B.08–7B.10.
- National Center for Safe Routes to School, The School Zone: School Zone Signs and Pavement Markings.
- FHWA Speed Limit Setting Handbook

PROTECTED INTERSECTIONS

Purpose:
Improve the safety of pedestrians and bicyclists crossing intersections.

Description:
Protected intersections are a type of intersection design that improves safety by reducing the speed of turning traffic, improving sightlines, and designating space for all road users. Protected intersections reduce conflict points between motorists and bicyclists.

Estimated Relative Cost:

$ | $$ | **$$$**

Applicable Street Types

- All street types.

Applicable Locations

- Any intersection with existing or planned sidepaths, separated bike lanes, buffered bike lanes, or conventional bike lanes.

Design Guidance Notes

- Corner refuge island size may vary. The curb radius along the path of motor vehicle travel should minimize turning motorist speeds to 15 mph or less.
- The forward bicycle queuing area should allow at least one bicyclist to wait without obstructing crossing bicyclists or pedestrians.
- The motorist yield zone should be 6 feet in length minimum, up to a typical car length (16.5 feet), to create space for a turning motorist to yield to a through moving bicyclist.
- A pedestrian crossing island should be a minimum of 6 feet in width to minimize pedestrian crossing distances of the street and provide space for an ADA-compliant refuge area.
- Marked pedestrian crosswalks should be provided across all bike lane crossings.
- Bicycle crossings should be separate from pedestrian crossings. They can be supplemented with green pavement to improve contrast.

Systemic Deployment

- Most suitable as a spot treatment or along corridors with sidepaths, separated bike lanes, buffered bike lanes, or conventional bike lanes.

Considerations

- Creating space for a motorist to yield to bicyclists and pedestrians. Research has found crashes are reduced at locations where bicycle crossings are set back from the motorist travel way by a distance of 6 to 20 feet, creating space for turning motorists to yield. At locations where the street buffer is less than 6 feet mid-block, additional dedication from developments may be necessary.

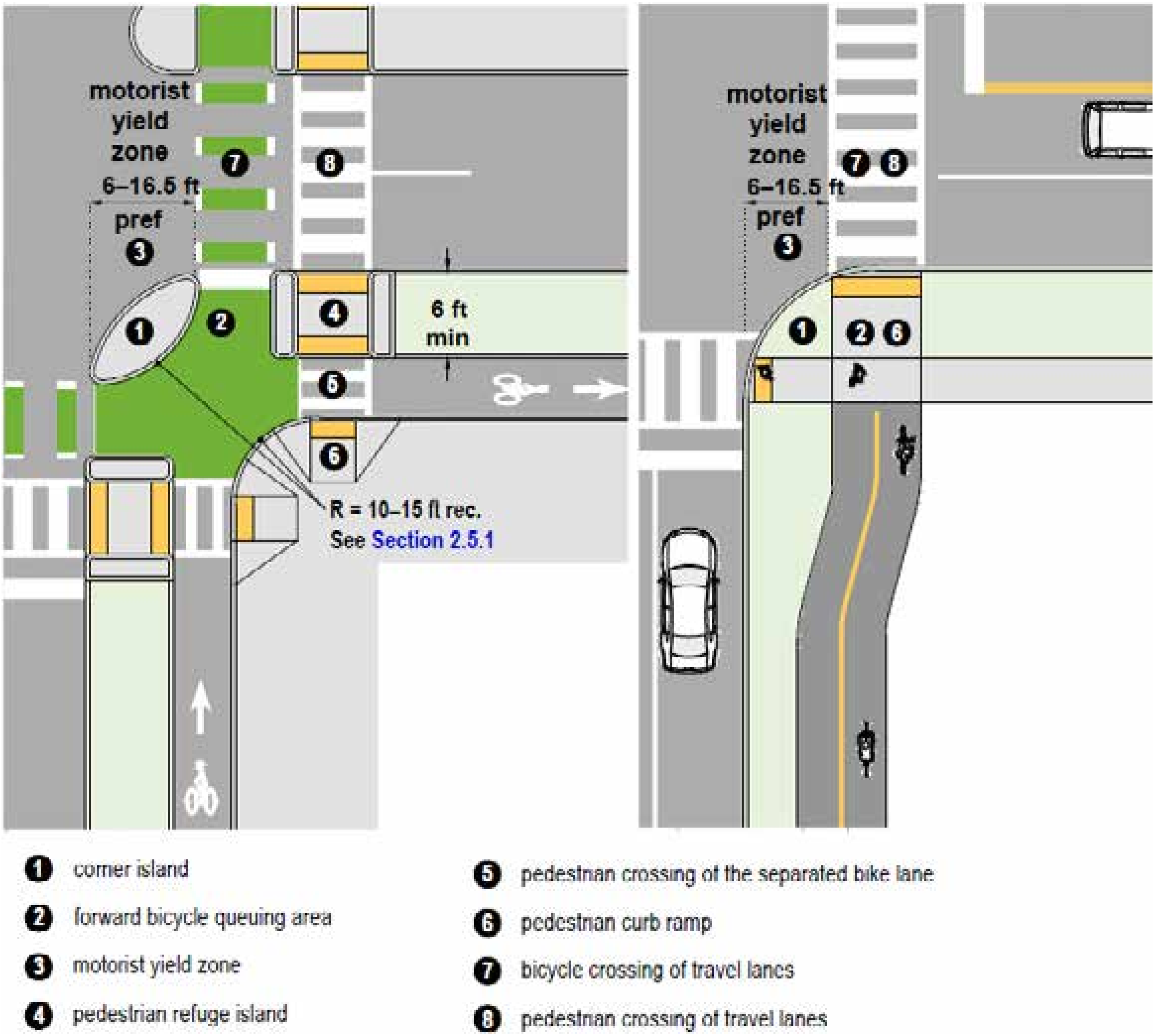


Image Source: Guide for the Development of Bicycle Facilities, 5th Edition. AASHTO. Figure 7-13.

Additional Information

- [NACTO Urban Bikeway Design Guide]
- AASHTO Guide for the Development of Bicycle Facilities

PROTECTED SIGNAL PHASES

Purpose:
Separate vehicular turns from pedestrian and bicyclist movement to eliminate conflicts.

Description:
Green- or red-arrow signals to restrict left or right motorist turning, allowing pedestrians and bicyclists to use crossings without interactions from turning vehicles.

Estimated Relative Cost:

$ | $$ | $$$

Applicable Street Types

- All street types.

Applicable Locations

- Intersections with high turning volumes.
- Intersections in urban areas.
- Intersections with a high volume of pedestrians or bicyclists.

Design Guidance Notes

- Install green- or red-arrow capabilities in traffic signals.
- Can be used for both right turning and left turning vehicles.
- When restricting right turns, install a "No Right Turn on Red" sign (MUTCD R10-11 series).
- Exclusive left turn lanes are strongly recommended for protected left turn phasing to avoid significant reductions in intersection capacity.

Systemic Deployment

- Useful as a systemic safety improvement at locations with a history of serious injury or fatal right- or left-turn crashes, or at high-risk locations with the same roadway and land use characteristics.

Considerations

- Needs of pedestrians, bicyclists, trucks, buses, and motor vehicles should be considered.
- Consider volume of motorists turning left and right.
- May reduce intersection vehicle capacity and increase vehicle queuing and blocking.

Additional Information

- [PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System]
- FHWA Traffic Signal Timing Manual, Chapter 4

RAISED CROSSINGS

Purpose:
Reduce vehicle speeds, increase motorist yielding, and improve bicyclist and pedestrian crossing safety.

Description:
Crossings elevated at least three inches above the roadway, up to the sidewalk level.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- Access streets.
- Balanced streets.

Applicable Locations

- Raised crossings are a treatment option often used mid-block. However, intersections can also have raised crosswalks or the entire intersection can be raised.
- Roadways with a posted speed of 30 mph or lower.
- Common on school campuses, at shopping centers, and in pick up/drop off zones.

Design Guidance Notes

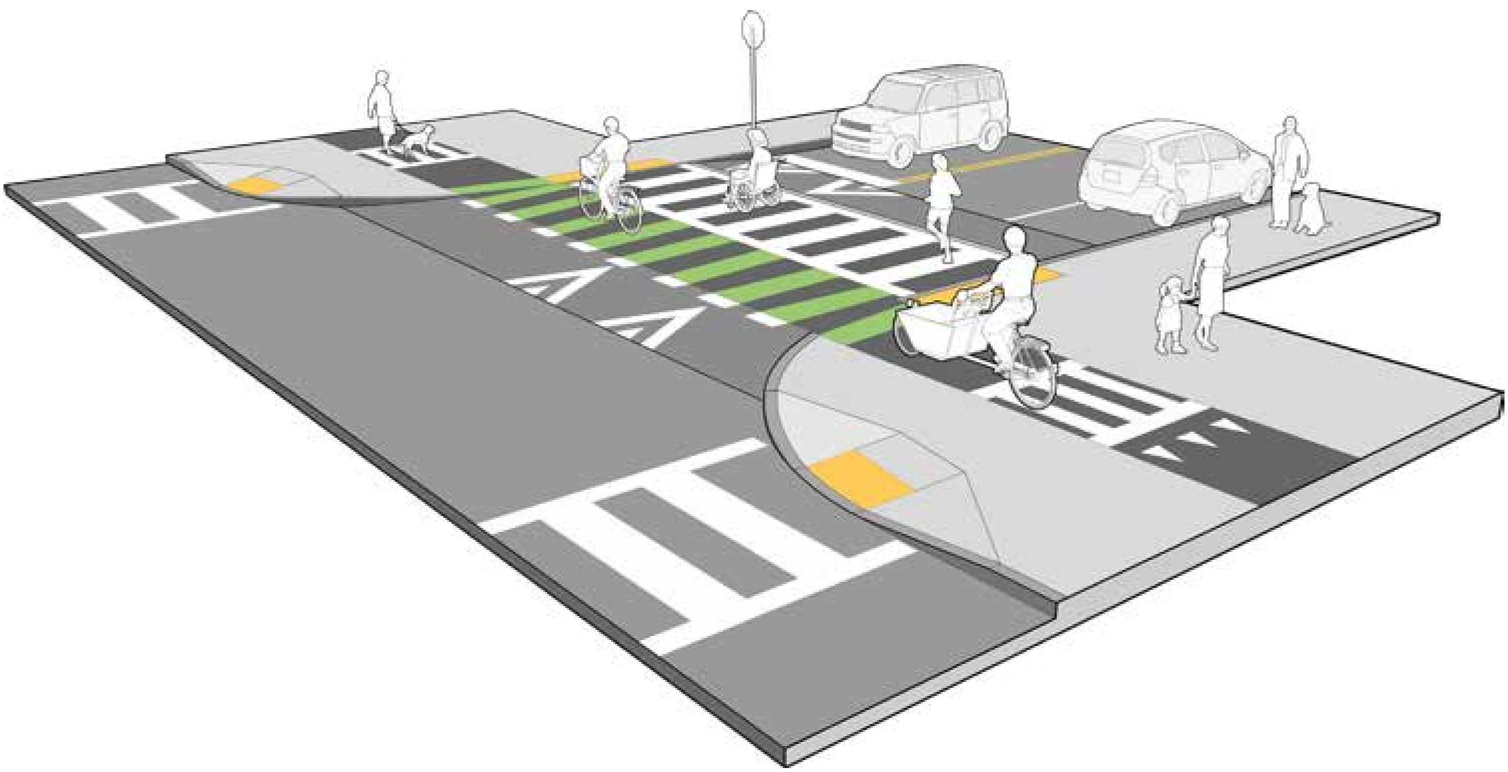
- Place ramps on each vehicle approach.
- Raised crossings are often demarcated with different paving materials and additional paint markings.
- Mark the crossing with high-visibility crosswalk markings.
- Install with applicable warning sign (MUTCD W11-1, W11-2, W11-15, or S1-1).
- Raised crossings do not require curb ramps, though truncated domes should be included at each crossing entrance.

Systemic Deployment

- Best suited as a spot treatment.

Considerations

- Raised crossings at sidewalk level are preferred for pedestrian accessibility and comfort, and safety.
- Raised crossings should not be used on steep curves or roadways with steep grades.
- May be used for bicyclists along crossings for shared use paths and sidepaths.
- Consider drainage needs.
- Further consideration is needed for roadways heavily used by trucks, buses, and emergency vehicles.



Additional Information

- [Field Guide for Selecting Countermeasures at Uncontrolled Pedestrian Crossing Locations]
- [FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations]

RAISED MEDIANS

Purpose:
Restrict motor vehicle turn movements, reduce head-on collisions, and provide refuge for crossing pedestrians.

Description:
Continuous raised medians are curbed sections in the center of a roadway that separate opposing directions of motor vehicle travel.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- All street types.

Applicable Locations

- At intersections.
- Along the entire block.
- At mid-block crossings.
- Across intersections where it is desirable to restrict motor vehicles turning left due to insufficient yielding or excessive speeds.

Expected Crash Reduction

- Medians with marked crosswalk - 46% reduction in pedestrian crashes (FHWA-SA-21-044).

Design Guidance Notes

- Medians may be landscaped or paved with a material different to that of the roadway.
- Continuous raised medians require 6 feet width to provide pedestrian refuge or 8 feet width to provide bicyclist refuge.
- Crossings must have ramps or cut-throughs to be fully accessible.

Systemic Deployment

- May be applied as a systemic safety improvement on corridors where motor vehicles do not sufficiently yield to pedestrians or bicyclists.
- Pedestrian refuge is needed where motor vehicle speeds are above 30 mph and average motor vehicle volumes are above 9,000 vehicles per day.

Considerations

- Landscaping can be added along the median, but vegetation at any crossings should not obstruct visibility for the pedestrian or motorist.
- Emergency vehicles may need to travel in lanes of opposing direction of travel.
- Continuous raised medians use space that can be used for bike lanes or wider sidewalks.
- Medians reduce the length a pedestrian has to cross at one time, but increase the total distance to cross the street.
- Can be installed with an active warning beacon at mid-block crossings.
- Intersections on a raised median corridor will experience high volumes of U-turns. Roundabouts (link) easily accommodate this movement and so pair well with continuous median corridors.

Additional Information

- American Disabilities Act Accessibility Guidelines for Buildings and Facilities
- [FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations]
- [FHWA Proven Safety Countermeasures]

RECTANGULAR RAPID FLASHING BEACONS (RRFB)

Purpose:
Increase driver yielding to pedestrians at uncontrolled crossings.

Description:
Bright, irregularly flashing LEDs, mounted with pedestrian crossing signs, which increase pedestrian visibility to drivers at uncontrolled crossings.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- All street types.

Applicable Locations

- May be used mid-block or at uncontrolled approaches of an intersection.
- RRFBs are a treatment option at many types of unsignalized pedestrian crossings, including at standard pedestrian, school, or trail crossings.
- RRFBs are particularly effective at multi-lane crossings with speed limits under 40 mph.
- Consider a Pedestrian Hybrid Beacon (PHB) for roadways with multiple lanes and higher speeds.

Expected Crash Reduction

- 47% reduction in pedestrian crashes.
- Can increase motorist yielding rates up to 98% (FHWA-SA-21-053).

Design Guidance Notes

- Place on both sides of an uncontrolled crosswalk.
- If pole-mounted, place below a W11-2 (Pedestrian), S1-1 (School), or W11-15 (Trail) crossing warning sign and above a diagonal downward arrow (W16-7P) plaque.
- May also be used with an overhead-mounted W11-2, S1-1, or W11-15 crossing warning sign, located at or immediately adjacent to an uncontrolled marked crosswalk.

Systemic Deployment

- Spot treatment or targeted systemic locations, such as trail or school crossings are appropriate. Broad application suggests other treatments such as speed reduction or roadway redesign may be necessary.

Considerations

- RRFBs should not be used in conjunction with "Yield," "Stop," or traffic signal control (except at roundabouts).
- If multiple RRFBs are needed in close proximity, consider redesigning the roadway to address systemic safety challenges.
- Other treatments may be more appropriate in locations with sight distance constraints.

Additional Information

- FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations
- FHWA Proven Safety Countermeasures
- Manual on Uniform Traffic Control Devices

REDUCED LEFT-TURN CONFLICT INTERSECTIONS

Purpose:
These intersections simplify decision-making for drivers and minimize the potential for higher severity crash types, such as head-on angle crashes.

Description:
Roadway design changes that alter how left-turn movements at intersections occur.

Estimated Relative Cost:

$ | $$ | **$$$**

Applicable Street Types

- Throughput streets.

Applicable Locations

- Applicable at a wide range of roadway types and contexts.

Expected Crash Reduction

RCUT:

- 2-way Stop Controlled to RCUT: 54% FSI crash reduction.
- Signalized Intersection to Signalized RCUT: 22% in FSI crashes.
- Unsignalized to Unsignalized RCUT: 63% reduction in FSI crashes.

MUT:

- 30% reduction in intersection related injury crash rate.

Design Guidance Notes

- Refer to FHWA for Planning and Design Guidances.

Systemic Deployment

- Due to high costs, best suited as a spot treatment where a history of severe left-turn crashes exists, or as a component of a larger reconstruction project.

Considerations

- Can be used in combination with Corridor Access Management to reduce turning conflicts on roadways with many commercial or office access points.
- Reduced conflict intersections can be unpopular due to the increased complexity and delay for drivers making certain movements from the minor road. Public engagement and driver education campaigns are important elements of a reduced conflict intersection project.

Additional Information

- FHWA Proven Safety Countermeasures

REST ON RED

Image Source: https://www.portland.gov/transportation/vision-zero/rest-red

Purpose:
Manage vehicle speeds and improve overall safety during overnight hours when visibility is poor, speeding is more likely to occur, and impaired driving is more common.

Description:
Traffic signals display red lights in all directions during late night and early morning hours when vehicle volumes are low. Lights will turn green when a vehicle is detected, but are timed to activate when a vehicle is traveling at a desired speed.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- All street types.

Applicable Locations

- Along corridors with a history of speed related crashes or citations at night or along corridors where bicyclists or pedestrians may be present at late night or early morning hours.

