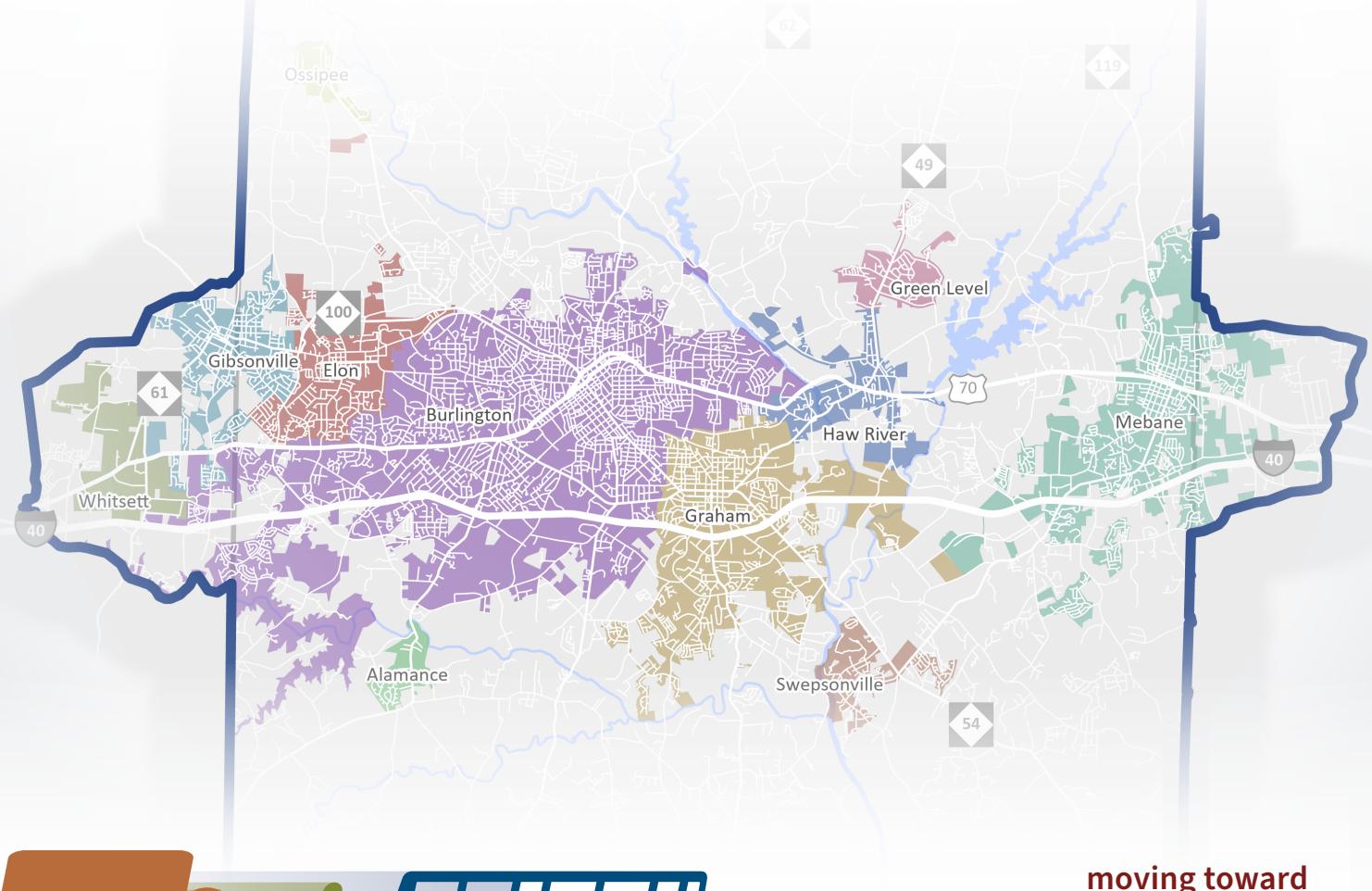
Burlington-Graham Metropolitan Planning Organization

Transportation Safety Plan



moving toward

Zero Deaths

for all users

BURLINGTON - GRAHAM MPO
TRANSPORTATION SAFETY PLAN

BGMPO
Burlington - Graham Metropolitan Planning Organization

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Acknowledgements

The Burlington-Graham Metropolitan Planning Organization (BGMPO) would like to thank the project team, Transportation Advisory Committee, Technical Coordinating Committee, and Safety Subcommittee members for their efforts in the development of the Transportation Safety Plan.

BGMPO Transportation Advisory Committee (TAC)

Leonard Williams
TAC Chair, Town of Gibsonville

Bob Ward
TAC Vice Chair
City of Burlington

Montrena Hadley
City of Mebane

Jim Butler
City of Burlington

Ricky Hall
City of Graham

Monti Allison
Town of Elon

Barret Brown
Town of Green Level

Kelly Allen
Town of Haw River

Elaine Garner
Town of Whitsett

Donald Tichy
Village of Alamance

Steve Carter
Alamance County Commissioner

Mary Beth Murphy
Guilford County Commissioner

Michael Fox
NCDOT Board of Transportation

Jamezetta Bedford
Orange County Commissioner

Archer Wright
NCDOT Division Engineer

Suzette Morales
FHWA

BGMPO Technical Coordinating Committee (TCC)