Design Guidance Notes

- Should be deployed along corridors with multiple signalized intersections to decrease dangerous speeding through a corridor.

Systemic Deployment

- Deploy along corridors with multiple traffic signals that can be used in tandem to control traffic speeds.

Considerations

- Costs to implement this technology can depend on existing infrastructure and technology. Consider rest on red technology when evaluating corridors for signal infrastructure upgrades.
- Staff time may be needed to evaluate and re-time rest on red signals as needed.

Additional Information

- City of Portland, OR whitesheet - https://www.portland.gov/transportation/vision-zero/rest-red#:~:text=When%20a%20person%20driving%20a,driving%20within%20the%20speed%20limit

ROADSIDE IMPROVEMENTS AT CURVES

Purpose:
Prevent or provide motor vehicles the opportunity to recover from lane departure at curves.

Description:
Enhance delineation and friction; creating or widening shoulders; improving clear zones; flattening slopes; or adding barriers such as cable barriers, guardrails, or concrete barriers at curves.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- All street types.

Applicable Locations

- At horizontal curves on rural roadways where data indicate a higher risk of roadway departure serious injuries or fatalities, such as:
  - Sharp or blind curves.
  - Curves without shoulders.
  - Curves with steep side slopes.

Expected Crash Reduction

- Enhanced Delineation for Horizontal Curves:
  - Treatments ranges from 15 to 60 percent in fatal and injury crash reduction.
- Roadside Design Improvements at Curves:
  - 8 to 12 percent reduction for single-vehicle crashes.
  - 22 to 44 percent reduction for all crashes (FHWA-SA-21-035).

Design Guidance Notes

- Low-cost countermeasures include:
  - Chevron and curve warning signs (MUTCD W1-x).
  - Retroreflective pavement markings.
  - Raised retroreflective lane markers.
  - Widened shoulders and shoulder rumble strips allow drivers more time to react and prevent a roadway departure. These treatments are commonly installed as part of a pavement resurfacing project.
- Pavement friction improvements may reduce lane or roadway departures.
- Wider clear zones and flatter slopes allow for recovery from roadway departure.
- Where both rumble strips and guardrails are provided, locate guardrails at least 5 feet from the rumble strips.
- Longitudinal barriers should be between pedestrian or bicyclist facilities and the motor vehicle travelway. Also provide a fence between pedestrian and bicyclist facilities and steep side slopes.
- The MUTCD requires that sign supports within the clear zone must be made breakaway or shielded by a barrier.
- Include a safety edge treatment when repaving and/or widening shoulders at curves.

Systemic Deployment

- Systemic treatment possible on rural roads at sharp curves or locations with steep side slopes. Especially important on higher-speed rural roads.

Considerations

- Treatments that visually widen the roadway, such as shoulder widening or tree clearing, may encourage higher vehicle speeds. These treatments are not recommended in urban contexts where pedestrians and bicyclists are common.

Additional Information

- FHWA Low-Cost Treatments for Horizontal Curve Safety
- FHWA Proven Safety Countermeasures:
  - Enhanced Delineation for Horizontal Curves
  - Pavement Friction Management
  - Roadside Design Improvements
- AASHTO Roadside Design Guide

ROAD SAFETY AUDITS

Purpose:

- Reduced number and severity of crashes due to safer designs.
- Reduced costs resulting from early identification and mitigation of safety issues before projects are built.
- Increased opportunities to integrate multimodal safety strategies and proven safety countermeasures.
- Expanded ability to consider human factors in all facets of design.
- Increased communication and collaboration among safety stakeholders.
- Objective review by independent multidisciplinary team.

Description:
Road Safety Audits are performed by a multidisciplinary team independent of the project. RSAs consider all road users, account for human factors and road user capabilities, are documented in a formal report, and require a formal response from the road owner.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- All street types.

Applicable Locations

- All roadways going through design changes.

Expected Crash Reduction

- 10-60% in reduction in total crashes.

Design Guidance Notes

- Refer to FHWA for implementation guidances.

Systemic Deployment

- RSAs can be performed in any phase of project development, from planning through construction. Agencies may focus RSAs specifically on motorized vehicles, pedestrians, bicyclists, motorcyclists, or a combination of these roadway users. Agencies are encouraged to conduct an RSA at the earliest stage possible, as all roadway design options and alternatives are being explored.

Considerations

- Conducting a RSA in advance of implementation can build support from a wide audience of stakeholders and even elected officials who participate in the plan and better understand the need for certain countermeasures which may raise the cost of a project, but improve safety for all users.

Additional Information

- [FHWA Proven Safety Countermeasure]
- [FHWA Road Safety Audit Guidelines]

ROADWAY RECONFIGURATION

Purpose:
Reduce the speed of traffic, reduce crossing distances, and/or provide additional space for other elements of the roadway.

Description:
Reduce the number of travel lanes, the width of travel lanes, or both.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- All street types.

Applicable Locations

- Multi-lane streets are eligible for lane reconfiguration.
- Emphasis should be placed on streets with priority pedestrian and bicyclist routes.
- Lane reconfiguration can be done in urban, suburban, and rural areas.

Design Guidance Notes

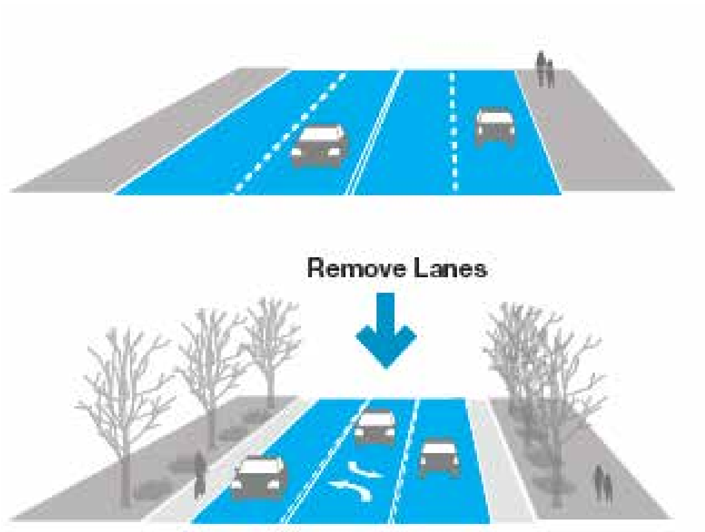
- Eliminating a travel through lane can make room for a bicycle lane, turn lanes, wider sidewalks, median island, curb extensions, on-street parking, transit lane, landscaping, or other uses.
- Reducing the number of travel lanes are often considered on roadways with up to 24,000 daily vehicles.
- Lane width is dependent on transportation function and land use context. See Street Design Guidelines for lane width guidance.

Systemic Deployment

- Generally a corridor treatment. Context is important to analyze need.

Considerations

- Removing a travel lane can increase some forms of congestion, like that caused by queuing at a signal. However, other types, such as congestion caused by vehicles waiting to turn left, can be reduced by converting travel lanes to turn lanes.
- Eliminating a travel through lane may increase congestion and vehicle queuing and blocking during peak travel hours.
- Evaluate impact of a roadway reconfiguration on all road users, not just vehicles.
- Consider implementing a roadway reconfiguration in conjunction with pavement overlay.



Road Diet

Lane Width Reduction

Additional Information

- Evaluation of Lane Reduction "Road Diet" Measures on Crashes
- PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System
- Road Diet Informational Guide
- FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations
- FHWA Achieving Multimodal Networks

ROUNDABOUTS

Purpose:
Reduce vehicle speeds, reduce high-speed collisions, and eliminate all left turns.

Description:
Circular intersections controlled by yield control rather than a signal or stop.

Estimated Relative Cost:

$ $$ **$$$**

Applicable Street Types

- All street types.

Applicable Locations

- Roundabouts can replace signalized intersections, or be installed at intersections where signals are unwarranted. They can also be installed at:
  - Intersections of local, collector, or arterial roadways.
  - Intersections with high left-turning vehicle volumes.
  - Intersections with more than four legs.
  - An entrance to an area signifying a change in land use.

Expected Crash Reduction

- 2-way Stop controlled intersection to a Roundabout - 82 percent reduction in fatal injury and crashes.
- Signalized Intersection to a Roundabout - 78 percent reduction in total injury and crashes (FHWA-SA-21-042).

Design Guidance Notes

- Curbed island in the middle of the intersection, often with landscaping.
- Inscribed diameter is typically less than 200 feet.
- Speeds and geometry should facilitate motor vehicle yielding. Entry speeds should be about 15 to 18 mph.
- Motorists can be slowed at exit and entry points with horizontal or vertical deflection.
- Channelization islands at all approaches can direct vehicles and slow traffic.
- Mark yield lines at all entries.
- Install crossing treatments for both pedestrian and bicyclists at least 20 feet from roundabout entry.
- Install with warning signs (MUTCD W11-1, W11-2, W11-15, or S1-1).
- May be installed with pedestrian-activated signals or beacons at crosswalks.

Systemic Deployment

- Spot treatment or targeted systemic locations for a corridor management program, such as gateways between areas with different target speeds.

Considerations

- Take into account pedestrian and bicycle volumes, the design vehicle, number of lanes, and available rights of way.
- Wayfinding should be provided for motorists, pedestrians, and bicyclists.
- Multi-lane or higher-speed roundabouts may not be suitable for intersections with high pedestrian and bicyclist volumes.
- Mini roundabouts may be more effective at intersections with low speeds and volumes.
- Roundabouts present unique challenges for individuals with visual disabilities. Wayfinding and gap selection cues need to be adequately addressed in roundabout designs. Accessible pedestrian signals should also be considered.

Additional Information

- Nebraska DOT Roadway Design Manual, Chapter 4
- FHWA Proven Safety Countermeasures
- FHWA Roundabouts
- NCHRP Guide for Roundabouts

SAFETYEDGE SM

FHWA

Purpose:
Allows drivers to return to the road safely and mitigate vehicles losing control

Description:
SafetyEdge$_{SM}$ technology shapes the edge of the pavement at approximately 30 degrees from the pavement cross slope during the paving process

Estimated Relative Cost:

$ | $$ | $$$

Applicable Street Types

- All street types.

Applicable Locations

- Applicable wherever the roadway is designed for open drainage (no curb & gutter). Typically used in rural contexts.

Expected Crash Reduction

- Fatal and Injury crashes - 11% reduction.
- Run-off-road crashes - 21% reduction.
- Head-on crashes - 19% reduction.

Design Guidance Notes

- FHWA suggests the beveled pavement edge slope should fall between 26 and 40 degrees. For pavement thickness greater than 5”, the pavement edge may be vertical below 5” depth.- At time of publication, NDOT has not developed a standard design specification for safety edge installation. When NDOT adopts a standard design, local roadway projects should adopt it to take advantage of contractor familiarity with NDOT’s practices.
- SafetyEdge Guide Specifications

Systemic Deployment

- Transportation agencies should consider systemic deployment at all new asphalt paving and resurfacing projects where curbs and/or guardrail are not present.
- Not appropriate to implement as a standalone project, because a safety edge installed on its own would not properly bond to existing pavement.

Considerations

- Safety edges can be installed on both asphalt and concrete roadways.- The beveled surface should not be considered part of the usable shoulder width. This is particularly important to consider if bikes are expected to ride on the shoulder.

Additional Information

- FHWA Proven Safety Countermeasure

SCHOOL ZONES

Purpose:
Alert drivers that they are approaching a school, where additional care is needed to ensure safety for all road users.

Description:
Speed limit signage is used to reduce vehicle speeds through a school zone. Signage is provided to indicate the presence of a school zone.

Estimated Relative Cost:

$ $$ $$$

Applicable Street Types

- All street types.

Applicable Locations

- Streets adjacent to school property.
- Street crossings that are heavily used by children walking and biking to school.

Design Guidance Notes

- School zone signage often includes the School Zone sign (S1-1), School Speed Limit Sign Assembly (S4-3P, R2-1), School Advance Crossing Assembly (S1- 1, W16-9P), and School Crossing Assembly (S1-1, W16-7P). All signs are included in the MUTCD, and should be fluorescent/ retroreflective yellow.
- At signalized intersections:
  - The School Zone sign should be installed 300 feet in advance of the signal when approaching the school zone.
  - The School Speed Limit Sign Assembly should be installed 200 feet in advance of the signal when approaching the school zone.
  - The School Crossing Assembly should be installed at the location of the marked crosswalk, or as close as possible to the marked crosswalk. If space does not exist at the intersection, the School Advance Crossing Assembly (S1-1, W16-9P) should be installed up to 100 feet in advance of the signalized crosswalk.

Image Source: MUTCD Figure 78-1

- At two-way and four-way stop intersections:
  - The School Zone sign should be installed 300 feet in advance of the stop sign when approaching the school zone.
  - The School Speed Limit Sign Assembly should be installed 200 feet in advance of the intersection when approaching the school zone.
  - The School Crossing Assembly should be omitted in this condition.
- At uncontrolled intersections with marked crosswalks, or at mid-block locations with a marked crosswalk:
  - The School Zone sign should be installed 300 feet in advance of the intersection or crosswalk when approaching the school zone.
  - The School Speed Limit Sign Assembly should be installed 200 feet in advance of the intersection when approaching the school zone.
  - The School Crossing Assembly should be installed at the location of the marked crosswalk.
- At mid-block locations without a marked crosswalk:
  - The School Zone sign should be installed 300 feet in advance of the school boundary.
  - The School Speed Limit Sign Assembly should be installed 200 feet in advance of the school boundary.
  - The School Crossing Assembly is not applicable in this condition.
- The End School Zone sign (S5-2) should be installed on the departure leg of all intersections at the corners of the school property boundary or at the limit of the school property boundary, opposite of the School Speed Limit Sign Assembly.

Systemic Deployment

- School speed zones should be a systemic safety improvement to all elementary, middle, and high school locations.

Considerations

- Sign placement should be mindful of sign clutter, or overusing signs, this might reduce the sign effectiveness.
- The application of each school zone sign should interact in a way that clearly conveys the message to motorists that they are approaching a school zone, indicate the required speed reduction, and warn of locations where students may be crossing.
- When designing for multiple schools nearby each other, these signs should be applied in a manner that supports a cohesive network between the school zones and avoids any confusion.

Additional Information

- Nebraska DOT Research on School Zone Safety (2020). https://dot.nebraska.gov/media/m2jfma3d/school_zone_final_report_06-15-2020.pdf
- Lawrence School Area Traffic Control Policy (2024). https://assets.lawrenceks.org/mso/Lawrence_School_Area_Traffic_Control_Policy.pdf
- City of Lincoln School Zone Standards (2020). https://www.lincoln.ne.gov/City/Departments/LTU/Transportation/Traffic-Engineering/School-Zone/Report

SEPARATED BIKE LANES

Purpose:
Provide physical separation between bicyclists and motorists.

Description:
Separated bike lanes provide exclusive space for bicycling, combining the user experience of a sidepath with the on-street infrastructure of a conventional bike lane. They are physically separated from motor vehicle traffic and distinct from the sidewalk.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- All street types.

Applicable Locations

- Applicable on streets with three or more lanes or speeds of 30 mph or greater.
- Suited for truck or bus routes, or streets where bike lane obstruction is likely to be frequent.
- Preferred in higher density areas, adjacent to commercial and mixed-use development, and near major transit stations or locations where observed or anticipated pedestrian volumes will be higher.

Design Guidance Notes

- See Street Design Guidelines for design guidance and bikeway facility type selection.
- On streets with two to four through lanes, one-way directional separated bike lanes are preferred to a two-way separated bike lane on one side of the street as they:
  - Follow normal traffic flows, whereas two-way separated bike lanes can create unexpected movements.
  - Result in simpler transitions to other facilities.
  - Are less likely to need signal modifications.
- Separated bike lanes can provide different levels of separation:
  - Flexible delineator posts ("flex posts") offer the least separation and are appropriate as an interim solution.
  - Raised buffers provide the greatest level of separation from traffic but will often require street reconstruction or retrofit.
  - On-street parking offers a high-degree of separation but may require raised buffer treatments at intersections.
  - Can be implemented at street-level, sidewalk-level, or intermediate-level.

Systemic Deployment

- Best suited as a corridor treatment.

Considerations

- More attractive to a wider range of bicyclists than striped bikeways on higher volume and faster speed streets.
- Prevent motor vehicles from driving, stopping, or waiting in the bikeway.
- Provide greater comfort to pedestrians by separating them from bicyclists.

Additional Information

- AASHTO Guide for the Development of Bicycle Facilities
- FHWA Bikeway Selection Guide
- NACTO Urban Bikeway Design Guide
- FHWA Proven Safety Countermeasures

SHARED STREETS

Purpose:
Prioritize pedestrian and bicycle movement by slowing vehicular speeds and communicating clearly through design features that motorists must yield to all other users.

Description:
Streets designed such that pedestrians and bicyclists can walk or ride on the street and cross at any location, rather than at designated locations.

Estimated Relative Cost:

$ $$ **$$$**

Applicable Street Types

- Access streets.

Applicable Locations

- Walkable commercial streets where an enhanced pedestrian shopping experience can support economic development and tourism.- Downtown streets frequently used for festivals, parades, markets, or other civic events.- Low-traffic residential streets used for informal play and neighborhood gatherings

Design Guidance Notes

- Shared streets should not have vertical curbs, so that pedestrians can use the entire right-of-way. A lack of curbs encourages cautious behavior on the part of all users, which in turn reinforces slower speeds and comfortable walking and bicycling conditions.
- Shared street target speeds should be below 15 mph. Aggressive traffic calming is often necessary, particularly at the gateway to a shared space.
- Shared street gateway treatments should inform drivers they are entering a shared space. Common ways to do so include:
  - Narrowing entrances to one lane.
  - Elevating the street to the pedestrian level with a raised intersection at the start of the shared street section.
  - Using a colored or textured pavement.

Systemic Deployment

- Best suited as a corridor or street segment treatment.