Nishith Trevdi
Chair Orange County Planning Dept

Mike Nunn, *Vice Chair*
City of Burlington

Andy Bailey
NCDOT Transportation Planning Division

Dan Danieley
Airport Authority

Mary Harward
Town of Elon

Ben York
Village of Alamance

Oliver Bass
Guilford County Planning & Development

Ben Baxley
Town of Gibsonville

Stephen Robinson
NCDOT Division Planning Engineer

Sean Tencer
Town of Haw River

Tonya Caddle
Alamance County

Nolan Kirkman
City of Burlington

Scott Rhine
PART

Cy Stober
City of Mebane

Suzette Morales
FHWA

Barrett Brown
Town of Green Level

Nish Trivedi
Orange County Public Transportation

Justin Snyder
City of Graham

Aaron Holland
City of Graham

Peter Murphy
Alamance County Transportation Authority

Margaret Scully
GoTriangle

Tamara Njegovan
NCDOT Division 7

Jay Heikes
GoTriangle

Mark Kirstner
PART

John Andoh
Link Transit

Suzette Morales
FHWA

Terry Landsdell
BikeWalkNC

Lori Oakley
Town of Elon

Nolan Carter
Alamance Parks

Pam Cook
NCDOT TPD

Ruiqi Guo
GoTriangle

Donal Huffines
Division Program Manager

Audrey Vogel
City of Mebane

Ashley Ownbey
City of Mebane

Jamie Cousins
Town of Green Level

Megan Hoenk
NCRR

Tom Altieri
Orange County

Chris Rollins
City of Mebane

Preston Mitchell
City of Mebane

BGMPO Transportation Safety Subcommittee

Brian Mayhew*
NCDOT- Safety Unit

Brian Murphy*
NCDOT - Safety Unit

Andy Bailey*
NCDOT-TPD

Wannetta Mallette*
BGMPO

Nish Trivedi
Orange County Public Transportation

Cy Stober
Orange County

Tonya Caddle
Alamance County

Mary Beth Murphy
Guilford County

Steve Carter
Alamance County

Audrey Vogel
Mebane

Melody Wiggins
Graham

Stephen Robinson
NCDOT Division 7

Suzette Morales
FHWA

Ann Meletzke
Cone Health

Brian Tennent
Burlington

William Mauney
Alamance County Rescue

Nicole Cockerham
State Farm Insurance

Jaimee Cousin
Green Level

Officer Douglas Bowens
NC Department of Public Safety

Daniel Cada
Member of Public

Alex Rotenberry
NCDOT-IMD

VHB
Project Team Support

* = *Project Team Member*

Executive Summary

The Burlington-Graham Metropolitan Planning Organization (BGMPO) Transportation Safety Plan (TSP) reflects the region's commitment to improving transportation safety for all users and eliminating traffic fatalities and serious injuries on its roadways.

The BGMPO initiated the development of the Transportation Safety Plan with support of member jurisdictions, multidisciplinary stakeholders, and a grant from the North Carolina Department of Transportation (NCDOT) Traffic Safety Unit.

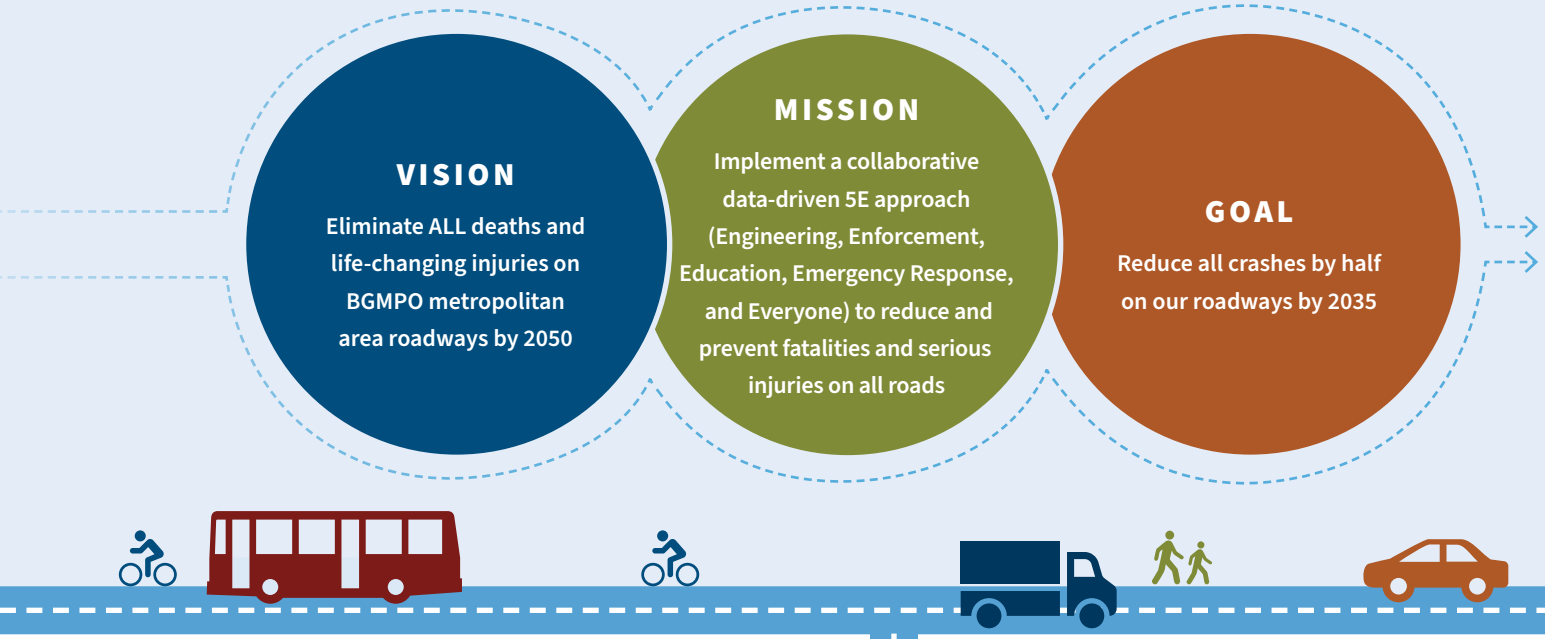
The Transportation Safety Plan incorporates a Safe System Approach which shifts the focus of road safety from crash frequency to crash management. The approach acknowledges that the human body is vulnerable and that humans make mistakes, but it is unacceptable that these mistakes result in death and injury. This approach is supported by the Federal Highway Administration (FHWA) and NCDOT and helps to minimize the frequency and severity of crashes. The development of the Transportation Safety Plan follows a six-step local road safety planning process framework that is a FHWA Proven Safety Countermeasure. The process results in a prioritized list of issues, risks, actions, and improvements that can be used to reduce fatalities and serious injuries on local roads. The Transportation Safety Plan aligns with the **North Carolina Strategic Highway Safety Plan (SHSP)** and the State's objective of moving toward zero deaths.

The BGMPO Transportation Safety Plan focuses on the 1,950 miles of roadway in the region.

The Vision, Mission, and Goal:

The BGMPO Transportation Safety Plan Vision, Mission, and Goal statements reflect the Safe System Approach principles that death and serious injuries are unacceptable and is a shared responsibility of all stakeholders.

Vision for the Transportation Safety Plan demonstrates the intent that all users of the local roadway system within the BGMPO metropolitan region reach their destination safely. The **Mission** statement recognizes that a collaborative effort by all the safety partners is necessary to reduce traffic-related fatalities and serious injuries set forth by the **Goal**. Strategies and action items identified in later sections of this Transportation Safety Plan reflect the Safe System Approach and support achieving the **Vision**, **Mission**, and **Goal** statements.



The Transportation Safety Plan helps to:

- Achieve significant reduction in traffic fatalities and serious injuries on the region's roadways.
- Inform other regional efforts such as the Metropolitan Transportation Plan (MTP).
- Leverage partnerships and resources to maximize implementation of this plan.
- Identify strategies and actionitems based on data analysis and crash trends.
- Prioritize needed roadway safety improvements.
- Increase awareness of road safety and risks through education and enforcement.
- Inform annual safety target setting initiatives and project selection to meet adopted targets.
- Develop support for funding applications.

The analysis of safety data (crash, roadway, and traffic volume) provided by NCDOT guided the development of this Transportation Safety Plan.

Fatal crashes have been slightly increasing in the region. NCDOT data compiled for BGMPO show that the five-year average crash rate, which is determined by dividing the number of fatalities by the number of miles traveled, rose for 0.98 fatal crashes per 100 million vehicle miles traveled (VMT) in 2016 to 1.21 in 2020.

NCDOT revised the definition of a **serious injury** in late-2016 which resulted in a dramatic rise in the number of this type of injury. A serious injury is one that prevents an individual from performing their normal activity for 24 hours or longer. Serious injury crashes have risen dramatically from a 5-year average of 1.86 serious injury crashes per 100 million VMT in 2016 to 4.83 serious injury crashes per 100 million VMT in 2020. In comparison to the statewide average, serious injuries crashes in the BGMPO region are rising significantly compared the slight rise that North Carolina has seen.

A **High Injury Network (HIN)** is identified to show how a small group of roadways in the region is the location of a large share of the region's severe crashes. For the BGMPO area, 212 miles of the region's roadway account for 72 percent of all crashes and 62 percent of fatal and serious injury crashes in the region between 2016–2020.

Several crash types were overrepresented for fatal and severe injury crashes compared to all crashes within the BGMPO region. These crash types include bicycle, fixed object, head on, overturn/rollover, pedestrian, ran off road—straight, and sideswipe—opposite direction.

0.98 fatal crashes per 100 million VMT in 2016 → **1.21 crashes per 100 million VMT in 2020**

1.86 serious injury crashes per 100 million VMT in 2016 → **4.83 serious injury crashes per 100 million VMT in 2020**

47 percent of the HIN is in Census tracts that are considered by the United States Department of Transportation (USDOT) as Disadvantaged Communities Census Tracts.

43 percent of fatal and serious injury bicycle and pedestrian crashes occurred in Census block groups with a high NCDOT Transportation Disadvantage Index score despite only 17 percent of BGMPO residents living in these areas.

BGMPO stakeholders identified strategies and action items for emphasis areas, many of which align with the North Carolina SHSP. Each strategy and action item incorporates the Safe System elements of Safe Roads, Safe Road Users, Safe Speeds, Post-Crash Care, and Safe Vehicles.

Example strategies and action items include the following:

- Implement traffic calming measures to manage speed
- Use radar speed feedback signs
- Install, enhance, or maintain center line and edge line markings on paved roadways
- Conduct enforcement of speed, impaired driving, distracted driving, and seat belt use laws
- Enhance curve delineation (advance curve warning signs, chevrons, reflective strips on posts)
- Expand current education and outreach efforts that focus on safe road users

BGMPO will use the Transportation Safety Plan to supplement its MTP and help guide decisions on project prioritization. The Transportation Safety Plan is viewed as a living document that will be updated to reflect changing needs and priorities of the region. The **BGMPO Transportation Safety Subcommittee**, **Transportation Advisory Committee**, and **Technical Coordinating Committee** will provide a forum for collaboration and help oversee implementation of the Transportation Safety Plan. By using the Safe System Approach during Transportation Safety Plan implementation, the region and its stakeholders can work together to acheive the goal to reduce traffic fatalities and serious injuries on its roadways.

1

Plan Purpose

The BGMPO area has experienced an increase in most forms of crashes over the last five years.

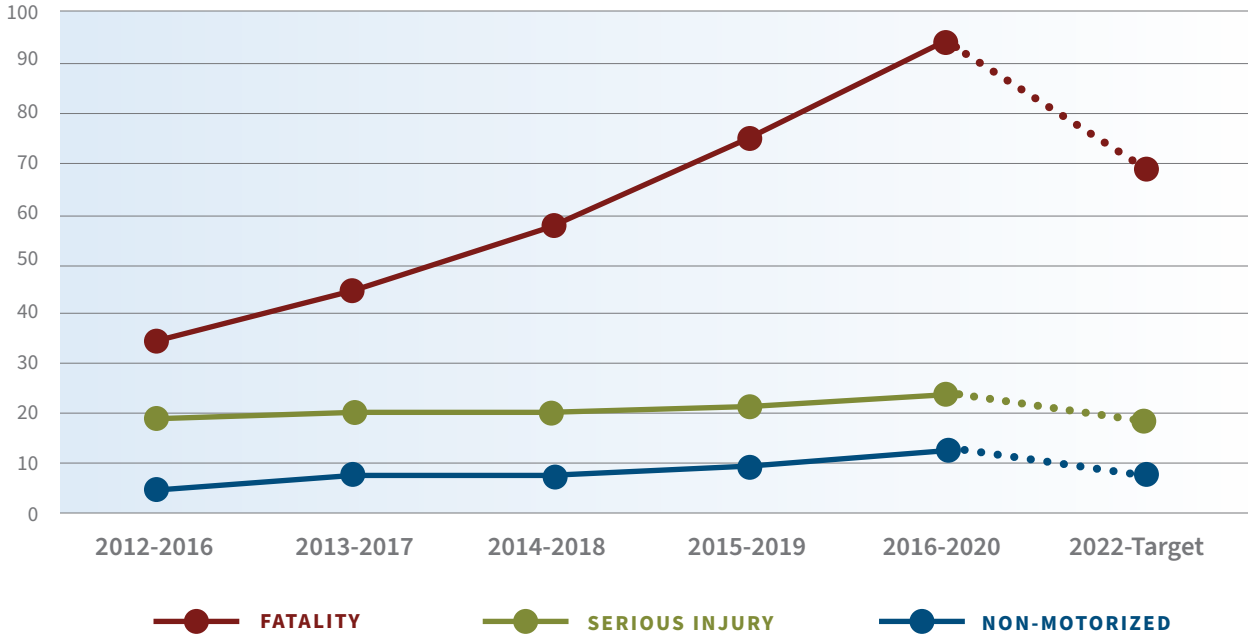
There has been a dramatic increase in serious injury crashes (incapacitating injury that prevents an individual from performing their normal activity for 24 hours or longer), from 31 in 2016 to 139 in 2020. This partially as a result of a revised definition of a serious injury in late-2016; even after the change, the number of serious injuries have continued to rise (**Figure 1.1**). The number of non-motorized user (pedestrian and bicyclist) crashes has also risen from 9 to 20 in the same period. This increase has exceeded the growth in the number of drivers (5 percent over the same period)[1] and the rate of fatal and serious injuries per 100 VMT also increased.

Serious injury crash rates sharply rose from 1.58 per 100 VMT in 2016 to 7.82 in 2020. Fatal crashes in the BGMPO area is rising, similar to statewide trends.[2]

1 https://www.fhwa.dot.gov/policyinformation/statistics.cfm

2 https://www.bgmpotransportationsafetyplan.com/conditions.htm

Figure 1.1. BGMPO Fatal & Serious Injury Trends



Source: NCDOT

Vision Zero Policy Resolution

The BGMPO Transportation Advisory Committee (TAC), in their efforts to reduce fatalities and serious injuries on its roadways, adopted the following resolution on August 16, 2022, to commit to a goal of zero deaths and serious injuries resulting from crashes by the year 2050.