Considerations

- The curbless nature of shared streets enhances universal access.
- Street zones may be delineated with pavement materials, color, bollards or street furniture.
- Sidewalk space in front of buildings should be paved with a surface that is smooth and vibration-free.
- Stormwater on shared streets can be captured using valley gutters, additional inlets and/or bioswales or other green infrastructure.
- A shared street may be closed to motor vehicles to host public events. Care should be taken to maintain access for bicyclists when it is closed to vehicles.
- Consideration should be given to design details for low vision or blind pedestrians.

Additional Information

- [NACTO Urban Street Design Guide] (pages on Residential Shared Streets and Commercial Shared Streets)
- [FHWA Accessible Shared Streets]

SHOULDERS

Purpose:
Provide space for pedestrian and bicycle travel and provide space for errant motor vehicles.

Description:
Paved shoulders extend the roadway on the outside of travel lanes.

Estimated Relative Cost:

$ $$ **$$$**

Applicable Street Types

- Throughput streets.
- Balanced streets.

Applicable Locations

- Shoulders are used on higher-speed rural roadways. They may be appropriate on rural bike routes where dedicated bikeways or sidepaths would not fit or be appropriate.

Design Guidance Notes

- Guidance on shoulder width to accommodate bicyclists is included in the Street Design Guidelines.
- Shoulders should be wider if guard rails or vertical barriers are present. Consider vehicle speeds and traffic volumes.
- Rumble strips should be designed for bicyclist safety. Rumble strips should be installed at least 4 feet from the outside edge of the paved shoulder.
- Rumble strips should have gaps to allow bicyclists to exit the shoulder.

Systemic Deployment

- Not suitable for short-term systemic deployment due to high costs and potential private property impacts. Standalone shoulder widening projects should be targeted based on run-off-road crash history.
- Shoulders should be provided in new construction and reconstruction of rural roadways carrying greater than 2,000 vehicles per day at speeds greater than 45 mph.

Considerations

- Wide shoulders encourage higher vehicular speeds. They are not known to provide a safety benefit in low-speed urban contexts, and increase the risk of pedestrian and cyclist crashes leading to fatalities due to increasing speeds.
- Consider providing wider paved shoulders at horizontal curves where roadway departure crashes are most likely, and at steep uphill grades to allow vehicles to safely pass climbing bicyclists. These locations may warrant spot shoulder installation even if the corridor's speed and volume do not meet the threshold for shoulders.
- On roads where posted speed exceeds 30 mph and volumes exceed 6,000 motorists per day, bikeable shoulders do not create low-stress environments.

Additional Information

- FHWA Achieving Multimodal Networks
- FHWA Proven Safety Countermeasures: Shoulder Rumble Strips
- AASHTO Roadside Design Guide
- AASHTO Guide for the Development of Bicycle Facilities

SIDEPATHS

Purpose:
Paths outside of the curb designated for bicyclists and pedestrians.

Description:
Shared-use paths that accommodate two-way traffic for bicyclists and pedestrians. While separated from traffic, they are located inside and parallel to the street right-of-way.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- All street types.

Applicable Locations

- Applicable on streets with three or more lanes, speeds of 30 mph or greater, or 6,000 vehicles or more.
- Suited for truck or bus routes, or streets where on-street bike lane obstruction is likely to be frequent.
- Sidepaths may be preferable to separated bike lanes if low pedestrian volumes are anticipated in order to minimize right-of-way impacts.
- Applicable near schools and senior living facilities where an on-street bike lane would not meet the needs of vulnerable bicyclists.

Design Guidance Notes

- See Street Design Guidelines for design guidance and bikeway facility type selection.

Systemic Deployment

- Best suited as a corridor treatment or systemically as described in the Street Design Guidelines.

Considerations

- Sidepaths expected to serve a high percentage of pedestrians (30 percent or more) or be used by large maintenance vehicles should be wider than 10 feet.
- Sidepaths with high use may require pedestrian and bicycle separation. This separation can take the form of pavement markings or separate parallel paths for each user group. If separation is achieved by pavement markings, the bicycle side of the pathway should be no less than 10 feet wide and the pedestrian side should be no less than 5 feet wide.

Additional Information

- AASHTO Guide for the Development of Bicycle Facilities
- FHWA Bikeway Selection Guide
- NACTO Urban Bikeway Design Guide

SPEED HUMPS, TABLES, AND CUSHIONS

Purpose:
Reduce motor vehicle speeds.

Description:
Speed humps are paved ramps measuring 3- to 4-inches high that extend the full width of the street. Speed tables are wider or have a flat top. Speed cushions have wheel cutouts to allow large vehicles to pass through unaffected.

Estimated Relative Cost:

$ **$$** $$$

Applicable Street Types

- Access streets
- Balanced streets.

Applicable Locations

- Vertical traffic control measures such as speed humps, tables, and cushions are best used on streets with lower motor vehicle speeds and volumes and have appropriate spacing between intersections.
- Useful in areas where traffic calming is needed, such as near schools.

Design Guidance Notes

- Install speed humps perpendicular to the flow of traffic.
- Use MUTCD-compliant pavement markings and warning signs at speed humps, tables, and cushions, to alert drivers to slow down.
- Speed humps can be placed periodically along a route to reinforce speed control.
- Well-designed speed humps, tables, and cushions allow vehicles and people riding bikes to proceed over the device at the intended speed with minimal discomfort.
- Do not install on the curve of the roadway.

Systemic Deployment

- Best suited as a spot treatment.

Considerations

- Speed cushions may be appropriate to allow faster emergency response on streets frequently used by fire and EMS vehicles.
- Vertical traffic calming measures are not recommended on truck routes used by “low-boy” trailers, or bus routes.

Additional Information

- AASHTO Guide for the Development of Bicycle Facilities
- [ITE Traffic Calming Measures]
- [NACTO Urban Street Design Guide]

TREE BUFFER

Purpose:
Separate sidewalk from the roadway, narrow motorists' field of vision, add shade, comfort, and beauty to the street.

Description:
Trees in raised medians or on the edge of streets between the travelway and sidewalk.

Estimated Relative Cost:

$ (selected) | $$ | $$$

Applicable Street Types

- All street types.

Applicable Locations

- Residential neighborhoods.
- Downtown commercial areas.
- Rural roads.
- Areas near schools.

Design Guidance Notes

- Select the right tree species for a space to provide canopy and minimize maintenance costs.
- To allow adequate space for root system growth, tree buffers should be a minimum of 5 feet wide, with at least 36" depth of uncompacted soil.
- Provide at least 800 cubic feet of uncompacted soil space per tree planted.
- Trees are healthiest when surrounded by permeable surfaces. Plant trees within a continuous green buffer strip wherever possible.
- In urban areas with high pedestrian volumes, engineered tree pits with ADA-compliant tree grate surfaces can provide soil volume for trees while allowing wider sidewalks.
- Coordinate placement of street trees with streetlights, overhead utilities, street furniture, and traffic signals.
- Make sure to minimize construction impacts including trenching and soil compaction in root areas.
- Consider watering throughout the plant establishment period or installing irrigation.

Systemic Deployment

- Street trees can be included for traffic calming on all street types. Sight lines should be maintained on all street types and clear zones as applicable.
- Major changes to streets are often needed to provide space for trees. If there is space, street trees can be added to streets.

Considerations

- Width of planting zone should be considered so trees do not damage the sidewalk as they grow.
- Street trees can improve vibrancy of the streetscape.
- Consider allocation of space to optimize tree health and maintenance.
- Sight distance (and the maintenance needed to maintain a safe sight distance) must be considered for street trees near intersections or on roadway curves.

Additional Information

- [The Role of Street Trees for Pedestrian Safety, MassDOT]
- [NACTO Urban Street Design Guide]

TRUCK APRONS

Purpose:
Accommodate the turning radius of trucks and other large vehicles to allow them to safely turn while deterring high-speed turns.

Description:
Mountable curblines in the middle of roundabouts and intersection corners

Estimated Relative Cost:

$ $$ $$$

Applicable Street Types

- Balanced streets.
- Throughput-oriented streets.

Applicable Locations

- Residential place types.
- Commercial/Mixed-Use & Commercial place types.
- Streets with high volumes of both non-motorized users and freight traffic.

Design Guidance Notes

- Truck aprons should be mountable by larger vehicles while still maintaining the tighter turning radius for smaller vehicles.
- Avoid extending the truck apron through bicycle lanes and pedestrian crosswalks.
- Indicate to smaller vehicles that they should avoid traveling over the truck apron by using colored concrete or pavement markings to provide visual contrast.
- Demonstration or quick-build truck aprons can be constructed with plastic or rubber curbing, allowing faster, less costly construction and typically slow right-turning vehicles.

Systemic Deployment

- Best suited as a spot treatment based on traffic characteristics at a specific intersection.
- Consider deployment at roundabouts and at the intersections of high volume truck routes or intersections with large corner radii.

Considerations

- Stormwater drainage systems may need to be modified to accommodate extending truck aprons to the existing curbline.
- There are multiple types of truck aprons that can be used depending upon location of crosswalks, curb ramps, and drainage patterns.

Additional Information

- [Pedestrian Facilities - Multimodal Design Guide, Ohio DOT]
- AASHTO Guide for the Development of Bicycle Facilities

WALKWAYS

Purpose:
A designated space for pedestrians travel.

Description:
Any type of defined space or pathway for use by a person traveling by foot or using a wheelchair, such as sidewalks, shared use paths, or roadway shoulders.

Estimated Relative Cost:

$ | **$$** | $$$

Applicable Street Types

- All street types.

Applicable Locations

- On both sides of all streets.

Expected Crash Reduction

- Sidewalks: 65-89% reduction in crashes involving pedestrians walking along roadways.
- Paved shoulders: 71% reduction in crashes involving pedestrians walking along roadways.

Design Guidance Notes

- See Street Design Guidelines.

Systemic Deployment

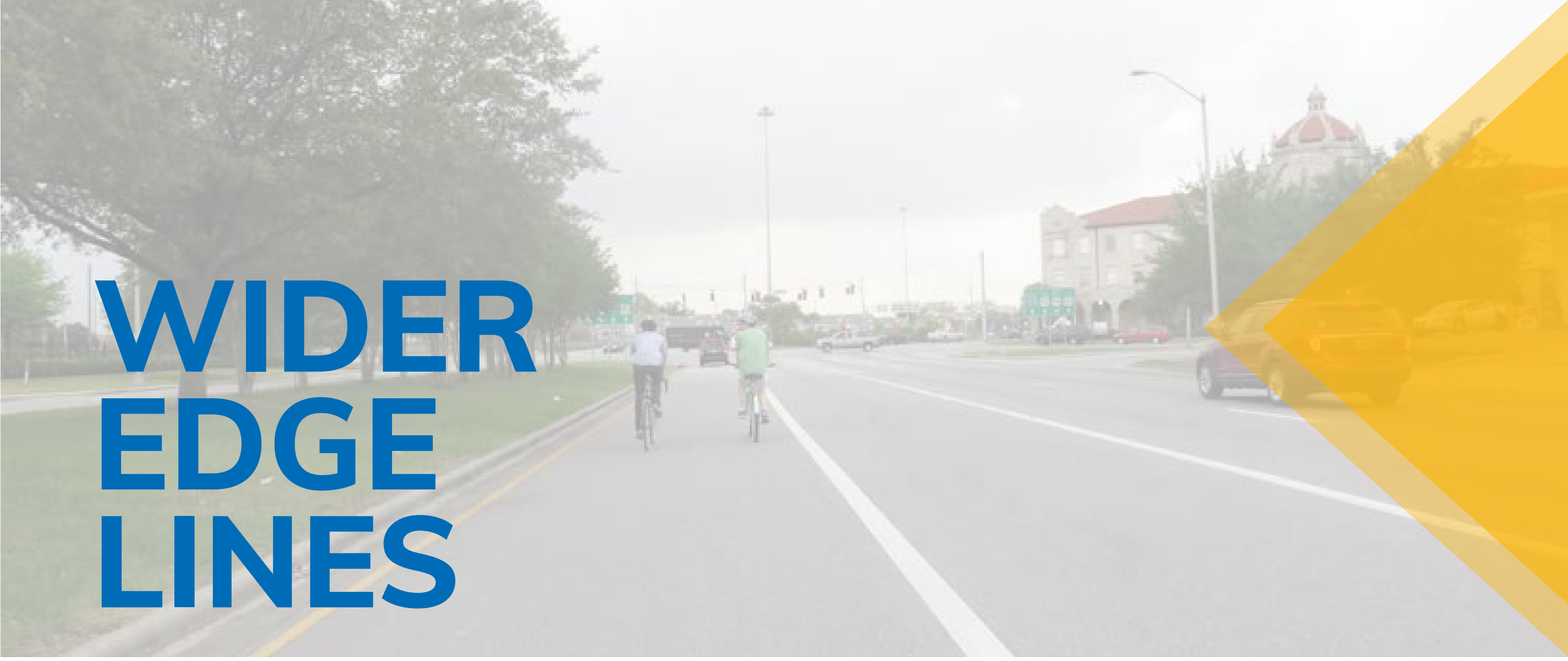
- Walkways should be provided on both sides of all streets and should be included in public infrastructure projects as well as private development and redevelopment projects.
- On existing streets, prioritize filling “sidewalk gaps” with new walkways as a short-term systemic countermeasure.

Considerations

- Walkways are particularly important near schools, transit stops, and areas with a large amount of pedestrian activity.
- Pedestrians should have a connected network of walkways and other infrastructure to provide connections to desired destinations without gaps or abrupt changes. Maintenance of sidewalks is critical to safe and comfortable pedestrian travel.
- The common practice of allowing developers to defer sidewalk installation on a lot until the home is built leads to disconnected, unusable pedestrian networks. Sidewalks should be constructed in full at the same time as the adjacent roadways.

Additional Information

- FHWA Proven Safety Countermeasures
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
- NACTO Urban Street Design Guide



WIDER EDGE LINES

Purpose:
Decreasing roadway departure by enhancing the visibility of travel lane boundaries.

Description:
Increasing edge lines from the minimum normal line width of 4 inches to the maximum normal line width of 6 inches.

Estimated Relative Cost:

$ $$ $$$

Applicable Street Types

- All street types.

Applicable Locations

- Applicable for a wide variety of facility types in both rural and urban areas.
- Most effective in reducing crashes on rural two-lane highways, especially for single-vehicle crashes.

Additional Information

- FHWA Proven Safety Countermeasures

Expected Crash Reduction

For the following roadway types:

- Rural, two-lane roads: 37% reduction for non-intersection, fatal and injury crashes.
- Rural freeways: 22% reduction for fatal and injury crashes.

Design Guidance Notes

- Wider edge lines are 6 inches wide instead of the standard 4 inches.

Systemic Deployment

- Consider systemic implementation to address roadway departure crash risk factors (traffic volumes, presence of curves, pavement and shoulder width, etc.).

Considerations

- Wider edge lines can be implemented using existing equipment during maintenance procedures like re-striping and resurfacing, with the only cost increase being the additional material.
- More durable materials (e.g. thermoplastic) may result in a lower life cycle cost based on their longer service life.
- Wider edge lines are more accurately detected by automated vehicles and allow them to operate with reduced need for human input.

YELLOW CHANGE INTERVALS

Purpose:
Reduce red-light running and improve overall intersection safety

Description:
Maintaining or adapting the yellow signal cycle so that it is appropriately timed.

Estimated Relative Cost:

$ $$ $$$

Applicable Street Types

- All street types.

Applicable Locations

- Systemic deployment at all signalized intersection to improve signal timing.

Expected Crash Reduction

- 36-50% reduction in red-light running.
- 8 to 14% reduction in total crashes.
- 12% reduction in injury crashes.

Design Guidance Notes

- Factors to consider for timing calculation:
  - Speed of approaching and turning vehicle.
  - Driver reaction time and vehicle deceleration.
  - Intersection geometry.

Systemic Deployment

- Systemic deployment at all signalized intersection to improve signal timing.

Considerations

- Transportation agencies should review and update their traffic signal timing policies and procedures concerning the yellow change interval.

Additional Information

- FHWA Proven Safety Countermeasures
- Manual on Uniform Traffic Control Devices
- ITE Guidelines for Determining Traffic Signal Change and Clearance Intervals

A6

Corridor Profiles

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Purpose of the Corridor Profiles

The purpose of a corridor profile is to provide location-specific infrastructure recommendations and the justification for them. The first two pages of each corridor profile document the existing conditions such as traffic volumes, number of lanes, presence of sidewalks, crash history and statistics, community feedback about the existing corridor, and analysis results. The third and four page of each corridor profile document the corridor-wide recommendations and site-specific recommendations, which are from the Toolbox in Appendix 5.

The four Corridor Profiles included in the MTAP are:

- Norfolk Avenue from South 14th Street to North Cottonwood Street.
- US-81 (13th Street) from Pasewalk Avenue to US-275 (Omaha Avenue).
- North 1st Street from Benjamin Avenue to Elm Avenue.
- US-275 (Omaha Avenue) from 7th Street to Pierce St.

Norfolk Avenue

from South 14th Street to North Cottonwood Street (1.3 Miles)

CONTEXT

Norfolk Ave is a primary east-west corridor serving Downtown Norfolk and commercial, retail, mixed-use, and residential uses. Development density relatively high along this corridor, especially between 8th St and 1st St, which is a Norfolk's traditional downtown area.