Burlington - Graham Metropolitan Planning Organization

RESOLUTION

FOR THE ADOPTION OF A VISION ZERO POLICY TO ELIMINATE FATALITIES AND SERIOUS INJURIES THAT RESULT FROM CRASHES WITHIN THE BURLINGTON – GRAHAM PLANNING AREA BY YEAR 2050

The motion to approve the following resolution was offered by Jim Butler and seconded by Kelly Allen and upon being put to a vote was duly adopted.

WHEREAS, hundreds of crashes occur in the region each year, resulting in fatalities and serious injuries; and

WHEREAS, the number of people dying and suffering serious injuries on our streets is a serious public health problem which necessitates public action; and

WHEREAS, crash reduction efforts necessitate a comprehensive and specific approaches to street planning, design, policy, enforcement, legal processes, education, and communication; and

WHEREAS, crashes that result in death or serious injury are not inevitable but largely preventable; and

WHEREAS, the Burlington – Graham Metropolitan Planning Organization (BGMPO) acknowledges the importance of everyone traveling safely within their communities and that the only acceptable goal is to eliminate traffic-related fatalities and serious injuries, while increasing safe, healthy, and equitable mobility for all; and

WHEREAS, a commitment to Vision Zero is a commitment to saving lives and ensuring equitable investment in the safety needs of underserved communities in our region; and

WHEREAS, it is the role of government to do its part to serve and protect the populace; and

WHEREAS, the BGMPO is required to establish safety targets per Federal legislations and to support the North Carolina State Highway Safety Plan goal to reduce fatalities and serious injuries by half by 2035, moving towards zero by 2050; and

WHEREAS, the Burlington – Graham Metropolitan Planning Organization (BGMPO) Transportation Advisory Committee (TAC) has found that the Metropolitan Planning Organization is conducting transportation planning in a continuous, cooperative, and comprehensive manner; and

WHEREAS, the BGMPO and its member jurisdictions have a strong history of commitment to prioritizing safety and the Comprehensive Transportation Plan, the Metropolitan Transportation Plan, and local governments' transportation plans have made demonstrable progress to improve safety by making systemic changes in the way the transportation network is planned, programmed, designed, constructed, and operated; and

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BGMPO
Burlington - Graham Metropolitan Planning Organization

WHEREAS, the BGMPO has taken the proactive approach to develop an effective Transportation Safety Plan built on a foundation of Safe Systems principles and elements that will translate into evidence-based implementation processes; and

WHEREAS, creating safer streets is likely to encourage more active transportation options, thereby increasing population health, access to healthy foods and active transportation options; and

WHEREAS, the Transportation Safety Plan has developed with equity at its forefront, striving to impact the most vulnerable and dependent users of the most dangerous roadways of the transportation network in the effort to ensure outcomes will be experienced equitably throughout the region.

NOW THEREFORE, BE IT RESOLVED, that the Burlington – Graham Metropolitan Planning Organization agrees to fund, plan and program projects that commits to a goal of zero deaths and serious injuries that are a result of crashes by 2050.

BE IT FURTHER RESOLVED that the Burlington – Graham Metropolitan Planning Organization is dedicated to measuring the progress, challenges, and successes of the Vision Zero commitment and will do so with tangible, reportable metrics that will be reported upon on an annual basis.

CERTIFICATE: The undersigned certifies that the foregoing is a true and correct copy of a resolution adopted by the voting members of the Transportation Advisory Committee (TAC) on August 16, 2022.

Date

TAC Chair

STATE of: North Carolina
COUNTY of: Alamance

I Gina M. Griffeth, Notary Public of Guilford County, North Carolina do hereby certify that Leonard N. Williams personally appeared before me on the 22 day of August to affix his signature to the foregoing document.

Gina M. Griffeth
Notary Public

My Commission Expires: 9-26-2026

GINA M. GRIFFETH NOTARY PUBLIC GUILFORD COUNTY, NC

Transportation Safety Plan Resolution

The BGMPO Transportation Advisory Committee (TAC), in their effort to implement equitable, data-driven safety strategies, adopted the following resolution on October 26, 2022 to adopt the Transportation Safety Plan (TSP).

BGMPO
Burlington - Graham Metropolitan Planning Organization

RESOLUTION

ADOPTING THE BURLINGTON – GRAHAM METROPOLITAN PLANNING ORGANIZATION TRANSPORTATION SAFETY PLAN

A motion was made by Transportation Advisory Committee Member (TAC) **Monti Allison** and seconded by TAC Member **Ricky Hall** for the adoption of the following resolution, and upon being put to vote was duly adopted.

WHEREAS, the Burlington – Graham Metropolitan Planning Organization (BGMPO) has been designated by the Governor of the State of North Carolina as the Metropolitan Planning Organization responsible, together with the State, for the comprehensive, continuing, and cooperative transportation planning (3-C) process for the metropolitan planning area; and,

WHEREAS, through the conduct of a 3-C process in conformance with applicable federal and state requirements, the BGMPO took a proactive approach to develop an effective Transportation Safety Plan (TSP) built on a foundation of Safe Systems principles and elements that will translate into data driven and evidence-based implementation processes; and

WHEREAS, a public review and comment process has been conducted, and the BGMPO TAC has approved the public review process; and

WHEREAS, as part of a coordinated planning effort the TSP recommendations reflect regional priorities for implementation of equitable safety strategies and the BGMPO will review and update the TSP at least every five (5) years to assess safe systems outcomes; and,

NOW THEREFORE, BE IT HEREBY RESOLVED, that the Transportation Advisory Committee hereby adopts the Burlington-Graham Metropolitan Planning Organization Transportation Safety Plan.

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CERTIFICATE: The undersigned certifies that the foregoing is a true and correct copy of a resolution adopted by the voting members of the TAC on this the 18th day of October, 2022.

Leonard Williams, Chair
Transportation Advisory Committee

STATE of North Carolina
County of Guilford

I, Gina M. Griffeth, Notary Public of Guilford County, North Carolina do hereby affix that Leonard Williams personally appeared before me on the 26 day of October, 2022 to affix his signature to the foregoing document.

← Disregard signature. GMG 10/26/22

Notary Public
Gina M. Griffeth
My Commission expires: 9-26-2026

GINA M. GRIFFETH NOTARY PUBLIC GUILFORD COUNTY, NC

Vision, Mission, and Goal

The BGMPO Transportation Safety Plan Vision, Mission, and Goal statements reflect the Safe System Approach principles that death and serious injuries are unacceptable and is a shared responsibility of all stakeholders.

Vision for the Transportation Safety Plan demonstrates the intent that all users of the local roadway system within the BGMPO metropolitan region reach their destination safely. The **Mission** statement recognizes that a collaborative effort by all the safety partners is necessary to reduce traffic-related fatalities and serious injuries set forth by the **Goal**. Strategies and action items identified in later sections of this Transportation Safety Plan reflect the Safe System Approach and support achieving the **Vision**, **Mission**, and **Goal** statements.