FSI Crashes - Fatal and Serious Injury
Minor Injury Crashes: Possible and Visible Injury
*This data does not include Property Damage Only crashes

	Fatal Crashes	Serious Injury Crashes	Minor Injury Crashes	Total Crashes*
Bicyclist	0	1	4	5
Pedestrian	1	2	3	6
Motor Vehicle	0	4	62	66
Total	**1**	**7**	**69**	**77**

INTERSECTION RELATED - LOCATION

- 7 of 8 (88%) of FSI crashes were at an intersection
- 6 of 7 (86%) of FSI crashes at intersections were at a signalized intersection

CRASH TYPES

- 38% of FSI crashes involved a pedestrian
- 13% of FSI crashes involved a bicyclist

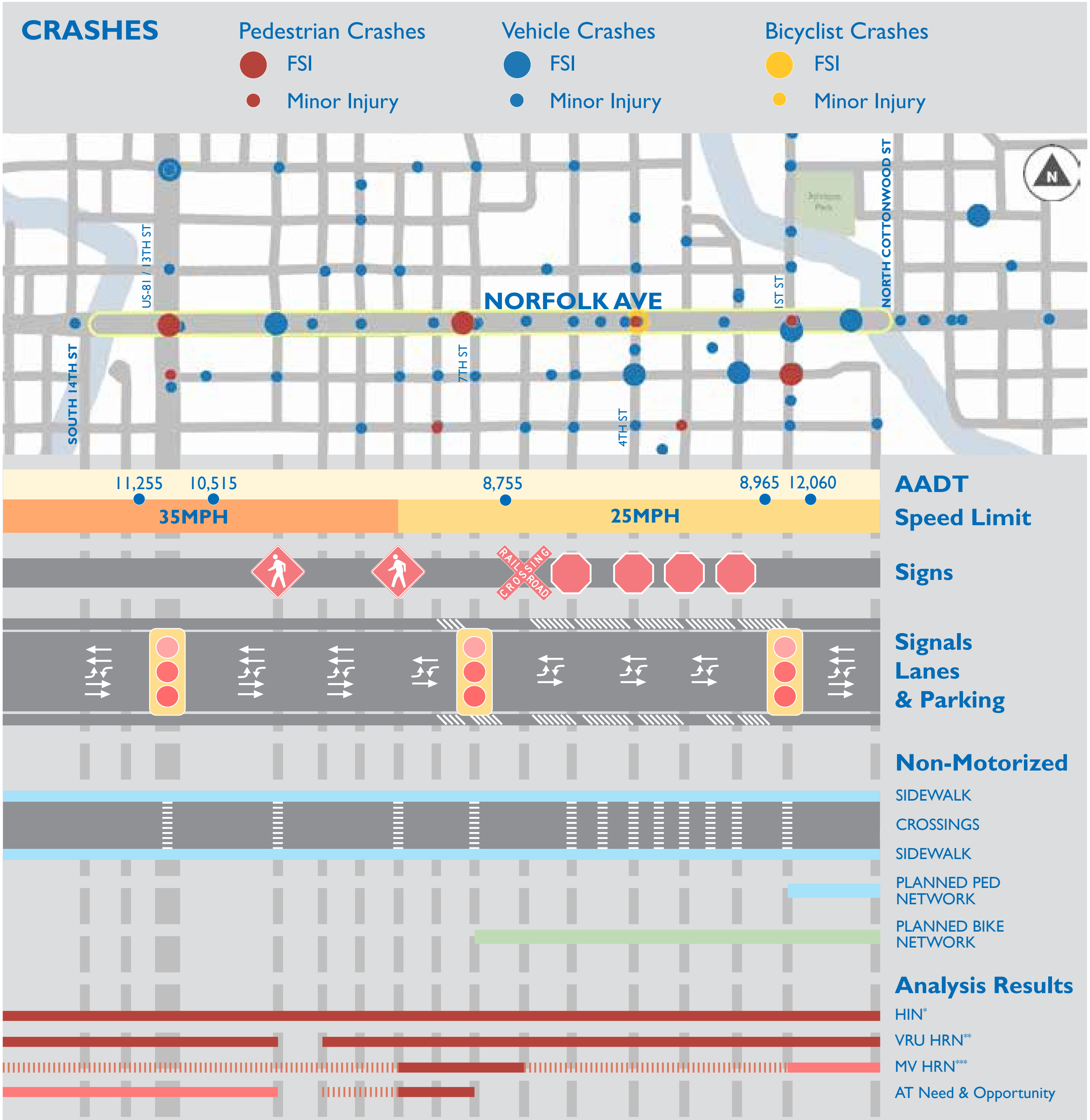
DRIVER CONTRIBUTING CIRCUMSTANCES

- 50% of FSI crashes were attributed to distracted driving
- 13% of FSI crashes were attributed to users dis-regarding traffic signals, signage, etc.
- 11% of FSI crashes were attributed to users failing to yield right of way

KEY COMMUNITY FEEDBACK

- Visibility is poor at intersections
- Drivers do not pay attention, and do not look out for pedestrians or bicyclists
- Roadway is too wide for pedestrians to comfortably and safely cross
- Signage and signal can be confusing


Source: Toole Design



High Risk Network

High

Medium

Low

Active Transportation Need & Opportunity****

Very High

High

Medium

*High Injury Network - Roadways with a elevated history of Fatal and Injury crashes

**VRU HRN - Roadways with a high risk for Fatal and Injury crashes involving Vulnerable Road Users

***MV HRN - Roadways with a high risk for Fatal and Injury crashes involving Motor Vehicles

****Active Transportation (AT) Need & Opportunity - Roadways with needs and opportunities for active transportation improvements

Norfolk Avenue

from South 14th Street to North Cottonwood Street (1.3 Miles)

CORRIDOR-WIDE RECOMMENDATIONS

CURB EXTENSIONS
Reduce crossing distance at crosswalks (including mid-block crossings) to improve pedestrian safety and reduce curb radius to slow turning motor vehicle traffic

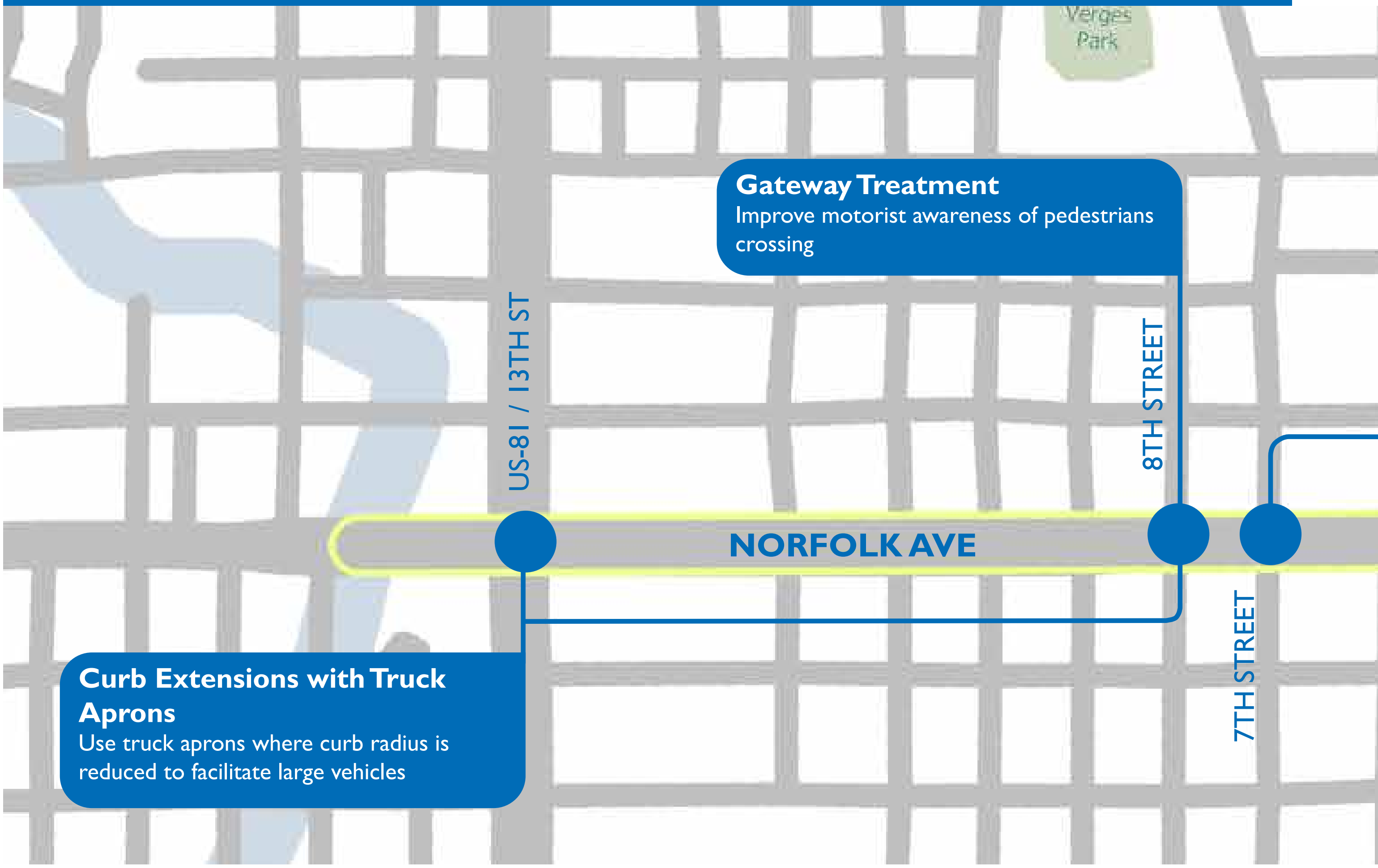
LIGHTING
Improve lighting at intersections and crossings, particularly to illuminate crosswalks, to improve visibility at night

RAISED MEDIANS
Between 8th St and 1st St - extend medians through crosswalk and install lighted R1-6 pedestrian crossing signs at intersections. Consider removing left turn lanes and provide full median for pedestrian refuge

ROADWAY RECONFIGURATION
From 8th St to S 14th St - a conversion from 5 lanes to 3 lanes would reduce traffic speed and make space for other roadway features

SIDEPATH OR SEPARATED BIKE LANES
Add dedicated bikeway(s) for people of all ages and abilities.

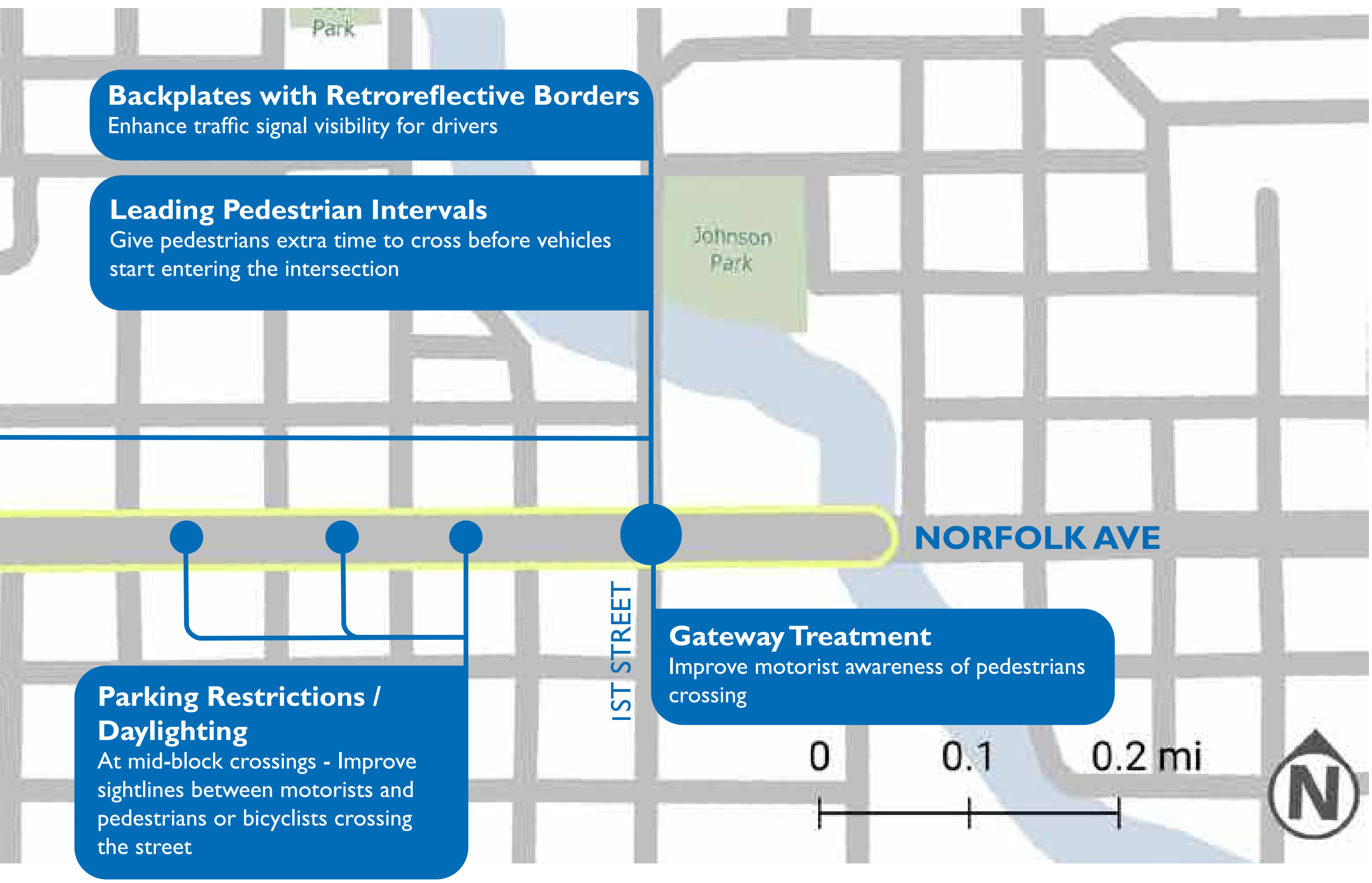
SITE-SPECIFIC RECOMMENDATIONS



TOTAL COST OF RECOMMENDATIONS

$10,402,000

- Curb extensions / truck aprons: $1,064,000
- Lighting: $1,380,000
- Raised medians: $1,176,000
- Roadway reconfiguration and separated bike lanes: $1,686,000
- Leading pedestrian/bicycle intervals: $5,000
- Gateway treatments: $200,000
- Parking restrictions / daylighting: $18,000
- Backplates with retroreflective borders: $10,000
- Miscellaneous work and contingency: $4,863,000



US-81 (13th St)

from W Pasewalk Avenue to US-275/Omaha Avenue (0.53 Miles)

CONTEXT

US-81 is a major north-south corridor in Norfolk and serves as a truck route. Between W Pasewalk Ave and US-275, US-81 serves many commercial businesses and pass-through north-south traffic.

FSI Crashes - Fatal and Serious Injury
Minor Injury Crashes: Possible and Visible Injury
*This data does not include Property Damage Only crashes

	Fatal Crashes	Serious Injury Crashes	Minor Injury Crashes	Total Crashes*
Bicyclist	0	0	1	1
Pedestrian	0	0	1	1
Motor Vehicle	0	6	63	69
Total	**0**	**6**	**65**	**71**

INTERSECTION RELATED - LOCATION

- 5 of 6 (83%) of FSI crashes were at an intersection
- High number of Left Turn crashes at intersections caused a high percentage of FSI crashes

CRASH TYPES

- 100% of FSI crashes were interactions between motor vehicles

DRIVER CONTRIBUTING CIRCUMSTANCES

- 50% of FSI crashes were attributed to distracted driving
- 33% of FSI crashes were attributed to users disregarding traffic signals, signage, etc.

KEY COMMUNITY FEEDBACK

- Road is not accessible for people of different ages and abilities
- Drivers do not pay attention, and do not look out for pedestrians or bicyclists
- Roadway is too wide and lacks separation between vehicles and pedestrians or bicyclists

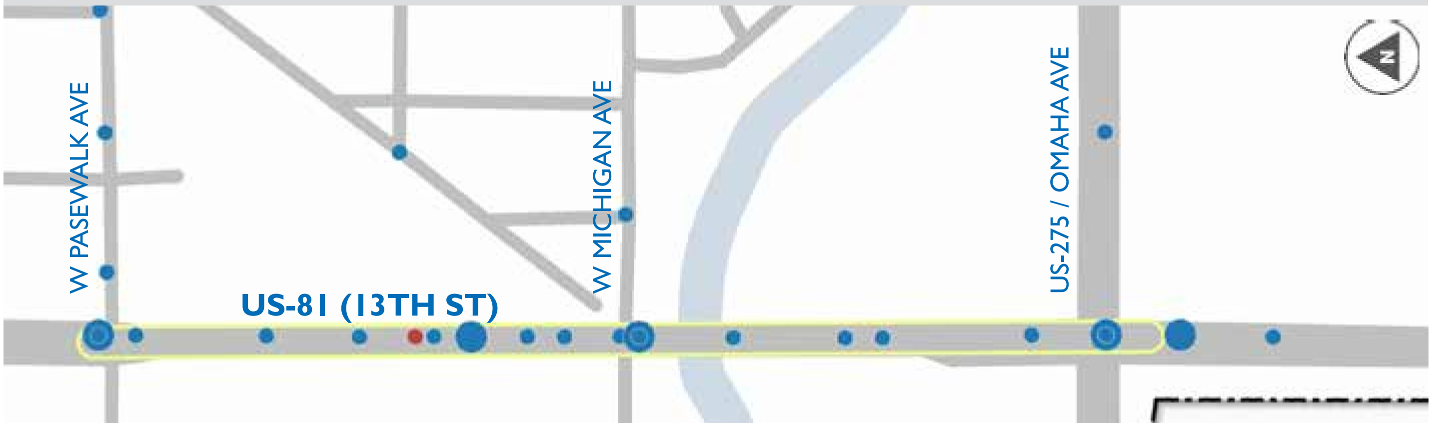
Source: Toole Design

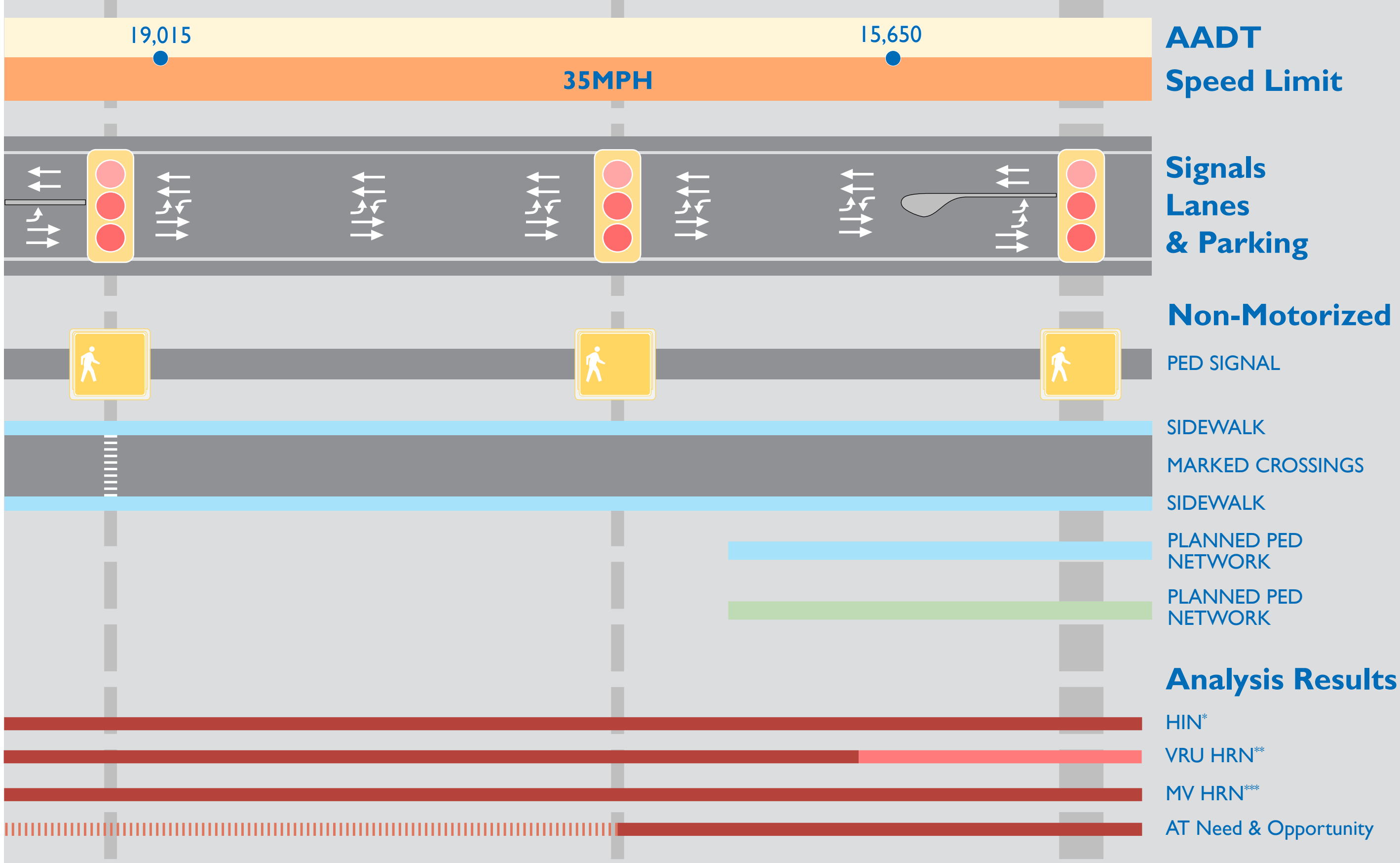
CRASHES

Pedestrian Crashes
- FSI
- Minor Injury

Vehicle Crashes
- FSI
- Minor Injury

Bicyclist Crashes
- FSI
- Minor Injury





High Risk Network
- High
- Medium
- Low

Active Transportation Need & Opportunity**
- Very High
- High
- Medium

*High Injury Network - Roadways with a elevated history of Fatal and Injury crashes

**VRU HRN - Roadways with a high risk for Fatal and Injury crashes involving Vulnerable Road Users

***MV HRN - Roadways with a high risk for Fatal and Injury crashes involving Motor Vehicles

****Active Transportation (AT) Need & Opportunity - Roadways with needs and opportunities for active transportation improvements

US-81 (13th St)

from W Pasewalk Avenue to US-275/Omaha Avenue (0.53 Miles)

CORRIDOR-WIDE RECOMMENDATIONS

STREET BUFFER
Create buffer space with streetscaping between roadway and sidewalk where possible to increase pedestrian comfort

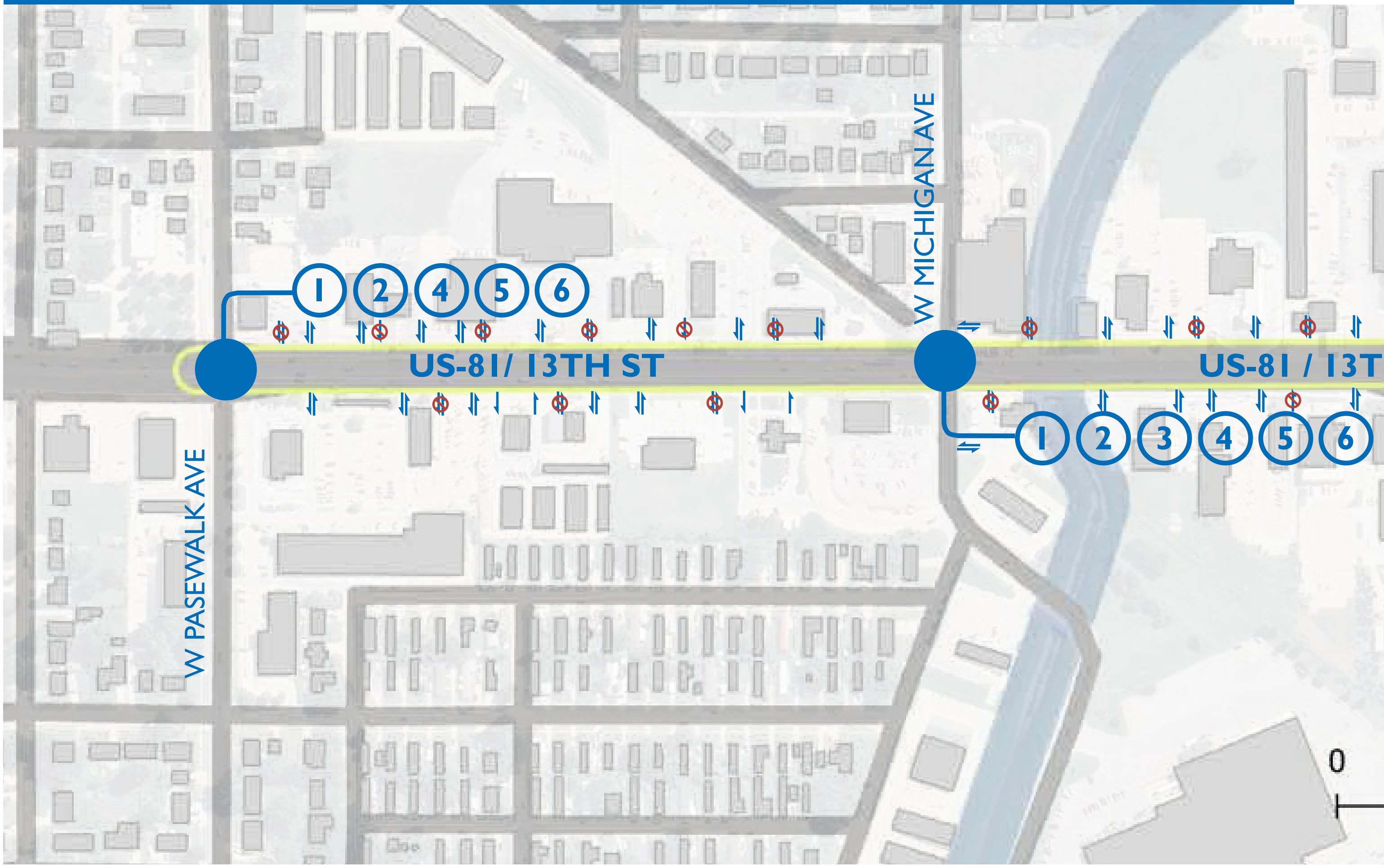
CORRIDOR ACCESS MANAGEMENT
Reduce the density of corridor access points to control turning movements and align driveway openings across the street with each other as much as possible

RAISED MEDIANS
Install along the corridor to delineate turning movements, provide crossing islands and enhanced crossings to reduce crossing gaps, and consider restricting left turns at some driveways

DRIVEWAY CROSSINGS
Reduce driveway turning radius and clearly define pedestrian sidewalk space as it crosses the driveway (following ADA guidelines)

LIGHTING
Improve illumination of the corridor, especially at crossings and driveways to improve visibility at night

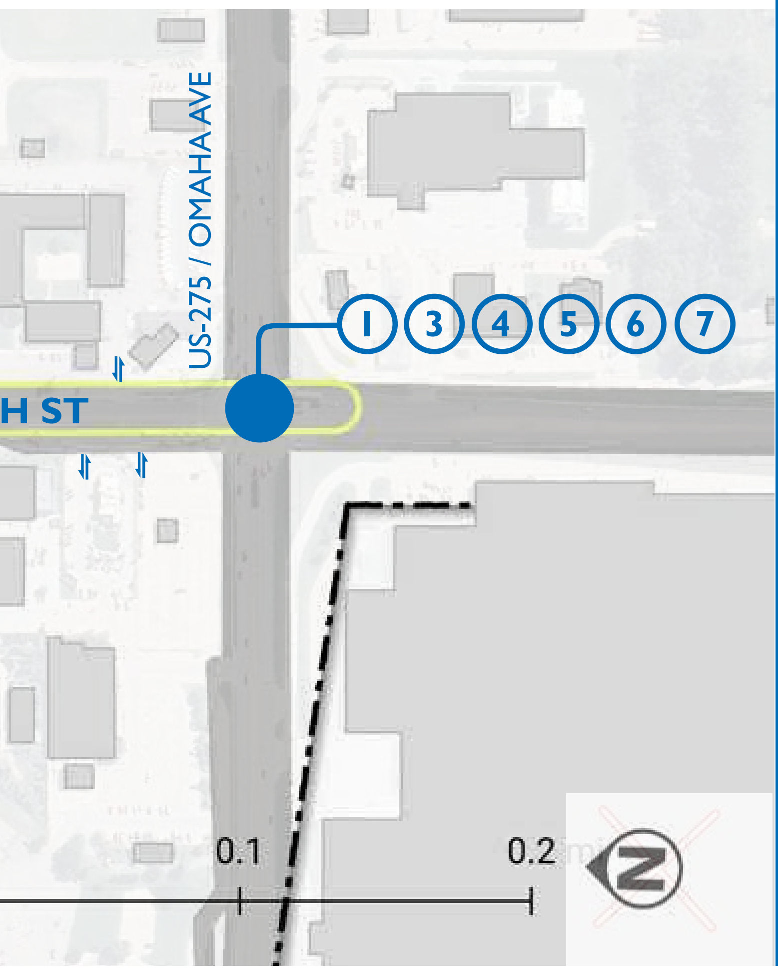
SITE-SPECIFIC RECOMMENDATIONS



TOTAL COST OF RECOMMENDATIONS

$3,923,000

- Street buffer: $12,000
- Corridor access management: $80,000
- Raised medians / crossing islands: $366,000
- Driveway crossings: $90,000
- Lighting: $540,000
- Curb extensions / truck aprons: $224,000
- Protected signal phases / leading pedestrian intervals: $22,000
- High visibility crosswalks: $60,000
- Backplates with retroreflective borders: $32,000
- Yellow change intervals: $15,000
- Positive offset left turn lanes: $648,000
- Miscellaneous work and contingency: $1,834,000



LEGEND

1. **Curb Extensions with Truck Aprons**
Curb extensions on east-west streets with ADA crossing ramps improve safety and shorten crossings for pedestrians, while truck aprons allow larger vehicles to turn safely

2. **Protected Signal Phases or Leading Pedestrian Intervals**
Add protected left-turns and phasing or leading pedestrian intervals

3. **High Visibility Crosswalks**
Improves visibility of pedestrians to approaching motorists

4. **Crossing Islands**
Protects pedestrian when they are crossing intersections and reduces pedestrian interaction time with motor vehicles

5. **Backplates with Retroreflective Borders**
Enhance traffic signal visibility for drivers

6. **Yellow Change Interval**
Adapt yellow light interval timing to reduce red light running

7. **Positive Offset Left Turn Lanes**
Improve sightlines for left-turning vehicles

North 1st Street

from Benjamin Avenue to Elm Avenue (0.63 Miles)

CONTEXT

North 1st Street is a north-south corridor extending beyond the Norfolk City Limits. Between Benjamin Ave and Elm Ave, North 1st Street serves residential and commercial uses and provides direct access to Norfolk Middle School.

FSI Crashes - Fatal and Serious Injury
Minor Injury Crashes: Possible and Visible Injury
*This data does not include Property Damage Only crashes

	Fatal Crashes	Serious Injury Crashes	Minor Injury Crashes	Total Crashes*
Bicyclist	0	0	1	1
Pedestrian	1	0	3	4
Motor Vehicle	0	0	14	14
Total	**1**	**0**	**18**	**19**

INTERSECTION RELATED - LOCATION

- The only fatal crash along this corridor occurred at an intersection

CRASH TYPES

- The sole fatal crash at this intersection involved a pedestrian and a vehicle

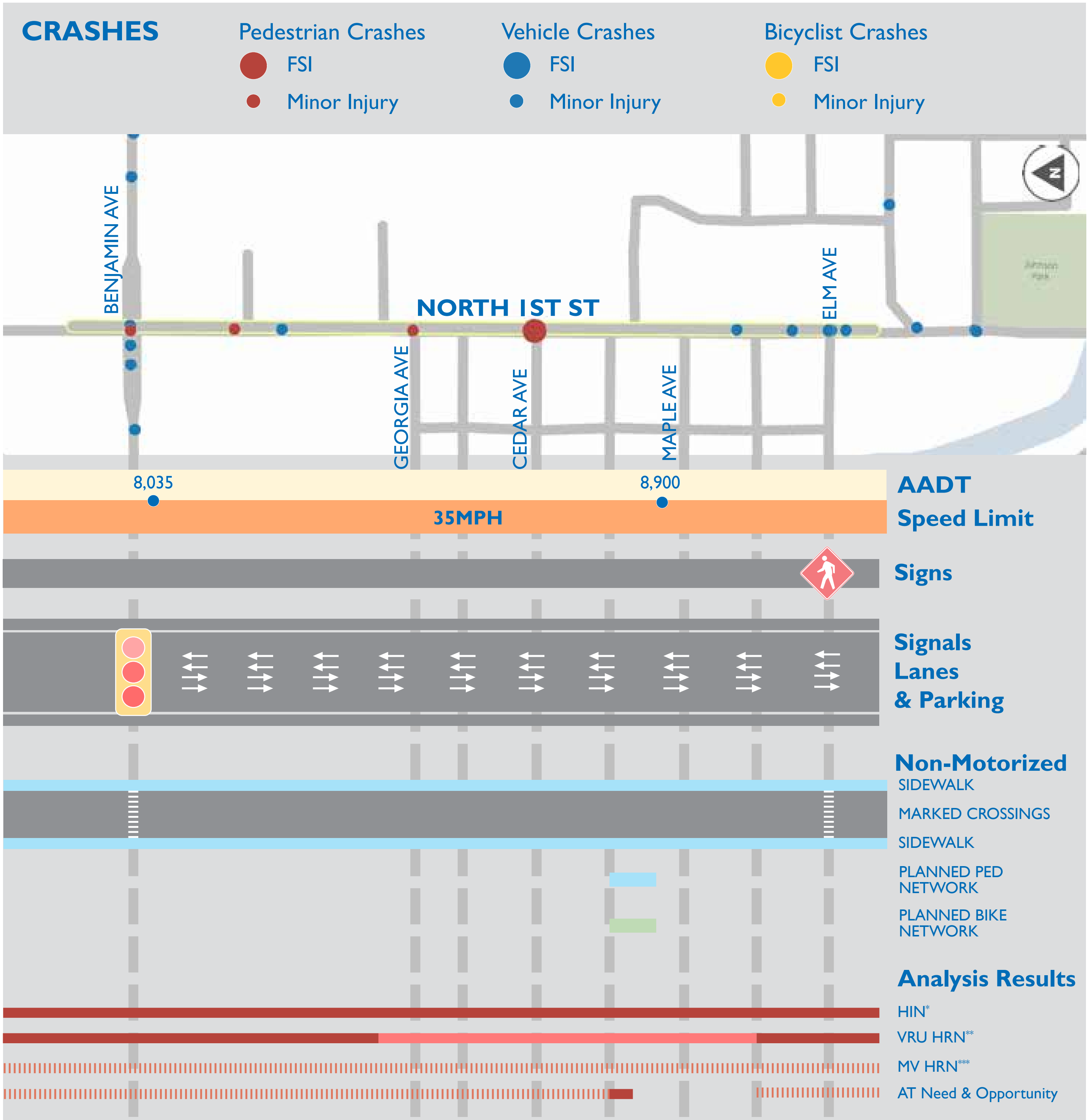
DRIVER CONTRIBUTING CIRCUMSTANCES

- 37% of all crashes were attributed to driver failure to yield the right-of-way
- 21% of all crashes were attributed to drivers following too closely

KEY COMMUNITY FEEDBACK

- Visibility is poor at intersections
- Drivers do not pay attention, and do not look out for pedestrians or bicyclists
- There is too much distance between pedestrian crossings
- School pick-up and drop-off can be problematic


Source: Toole Design



High Risk Network

- High
- Medium
- Low

Active Transportation Need & Opportunity****

- Very High
- High
- Medium

*High Injury Network - Roadways with a high history of Fatal and Injury crashes

**VRU HRN - Roadways with a high risk for Fatal and Injury crashes involving Vulnerable Road Users

***MV HRN - Roadways with a high risk for Fatal and Injury crashes involving Motor Vehicles

****Active Transportation (AT) Need & Opportunity - Roadways with needs and opportunities for active transportation improvements

North 1st Street

from Benjamin Avenue to Elm Avenue (0.63 Miles)

CORRIDOR-WIDE RECOMMENDATIONS

ROADWAY RECONFIGURATION
A 4-to-3 lane conversion with a center median / turn lane will increase the amount of space available for other roadway features, and improve pedestrian and bicyclist safety

SEPARATED BIKE LANES
Install separated bike lanes along each side of the street for bicyclists