Stakeholder Engagement and Equity

Transportation is a determinant of quality of life within a community, so equity within the transportation system is essential to ensuring that everyone within the system has access to affordable transportation options that meet their needs.

Transportation investments exclude some groups that leave them more vulnerable to fatalities and serious injuries from using a transportation system. An example is missing sidewalks and trails. Additionally, those without a vehicle and living in areas not serviced by public transit are more likely to walk or bike as their means of transportation, which could lead to a higher percentage of non-motorized crashes in these communities.

Transportation equity includes fostering systems that do not limit users by their race, sex, age, socio-economic status, or other demographic factors. The lack of safe and reliable transportation impacts how residents travel to work or school, as well as what opportunities in a community are accessible to them, such as shopping or recreational opportunities.

The federal government calls for equity in transportation systems through Title VI of the Civil Rights Act of 1964, prohibiting discrimination under any program receiving Federal funds based on race, color, or national origin, and through Executive Order 13985, directing agencies to advance equity and remove barriers for underserved communities through expanding outreaching, data collection, and resources for non-English speakers. Environmental justice (EJ) is stressed through Executive Order 12898, which mandates that agencies must identify and address environmental and health impacts from programs and activities that have a disproportionate effect on minority and low-income populations. As a steward of federal funds, the BGMPO is subject to the Title VI program requirements of the Federal Transit Administration (FTA) and the Federal Highway Administration (FHWA).

The need for transportation equity is quantified through the Transportation Disadvantage Index (TDI), which is a measure of communities that have notable EJ characteristics. This can include factors like racial and ethnic minorities, low household income, lack of access to a motor vehicle, elderly or young populations, and physical disabilities. **In the BGMPO area, 83 percent of residents live in block groups with low TDI scores.** TDI is a strong indicator of the need for bicycle and pedestrian safety, as these crashes strongly correlate with high TDI communities.

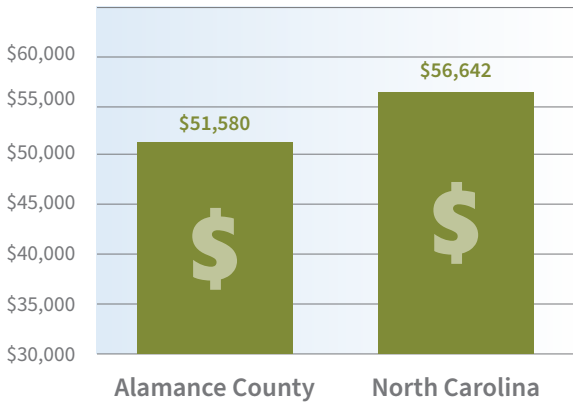
A high TDI score for an area suggests a population that is less likely to have access to cars or live in zero vehicle households. These areas generally have higher bicycle and pedestrian crash rates are therefore there is a need for non-motorized safety improvements.

There is a need to prioritize equity alongside safety as **43 percent of fatal and serious injury crashes occur in communities with a high TDI score.** All users have the right to safe transportation use, and since marginalized populations are often more vulnerable to harm from the transportation system, it is important to address these issues together within a transportation plan. Section 6 of Data Analysis explores this issue in more detail.

The BGMPO recently adopted a Complete Streets policy and Vision Zero policy to address such inequities. Affordability of transportation is also essential, as the median household income in Alamance County is $51,580, almost $5,000 below the median income for North Carolina of $56,642 (**Figure 1.2**). According to the 2020 U.S. Census, 50.3 percent of residents in Alamance County are below this State median (**Figure 1.3**). The average income for Alamance County is $69,461, almost $10,000 lower than the State's mean income of $79,620. The difference is starker in underserved communities with the region, where the median household is $37,535 and the mean income is $51,772.

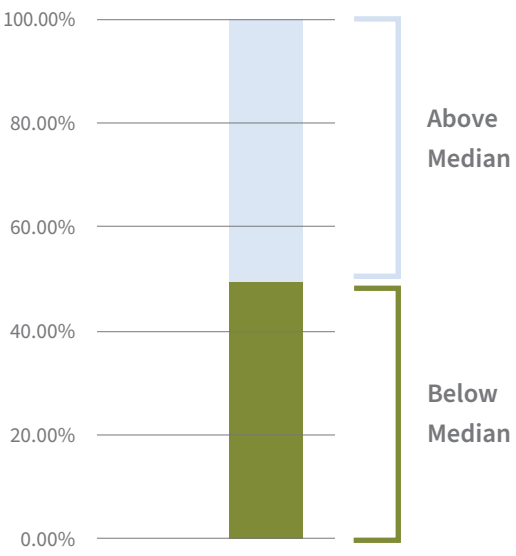
Population changes also indicate an increasingly diverse community. Between 2010 and 2020, according to data from the U.S. Census, there was a 19.9 percent increase in Black residents and a 48.5 percent increase in Hispanic residents. Some towns experienced particularly high growth rates, with the Black population increasing 135.7 percent in Alamance and 107.1 percent in Gibsonville. Hispanic populations in some localities also sharply increased, with 250 percent in Alamance, 140.7 percent in Elon, and 123.8 percent in Mebane (**Figure 1.4**). Meanwhile, white populations have shown slower growth or have decreased. In Alamance County, white residents have increased in population by 0.8 percent.

Figure 1.2. 2020 Median Household Income



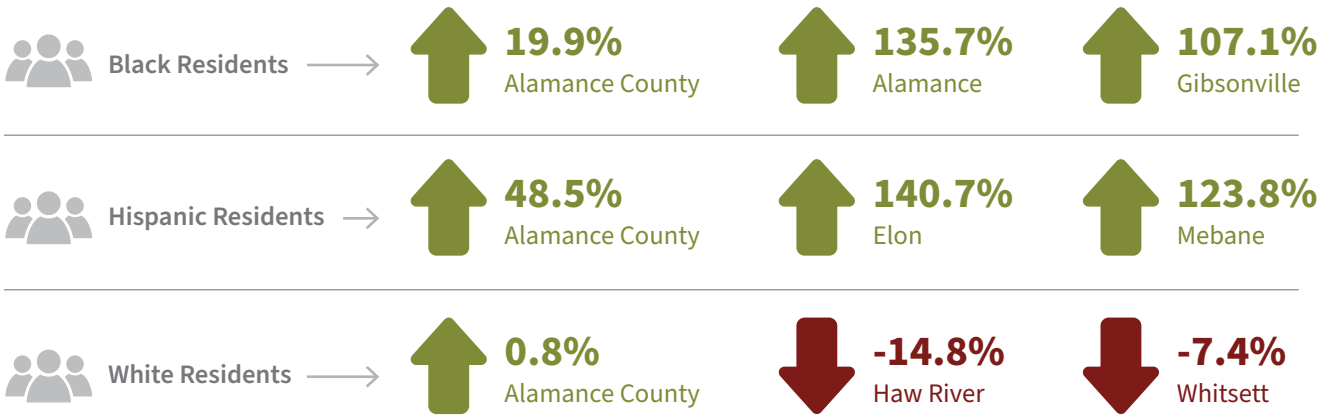
Source: US Census Bureau

Figure 1.3. 2020 State Median Income Compared to Residents



Source: US Census Bureau

Figure 1.4. Notable Demographic Changes in the BGMPO Region between 2010 and 2020



Source: U.S. Census Bureau

The largest decreases are in Haw River, with the population of white residents dropping by 14.8 percent and Whitsett at -7.4 percent. A notable exception is Green Level, in which the population of white residents has increased 48.6 percent.[3]

Ensuring that underserved communities have equal and safe access to transportation is essential for increasing quality of life and saving lives. To ensure this, the BGMPO Transportation Safety Plan identified these populations early in the planning process as a metric to identify safety issues and prioritize safety.