POSTED SPEED LIMITS
Reduce speed limit maximum to 30 MPH

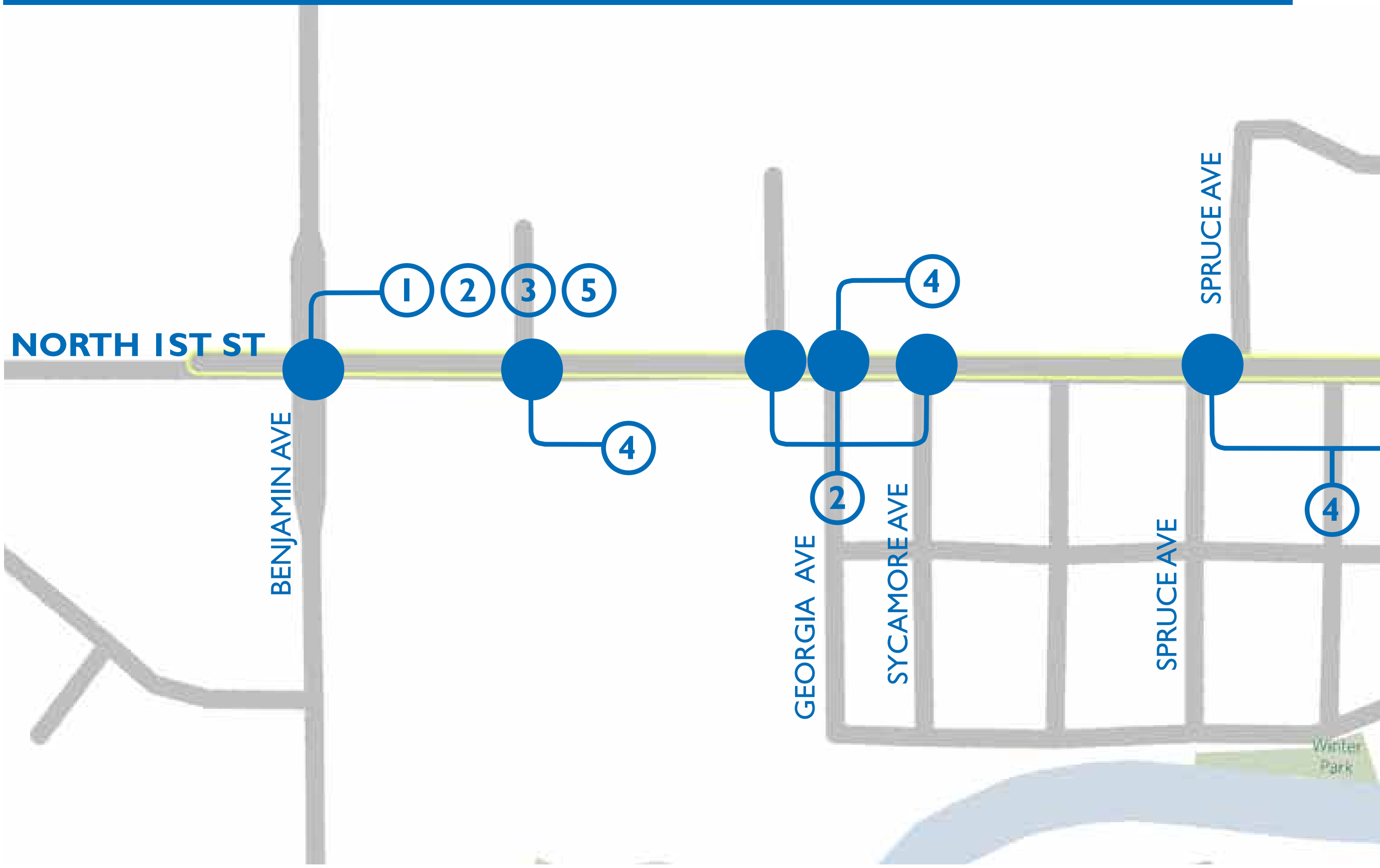
CURB EXTENSIONS
Reduce crossing distance at crosswalks to improve pedestrian safety and reduce curb radius to slow turning motor vehicle traffic

RAISED MEDIANS
Install along the corridor to delineate turning movements and provide pedestrian refuge

WALKWAYS
Install wider (5-6 feet wide) sidewalks to improve accessibility and comfort along with larger frontage zone

Consider similar improvements south of this segment - from Elm Ave to Braasch Ave

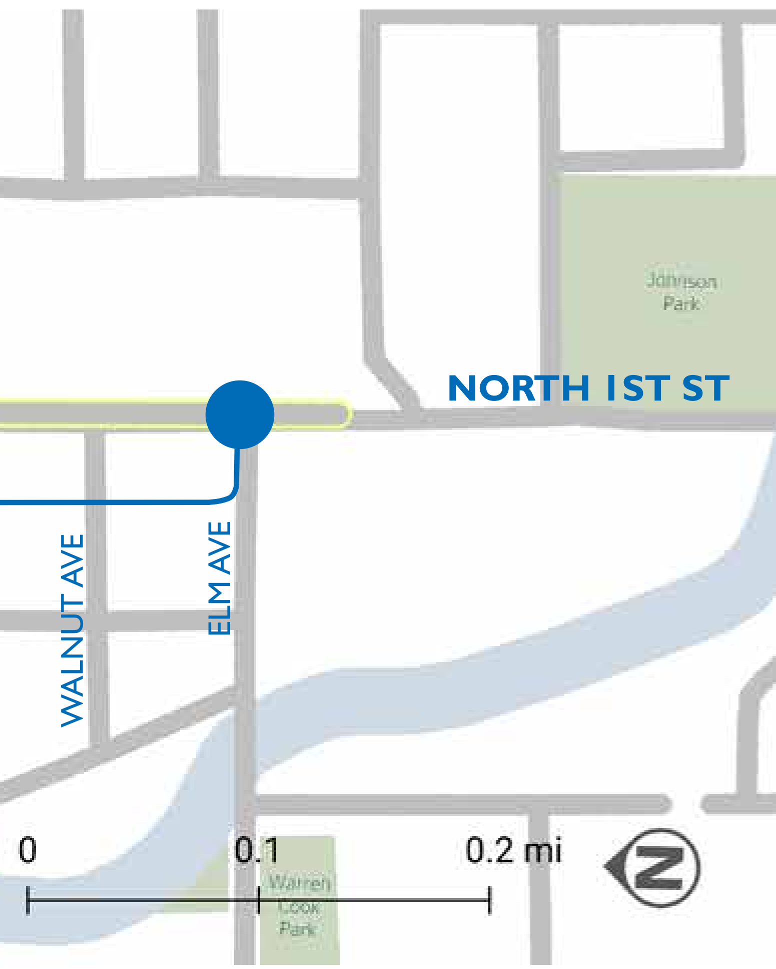
SITE-SPECIFIC RECOMMENDATIONS



TOTAL COST OF RECOMMENDATIONS

$13,216,000

- Roadway reconfiguration and separated bike lane: $4,048,000
- Curb extensions / truck aprons: $728,000
- Raised medians / crossing islands: $1,404,000
- Walkways: $800,000
- School zone signage: $43,000
- Protected signal phases / leading pedestrian intervals: $5,000
- Backplates with retroreflective borders: $10,000
- Miscellaneous work and contingency: $6,178,000



LEGEND

1. **Curb Extensions with Truck Aprons**
   At high traffic intersections where there is a curb extension, truck aprons will allow for larger vehicles to safely turn

2. **School Zone Signage**
   Install school zone signage according to the MUTCD Chapter 7 and reduce speed limit to 20 mph during arrival and dismissal

3. **Protected Signal Phases or Leading Pedestrian Intervals**
   Add protected left-turns and phasing or leading pedestrian intervals

4. **Crossing Islands**
   Add pedestrian refuge with crossing island and consider additional crossing countermeasures to protect pedestrian when they are crossing, improve visibility, and reduce pedestrian interaction time with motor vehicles

5. **Backplates with Retroreflective Borders**
   Enhance traffic signal visibility for drivers

US-275 (Omaha Avenue)

from South 7th Street to Pierce Street (0.57 Miles)

CONTEXT

US-275 is a major east-west corridor in Norfolk and serves as a truck route. From South 7th Street to Pierce Street, US-275 serves commercial and residential uses and pass-through east-west traffic. Washington Grade School is located at the intersection of South 1st St and US-275.

FSI Crashes - Fatal and Serious Injury
Minor Injury Crashes: Possible and Visible Injury
*This data does not include Property Damage Only crashes

	Fatal Crashes	Serious Injury Crashes	Minor Injury Crashes	Total Crashes*
Bicyclist	0	0	0	0
Pedestrian	0	1	1	2
Motor Vehicle	0	1	22	23
Total	**0**	**2**	**18**	**25**

INTERSECTION RELATED - LOCATION

- 100% of FSI crashes along this corridor occurred at an intersection

CRASH TYPES

- 92% of all crashes were interactions between motor vehicles

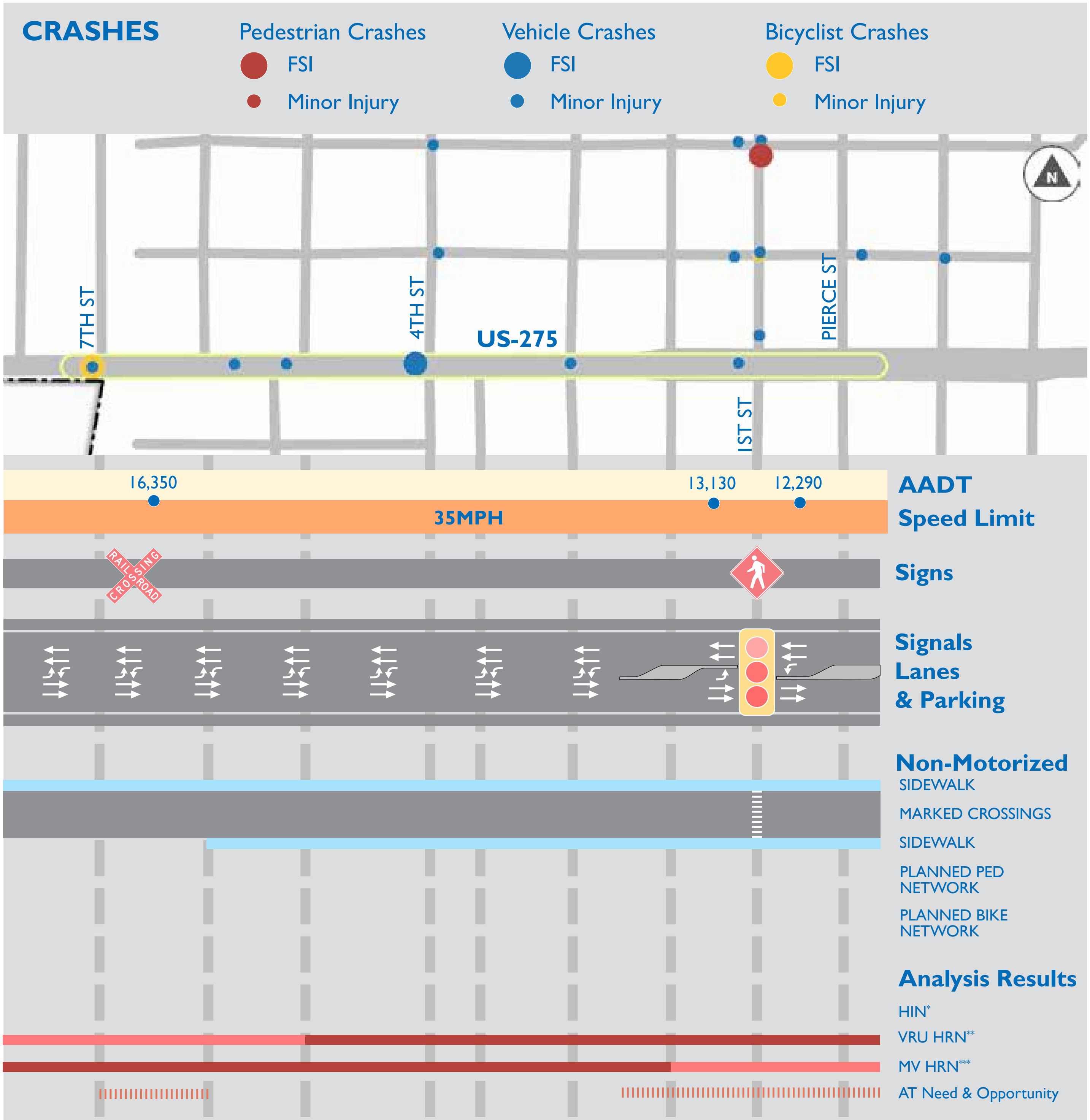
DRIVER CONTRIBUTING CIRCUMSTANCES

- 32% of all crashes were attributed to driver failure to yield right-of-way
- 32% of all crashes were attributed to users disregarding traffic signals, signage, etc.

KEY COMMUNITY FEEDBACK

- Drivers do not pay attention, and do not look out for pedestrians or bicyclists
- Roadway is too wide and lacks separation between vehicles and pedestrians or bicyclists
- Sidewalks are overgrown with vegetation and are in poor condition

Source: Toole Design



High Risk Network

High	
Medium	
Low	

Active Transportation Need & Opportunity**

- Very High
- High
- Medium

*High Injury Network - Roadways with a high history of Fatal and Injury crashes

**VRU HRN - Roadways with a high risk for Fatal and Injury crashes involving Vulnerable Road Users

***MV HRN - Roadways with a high risk for Fatal and Injury crashes involving Motor Vehicles

****Active Transportation (AT) Need & Opportunity - Roadways with needs and opportunities for active transportation improvements

US-275 (Omaha Avenue)

from South 7th Street to Pierce Street (0.57 Miles)

CORRIDOR-WIDE RECOMMENDATIONS

WALKWAYS

Consider widening sidewalks or performing regular maintenance to clear overgrown vegetation and obstacles

RAISED MEDIANS

From S 7th St to S 2nd St - Add raised median to provide pedestrian refuge and enhance access management

From S 2nd St to Pierce St - Add vegetation/planters/trees to center median to improve comfort and slow traffic

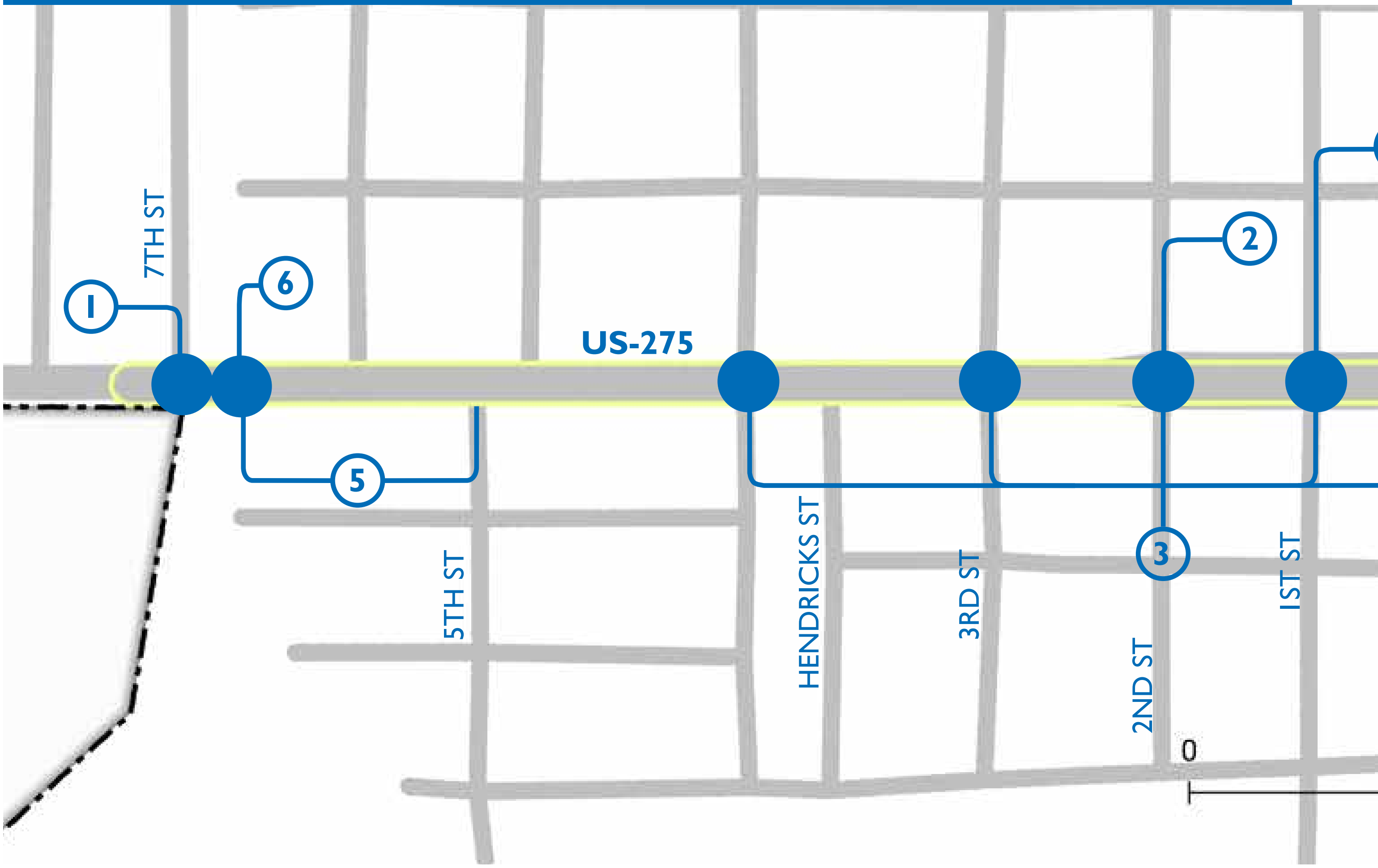
CURB EXTENSIONS

Add curb extensions on north-south streets with ADA crossing ramps improve safety, shorten crossings for pedestrians, and transition from higher speed street to lower speed local streets

CORRIDOR ACCESS MANAGEMENT

Reduce the density of corridor access points to control turning movements and align driveway openings across the street with each other as much as possible