Community Engagement Efforts

One of the ways the Transportation Safety Plan is fostering equity in their planning is through listening to the concerns of those in the community through public outreach. The BGMPO staff is a member of three groups that focus on eliminating racial disparities in Alamance County: The Health Equity Collective, Alamance Wellness Collaborative, and Healthy Alamance.

The **Alamance Health Equity Collective (HEC)** is a community-based partnership of residents and institutions engaged in the shared work of identifying and addressing the racial disparities most impacting the health of the Alamance County community. HEC is committed to shared and transparent institutional analysis and strategic and community-informed efforts to eliminate policies, practices, and procedures contributing to disparities. HEC recently developed a Social Vulnerability Index Map.

The **Alamance Wellness Collaborative (AWC)** is comprised of area planners, local college staffers and public health officials with the purpose of prioritizing racial equity and grounding its work in developing partnerships with the community while using racial disparities as the metric for improving health outcomes.

Healthy Alamance is a non-profit organization under the Cone Health Hospital system and serves as the umbrella organization for both HEC and AWC.

3 Burlington-Graham Metropolitan Planning Organization Demographic Report

The **BGMPO Safety Subcommittee** held three public meetings to understand safety issues and identity issues regarding the regional transportation system. The meetings were publicly advertised to allow the greatest potential for attendance.

BGMPO staff also presented an overview of the Transportation Safety Plan development to North Park Back to School Bash attendees and high school students attending North Carolina A&T State University's annual Summer High School Transportation Institute. The program is a FHWA-funded, 4-week, academically focused summer camp designed to introduce female and minority students to higher ed and career pathways in the transportation industry. Part of the program is a classroom curriculum that introduces the various modes and disciplines within transportation.

The use of equity as a metric to prioritize safety projects ensures that it will be considered along with traditional safety focuses, and that a data-driven approach will also be applied to implementing equity in the Transportation Safety Plan.

2

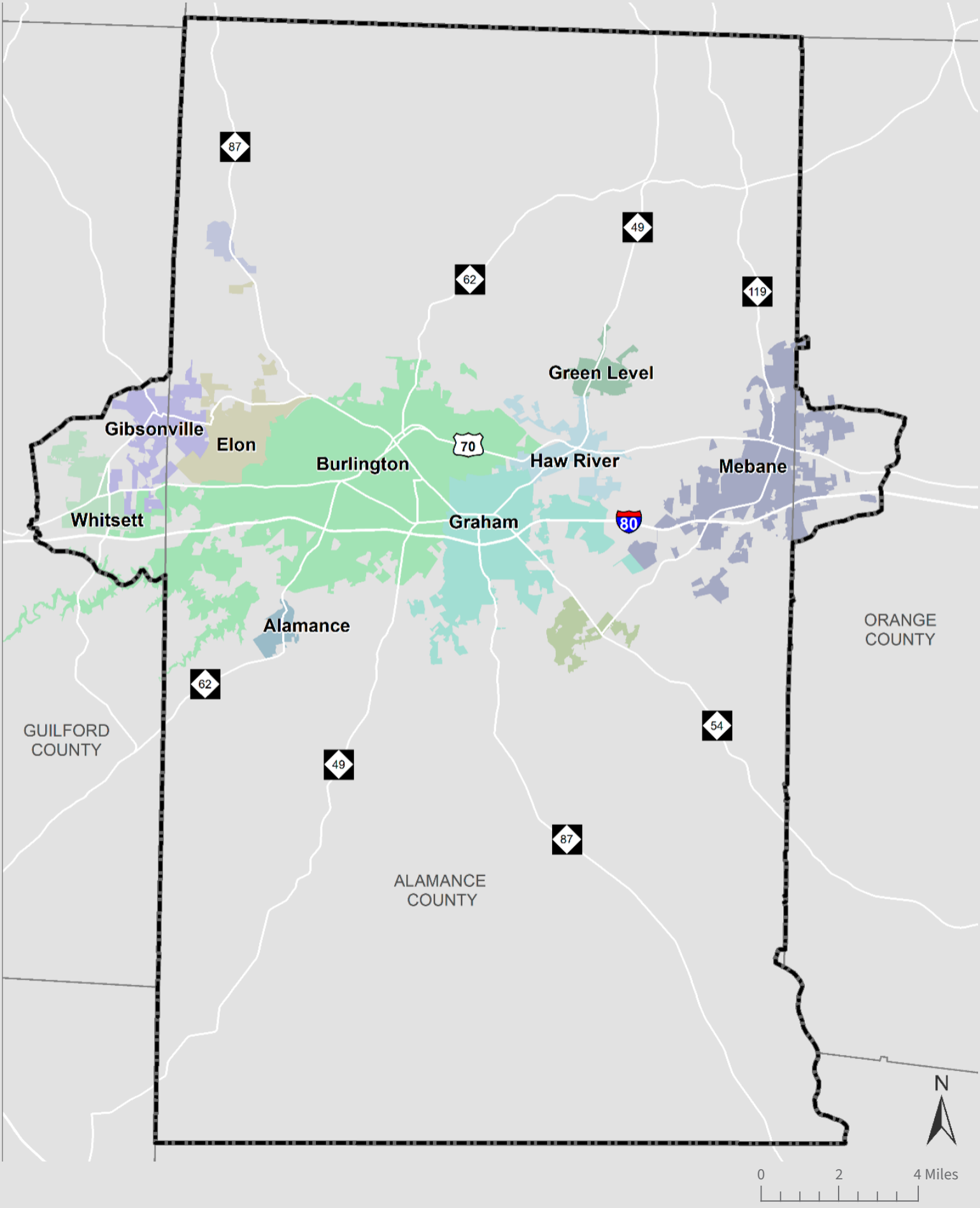
Background

The BGMPO is a regional transportation planning agency for Alamance County and portions of Guilford and Orange County. The organization was created in 1975 to ensure regional cooperation in managing transportation planning for growth after the region was declared an urbanized area in 1974.

The metropolitan area (**Figure 2.1**) includes:

- Alamance County
- Portions of Orange County
- Portions of Guilford County
- City of Burlington
- City of Graham
- City of Mebane
- Town of Elon
- Town of Gibsonville
- Town of Green Level
- Town of Haw River
- Town of Whitsett
- Village of Alamance

Figure 2.1. Burlington-Graham MPO Planning Boundary and Member Jurisdictions



POPULATION

According to the 2020 U.S Census, the population of BGMPO's planning area was **approximately 185,083**

Alamance County has experienced over **13 percent** population growth since 2010

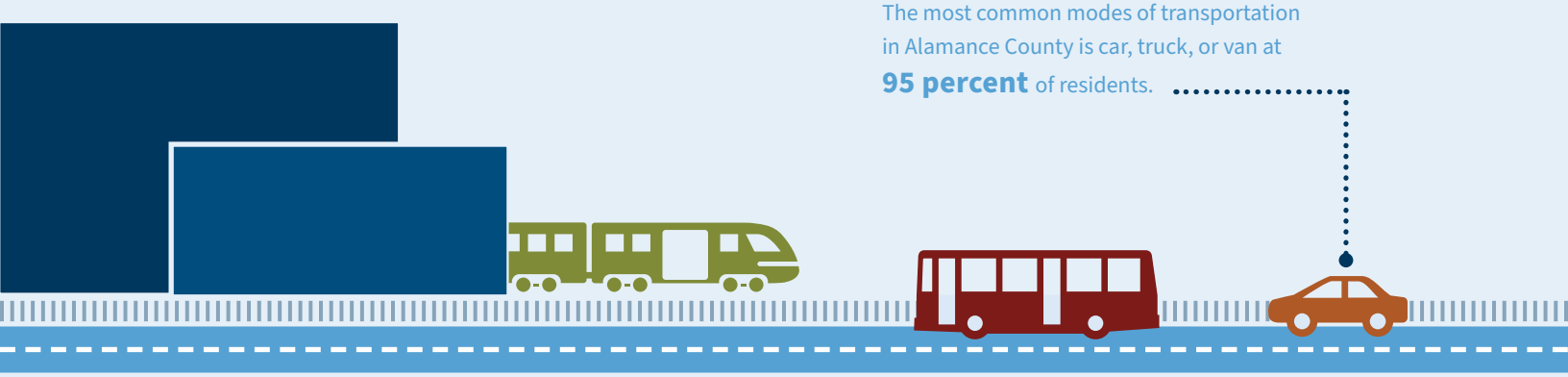
The largest city in BGMPO's jurisdiction is Burlington, with a population of **57,303**

POPULATION INCREASES AND DECREASES

Some locations within the planning area have experienced more rapid population increases, such as Mebane (56 percent), Green Level (50 percent), and Gibsonville (39 percent).

A few areas have declined, with Haw River's population decreasing by 2 percent since 2010 and Whitsett's population decreasing by 1 percent.

The most common modes of transportation in Alamance County is car, truck, or van at **95 percent** of residents.



Alignment with State Safety Plans

The BGMPO Transportation Safety Plan is essential for building a safe transportation network throughout the area of the MPO's jurisdiction. This will ensure the BGMPO and its stakeholders have a data-driven, planned approach to address safety needs and for prioritizing projects. The Transportation Safety Plan also aligns with long-range transportation plans, as the top goal in **BGMPO's 2045 Metropolitan Transportation Plan[4] (MTP)** is to "Provide a safe, secure, comprehensive, and effective transportation system to move people and goods within and through the area." This goal includes objectives that align with the purpose of the Transportation Safety Plan, such as enhancing mobility and supporting projects and programs that advance safe travel for all transportation users.

The **North Carolina SHSP**[5] and the **North Carolina Highway Safety Improvement Program (HSIP)**[6] both share a similar goal to the Transportation Safety Plan. The main goal of the SHSP is to reduce fatalities and serious injuries by half and uses the Safe System Approach, which the Transportation Safety Plan is also employing. The main goal of the HSIP is to reduce the number of fatalities and serious injuries on all public roads. The Transportation Safety Plan also employs the 5 E's of highway safety used in the SHSP: education, enforcement, engineering, emergency services, and everyone. The Transportation Safety Plan may also share similar target areas to those of the SHSP. The Safe System chapter of this Transportation Safety Plan provides a more detailed explanation of the 5E's.

Emphasis areas of the TSP	Emphasis Areas of the SHSP
Roadway Infrastructure Intersections | Lane Departure	**Roadway Infrastructure** Intersections | Lane Departure
Human Behavior Speed | Alertness | Seatbelts | Substance Impaired Driving | Aggressive Driving	**Human Behavior** Alertness | Occupant Protection | Speed | Substance Impaired Driving
Road Users Pedestrians, Bicyclists, and Personal Mobility | Young/New Drivers | Older Drivers | Motorcyclists	**All Users** Motorcyclists | Older Drivers | Pedestrians, Bicyclists, and Personal Mobility | Younger Drivers
Data and Evaluation Emerging Issues and Data	**Data and Evaluation** Emerging Issues and Data
A Culture of Safety All Emphasis Areas	

The BGMPO Transportation Safety Plan emphasis areas align well with those in the North Carolina SHSP.

4 http://bgmpo.org/Portals/0/BGMPO/Documents/MTP/BGMPO_MTP2045_Amended.pdf?ver=v7tO0lwtkasd0WooT5U77g%3d%3d

5 https://spatial.vhb.com/ncdotshsp/assets/Reports/NC%20SHSP%20Guide%20Web%20Spread.pdf

6 https://safety.fhwa.dot.gov/hsip/reports/pdf/2020/nc.pdf

3

Safe System Approach

The Safe System Approach shifts the focus from monitoring crash frequency to crash management. The approach acknowledges that the human body is vulnerable and that humans make mistakes, but it is unacceptable that these mistakes result in death and injury.

Understanding that humans are fallible and crashes will occur as a result refocuses the issue on managing crashes to minimize impact. This is done with a focus on safety in design and project planning. The Federal Highway Administration (FHWA) promotes the use of the Safe System Approach. The Strategic Highway Safety Plan (SHSP) calls for the Safe System Approach to be incorporated in any plans that address the frequency and severity of crashes; therefor, this Transportation Safety Plan will be implementing the approach.

Six principles form the basis of the Safe System Approach:

1. **Deaths and serious injuries are unacceptable**
2. **Humans make mistakes**
3. **Humans are vulnerable**
4. **Responsibility is shared**
5. **Safety is proactive**
6. **Redundancy is crucial**

Figure 3.1. Safe System Approach

Source: Federal Highway Administration

There are five Safe System elements (**Figure 3.1**). These elements are addressed using the 5 Es of highway safety, which the Transportation Safety Plan focuses on in its approach to safety. The Safe System elements are:

Safe Speeds help to reduce fatalities when a crash does occur, as there is an exponential chance of death with increasing speed. In the Transportation Safety Plan, speed is outlined as an emphasis area, as it is an area that makes up a disproportionate share of fatal and serious injury crashes. Speed will also be considered geographically, as BGMPO's data analysis indicates that it is more rural-focused. The E of "Enforcement" works to promote safe speeds, bringing law enforcement's role in maintaining safety on roads.