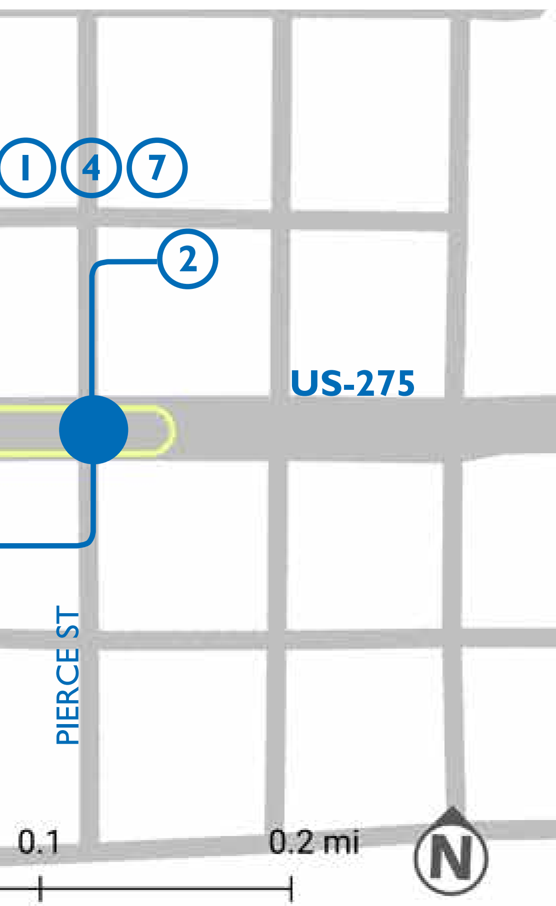
SITE-SPECIFIC RECOMMENDATIONS



TOTAL COST OF RECOMMENDATIONS

$5,274,000

- Walkways / sidepaths: $800,000
- Raised medians / crossing islands: $1,359,000
- Curb extensions / truck aprons: $476,000
- Corridor access management: $100,000
- Crosswalk visibility enhancements: $20,000
- School zone signage: $43,000
- Backplates with retroreflective backplates: $9,000
- Additional signal heads: $2,000
- Miscellaneous work and contingency: $2,466,000



LEGEND

1 **Curb Extensions with Truck Aprons**
Install truck aprons to allow larger vehicles to turn safely

2 **Crosswalk Visibility Enhancement**
Enhance crosswalks along intersecting roadways to better warn incoming traffic of crossing pedestrians and include ADA compliant ramps to improve accessibility

3 **School Zone Signage**
Install school zone signage according to the MUTCD Chapter 7 and reduce speed limit to 20 mph during arrival and dismissal

4 **Backplates with Retroreflective Borders**
Enhance traffic signal visibility for drivers

5 **Sidepaths**
Install sidepath from 5th St to pedestrian crossing as part of LINC Norfolk route

6 **Crossing Islands**
Install crossing with Pedestrian Hybrid Beacon, crossing island, and crosswalk visibility enhancements

7 **Additional Signal Heads**
Add additional signal head for left turn lanes and consider protected left-turns or leading pedestrian intervals

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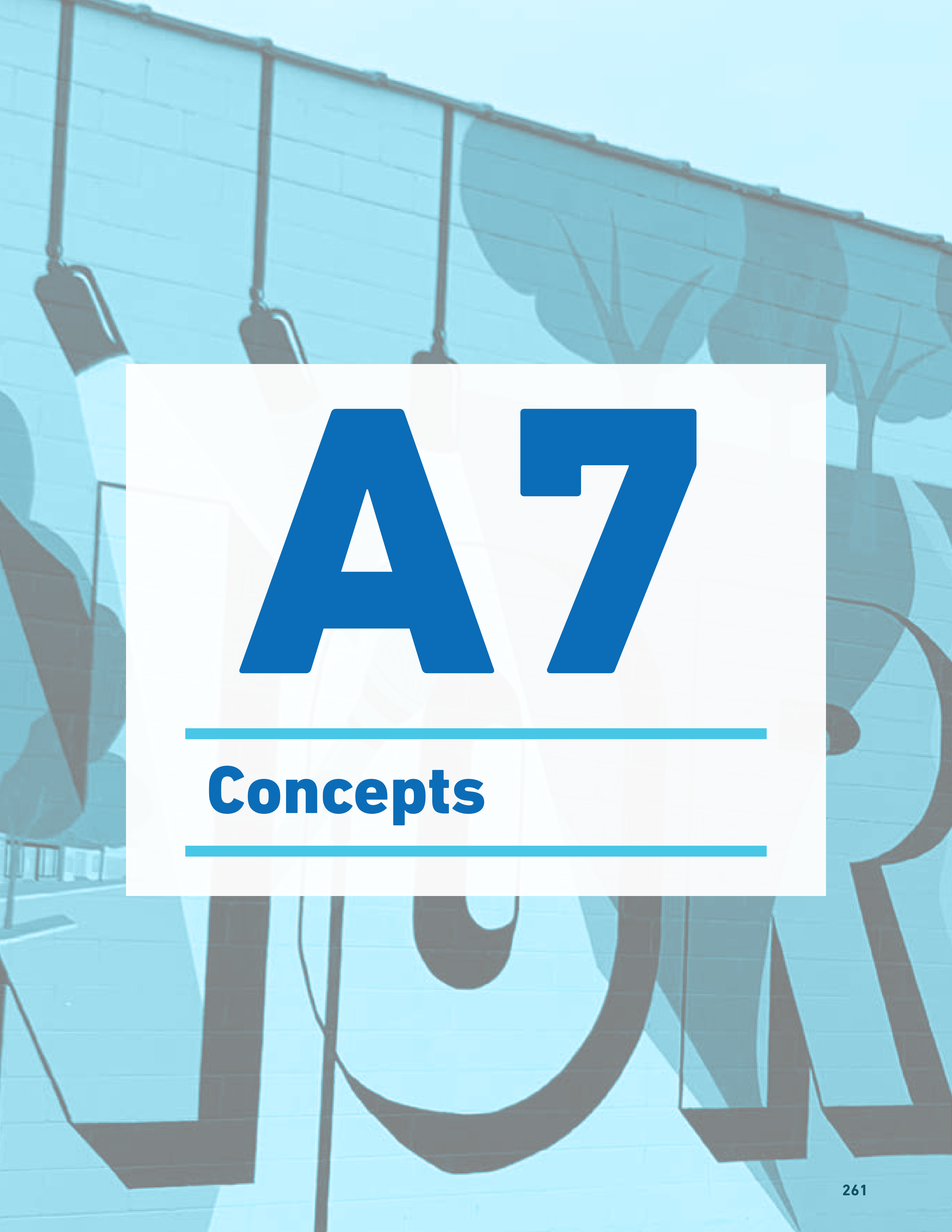

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Concepts

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Purpose of the Concepts

Concepts were developed for four locations to illustrate potential infrastructure changes proposed in the Corridor Profiles in Appendix 6. These concepts are intended to be for informational purposes as the City contemplates street projects and programs.

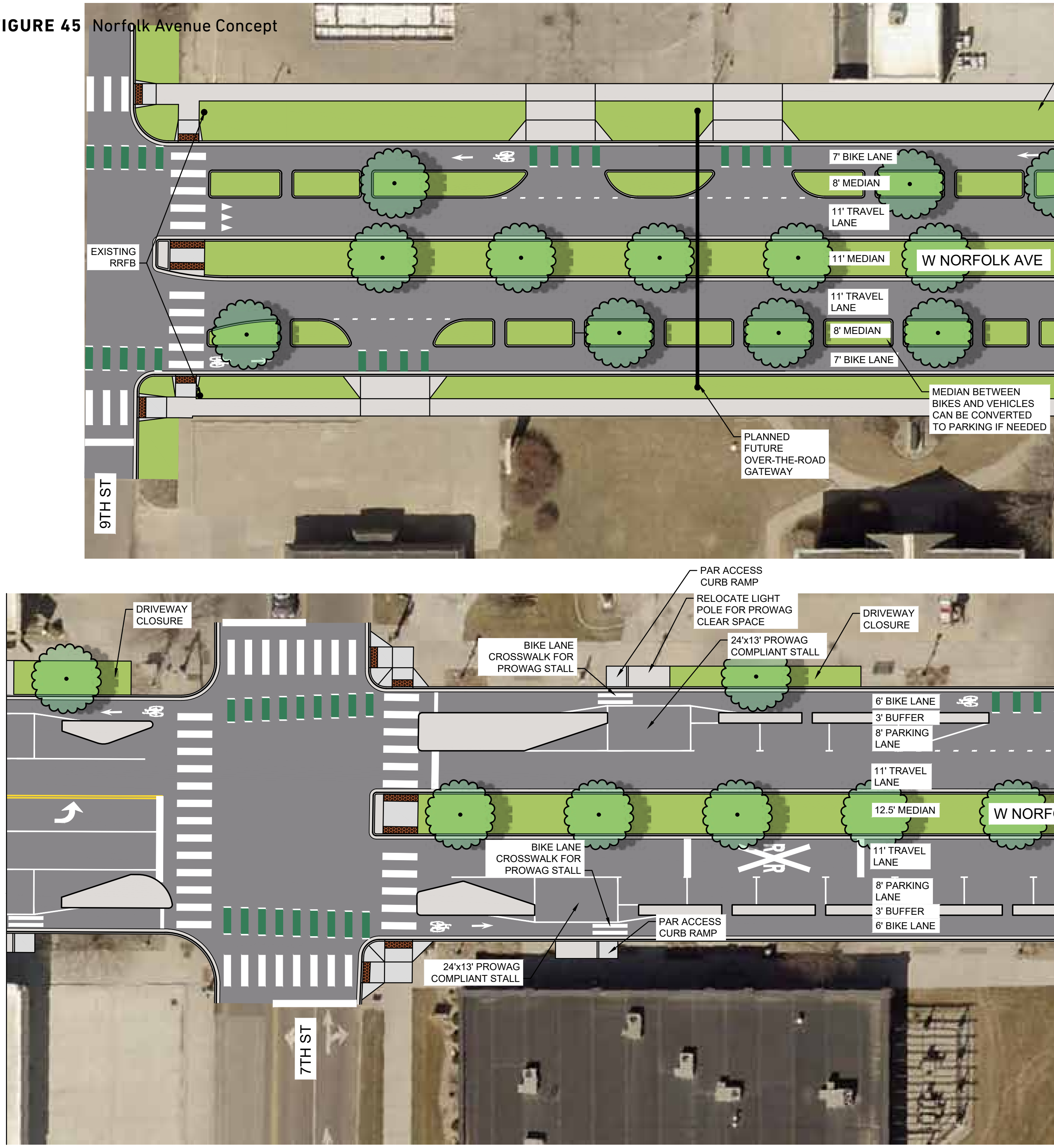
The first concept location is along Norfolk Avenue from 9th Street to 6th Street. As shown in Figure 45, this concept shows a roadway reconfiguration of Norfolk Avenue and various other modifications, as identified in the Norfolk Avenue Corridor Profile.

The second concept location is at North 1st Street and East Wilson Avenue a few hundred feet south of Benjamin Avenue. As shown in Figure 46, this concept shows a roadway reconfiguration of 1st Street as well as pedestrian and bicyclist safety and access enhancements, as identified in the 1st Street Corridor Profile.

The third concept location is along US-81 just south of Pasewalk Avenue. As shown in Figure 47, this concept shows a enhancements to access, safety, and non-motorized access, as identified in the US-81 Corridor Profile.

The fourth concept location is along US-275 from 7th Street to 5th Street. The intent of this concept is to show walking and bicycling access along and crossing this segment, which is part of the larger Local Intermodal Network Connection (LINC) project. Figure 48 shows the pedestrian crossing east of the railroad tracks.

FIGURE 45 Norfolk Avenue Concept



THIS IS A PRELIMINARY CONCEPT. FIELD VERIFICATION, SITE CONDITION ASSESSMENTS, ENGINEERING ANALYSIS AND DESIGN ARE NECESSARY PRIOR TO IMPLEMENTING ANY OF THE RECOMMENDATIONS CONTAINED HEREIN.

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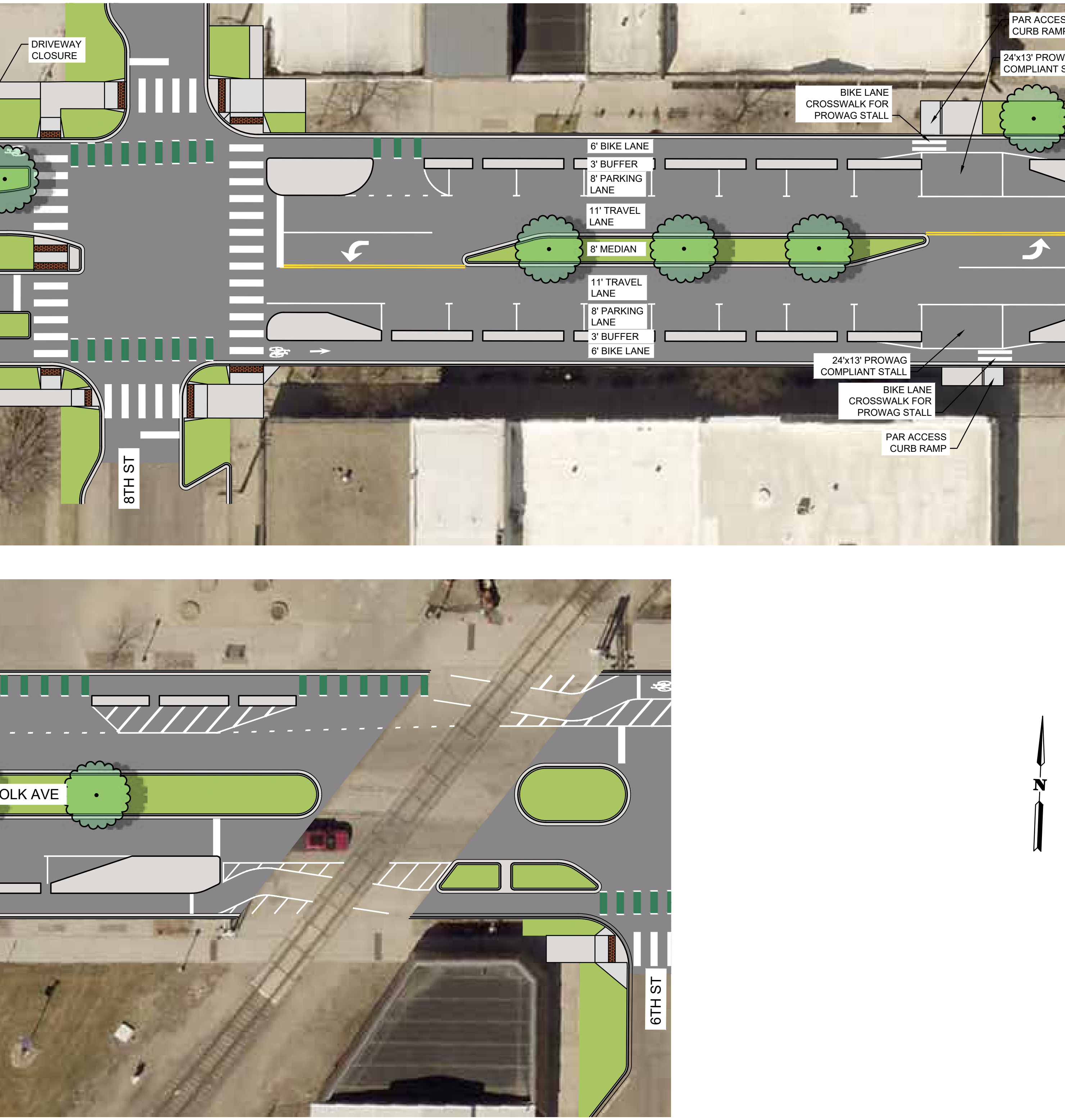

0 20' 40' 60'

SCALE IN FEET

TOOLE DESIGN

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MINNEAPOLIS, MN 55401
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FAX: 301.927.2800
www.tooledesign.com

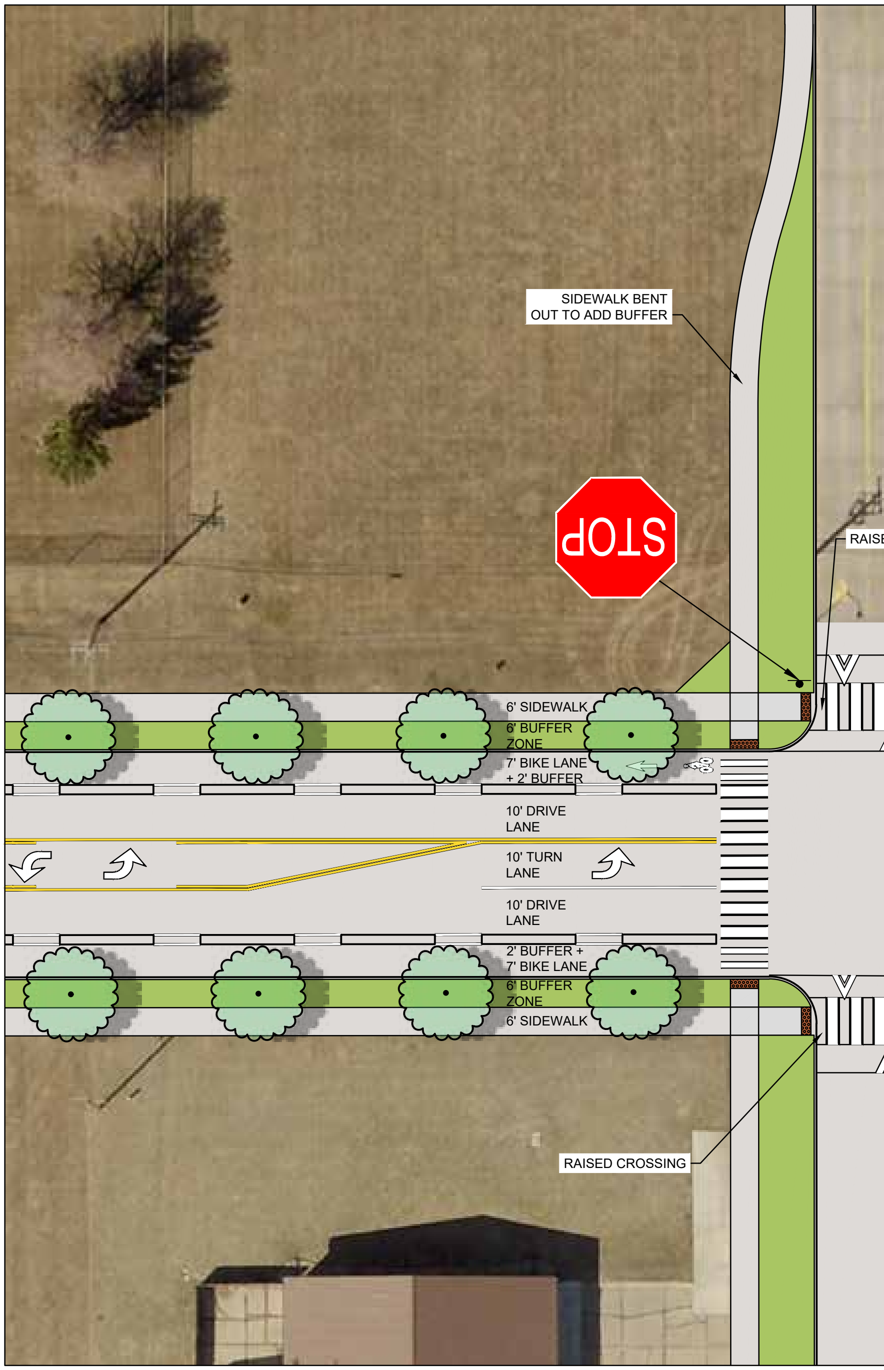
W NORFOLK AVE SAFETY CONCEPT

Norfolk Multimodal Transportation Action Plan

04/22/2025

PRELIMINARY CONCEPT - NOT FOR CONSTRUCTION

FIGURE 46 North 1st Street Concept



* NOTE: LIGHT POLES WILL NEED TO BE RELOCATED TO BUFFER

THIS IS A PRELIMINARY CONCEPT. FIELD VERIFICATION, SITE CONDITION ASSESSMENTS, ENGINEERING ANALYSIS AND DESIGN ARE NECESSARY PRIOR TO IMPLEMENTING ANY OF THE RECOMMENDATIONS CONTAINED HEREIN.

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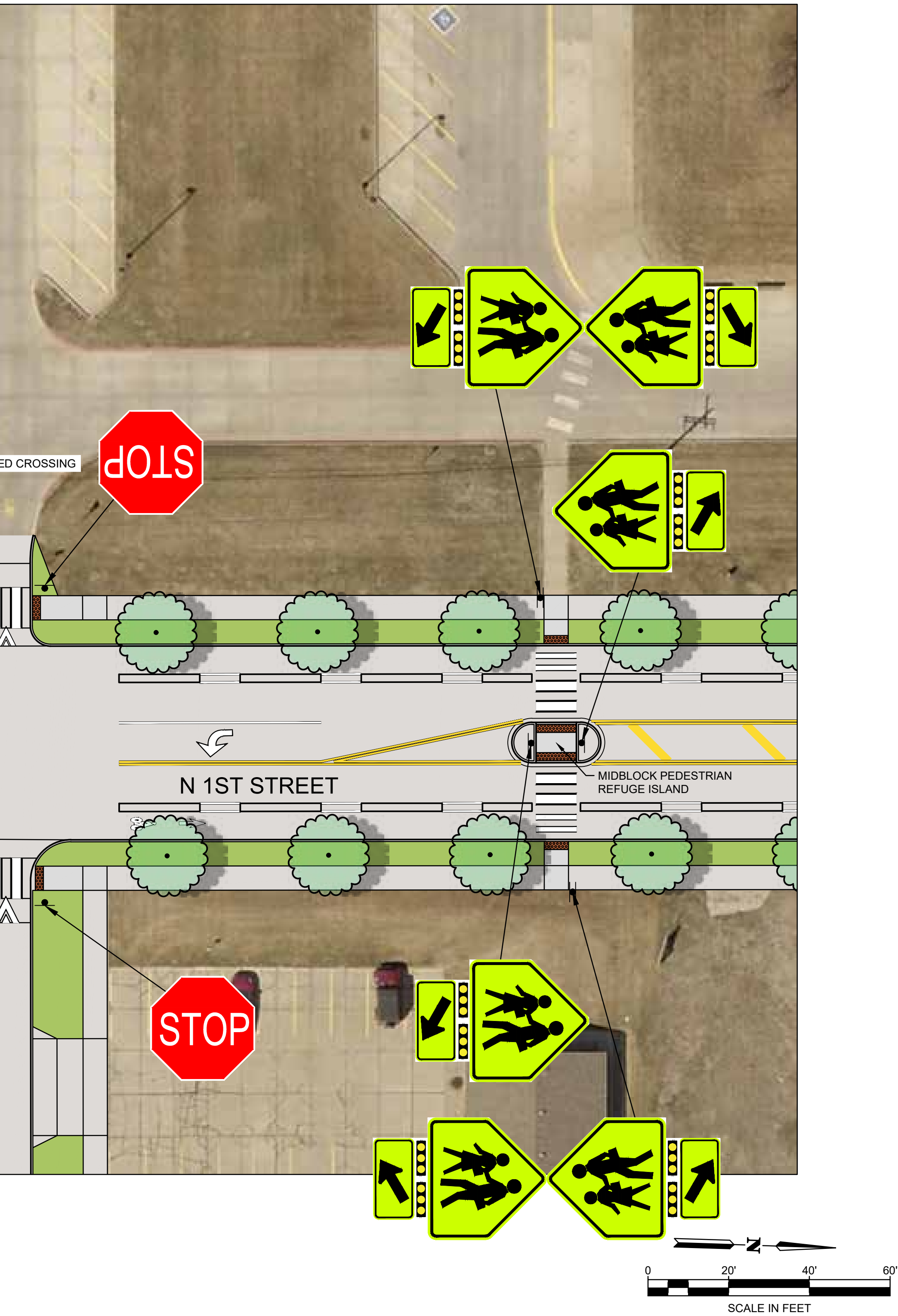

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N 1ST ST SAFETY CONCEPT

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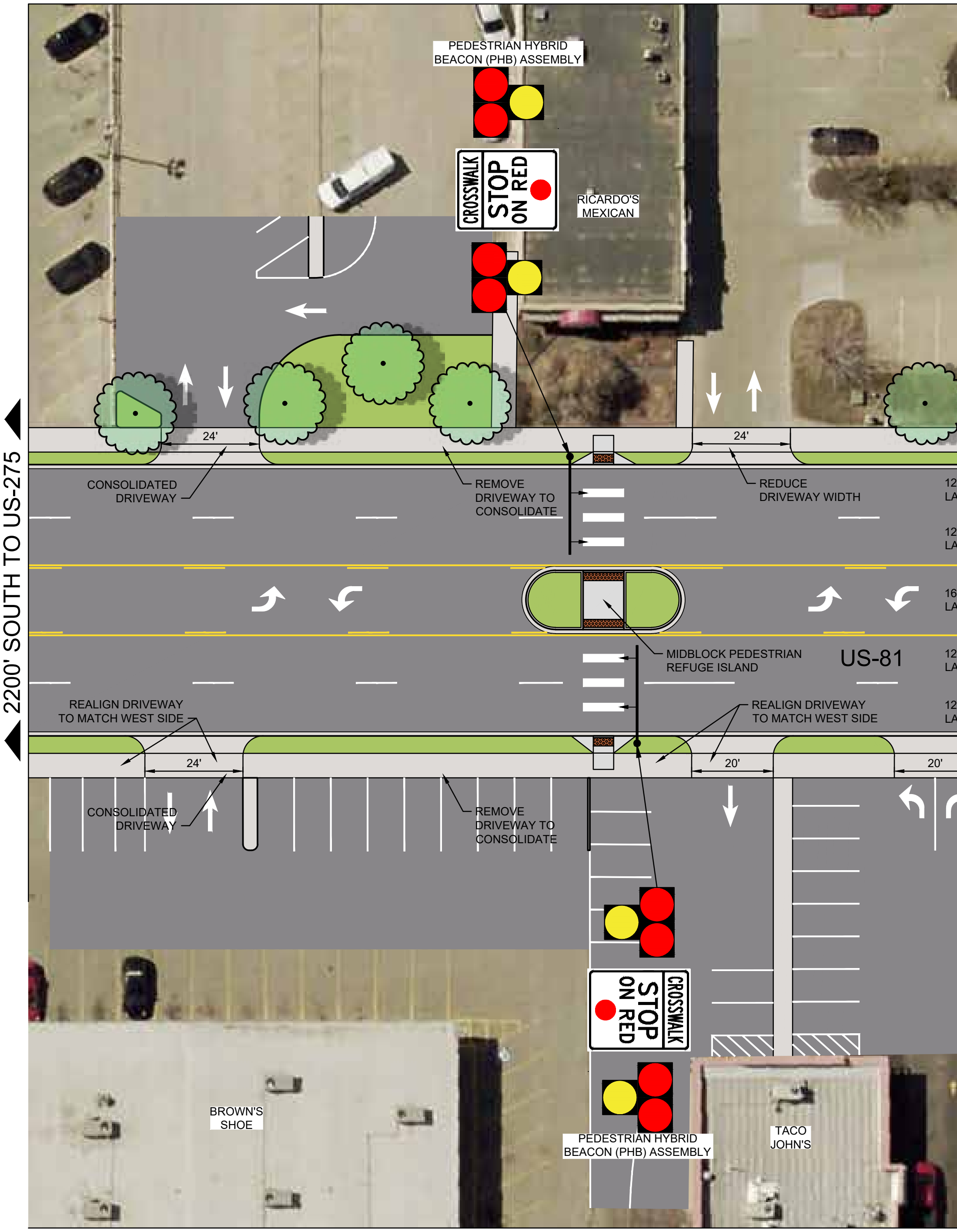
PRELIMINARY CONCEPT - NOT FOR CONSTRUCTION

FIGURE 47 US-81 Concept



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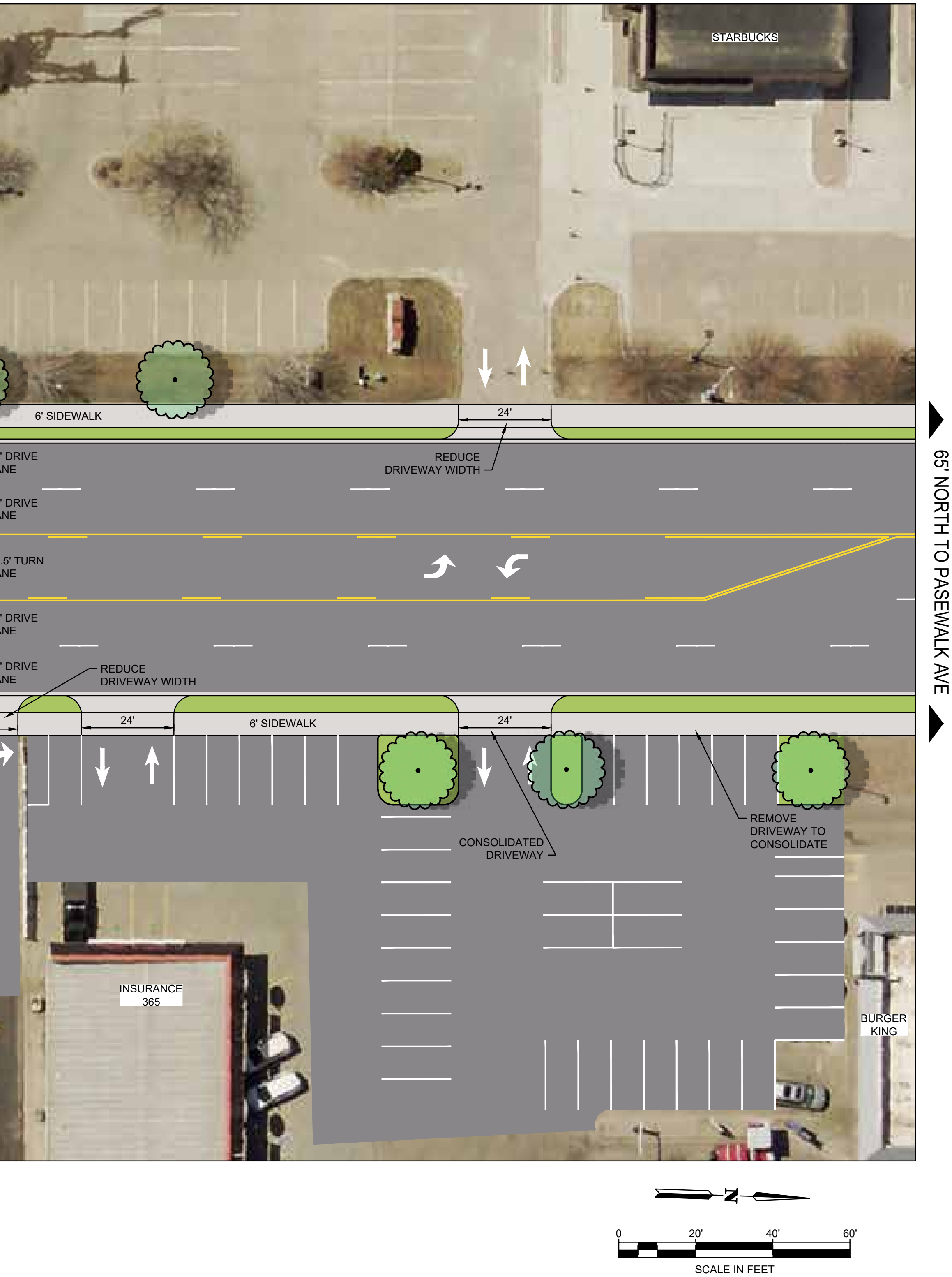

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US-81 SAFETY CONCEPT

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PRELIMINARY CONCEPT - NOT FOR CONSTRUCTION

FIGURE 48 US-275 Concept

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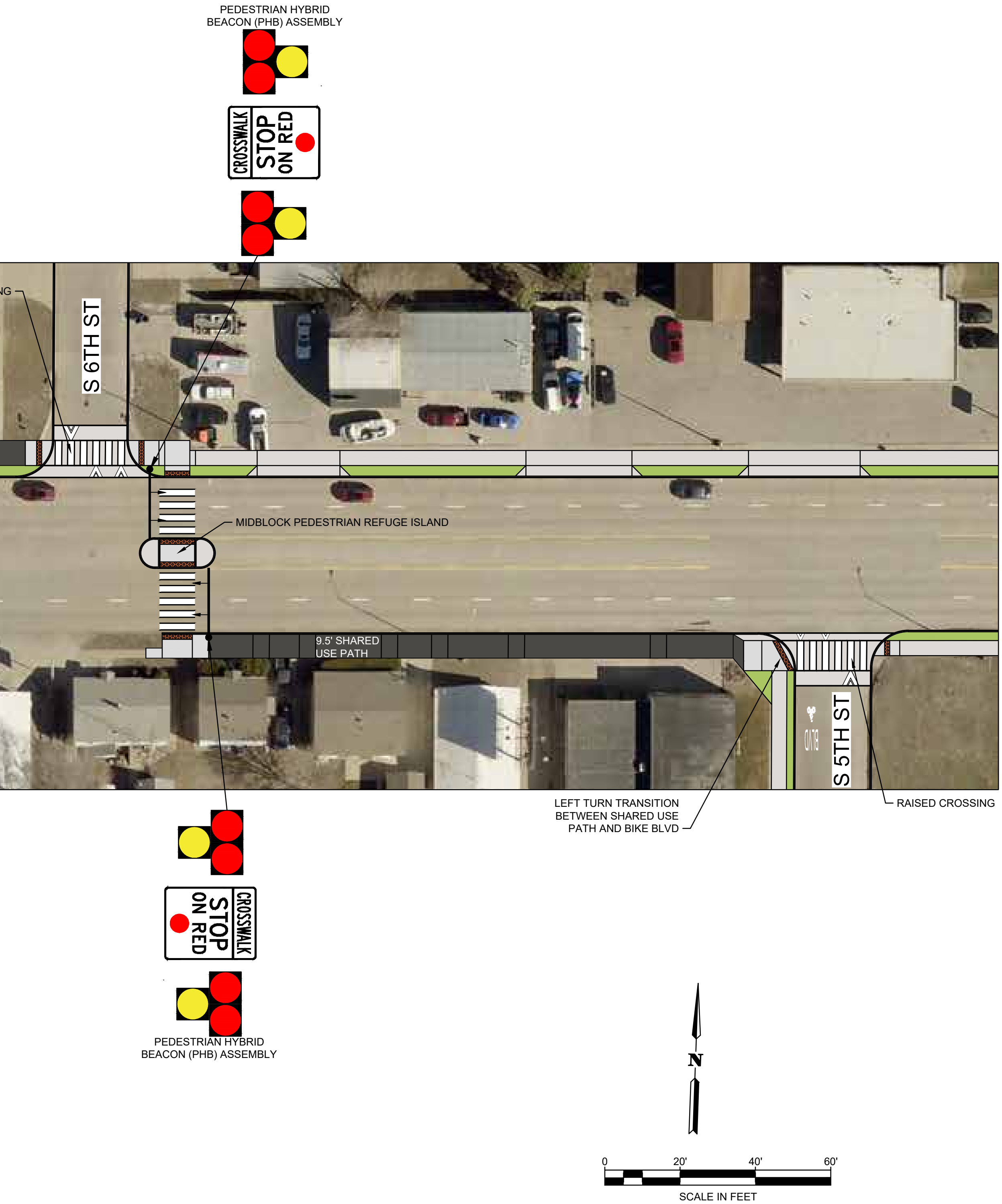

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US-275 SAFETY CONCEPT

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PRELIMINARY CONCEPT - NOT FOR CONSTRUCTION

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