Safe Roads, through engineering changes, create conditions for road users that promote safe practice. The Transportation Safety Plan's emphasis on roadway infrastructure adheres to this facet of the Safe System by focusing on intersections, lane departure, and speed limit signs. These changes can help to influence human behavior and lead to a Safe System. The E of "Engineering" is used to shape safe roads through the implementation of proven countermeasures and infrastructure solutions to improve the safety of the roadway.

These engineering changes can range from low-cost countermeasures, such as roadway delineation and rumble strips to more involved projects like intersection reconfiguration to re-shape the roadway for safer conditions.

The **Users** of a transportation system must also make safe choices when using the roadway. The Transportation Safety Plan's focus on human behavior addresses this need to influence human actions. Human behavior in the Transportation Safety Plan focuses on mitigating speed and aggressive and substance impaired driving, as well as promoting seatbelt use and alertness. This connects with the E of "Everyone," creating a call that all road users have a responsibility to make safe choices while using the roadway. This topic also ties in with the Transportation Safety Plan's desire to build a culture of safety, with all users, even non-drivers, participating in safe practice.

Post-Crash Care is addressed with the fourth E of "emergency services." The Transportation Safety Plan emphasizes the need for emergency vehicle operators to arrive at the scene of a crash quickly to provide prompt assistance and clear the crash quickly, while also not causing an additional crash on their way.

Safe Vehicles are important in protecting the driver and occupants if a crash occurs, as the Safe System Approach asserts that we must understand that the body has a limited ability to tolerate crash impacts. Safe vehicles include having an appropriate mode available, and creating a call for BGMPO to increase multimodal transportation. Safe vehicles are also stressed through safe vehicle technology and through the promotion of fleet management and company policies against unsafe driving practices while using company vehicles. BGMPO will monitor advances in vehicle and communications technology and identify opportunities to integrate new systems that advance vehicle and road safety.

Each system element is interconnected, as stressed by the Transportation Safety Plan's emphasis on the overlaps among areas.

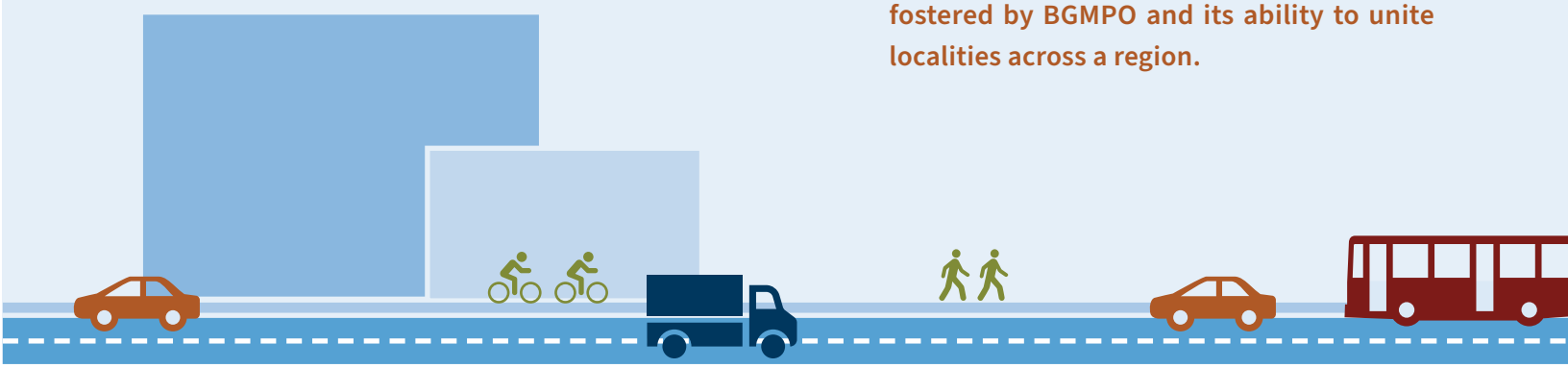
For example, 72 percent of speed-related fatal and serious injuries involve lane departure, connecting safe speeds with safe roads, and 32 percent of speed-related fatal and serious injuries involve alcohol impaired driving, connecting safe speeds with safe road users.

However, data cannot tell a full story on its own. In the fifth E of "Everyone", it is important to understand the context behind data collected on roadway safety and understand that there may be gaps in the strategy that could compound inequities in already underserved communities if data alone is depended on to identify safety issues. For example, inequitable funding results in unsafe road conditions for cyclists and pedestrians. Additionally, communities that have been systematically marginalized may have a higher rate of citations, so crash data may not be able to give an accurate picture of roadway safety in a community. To improve this, a successful equitable and data-driven approach will combine both data analysis and robust public outreach, especially prioritizing engagement in marginalized communities. This data identifies underserved communities to help with project prioritization.

5 E's

education | enforcement | engineering
emergency services | everyone

The Safe System Approach combined with the 5 E's calls for work that is unique to the strengths of BGMPO. The approach stresses shared responsibility by stakeholders and collaboration among all partners, which is fostered by BGMPO and its ability to unite localities across a region.



4

Process Methodology

The BGMPO Transportation Safety Plan will use the data-driven safety planning process and the six-step approach (Figure 4.1) to create a Transportation Safety Plan for the region. The six-step approach to local road safety planning (LRSP) was developed by the Federal Highway Administration (FHWA) as a Proven Safety Countermeasure to help localities successfully create safety plans for their local roads.

These six steps are:

1. Establish Leadership and a Commitment to Safety
2. Analyze Safety Data
3. Determine Emphasis Areas
4. Identify Strategies
5. Prioritize and Incorporate Strategies
6. Evaluate and Update

Figure 4.1. LRSP Development Process

Source: FHWA

These steps will be used in the Transportation Safety Plan to guide the prioritization planning for high-risk/ high-crash locations and for the selection of the most relevant emphasis areas for the BGMPO area using current data.

Comparison with other partner MPOs in North Carolina have aided in indicating unique areas of emphasis for the BGMPO. These initial areas are:

Substance impaired driving (particularly alcohol)

Speed

Motorcyclists

Pedestrians

Intersections

Younger Drivers

BGMPO ensured that the planning process for the Transportation Safety Plan was open and transparent, and that the public, especially those who are most vulnerable on the roadways, had an opportunity to engage with the process.

To do so, BGMPO reached out to the public through a designated website for the plan, press releases, and events to inform residents of the Transportation Safety Plan and public meetings.

5

Existing Efforts

Several resources developed by regional and State agencies served as background research for this Transportation Safety Plan. These resources included the 2019 North Carolina Strategic Highway Safety Plan (SHSP), the 2022 North Carolina Highway Safety Improvement Program annual report, the State of North Carolina Highway Safety Plan (HSP) for fiscal year 2022, and the BGMPO Metropolitan Transportation Plan 2045.

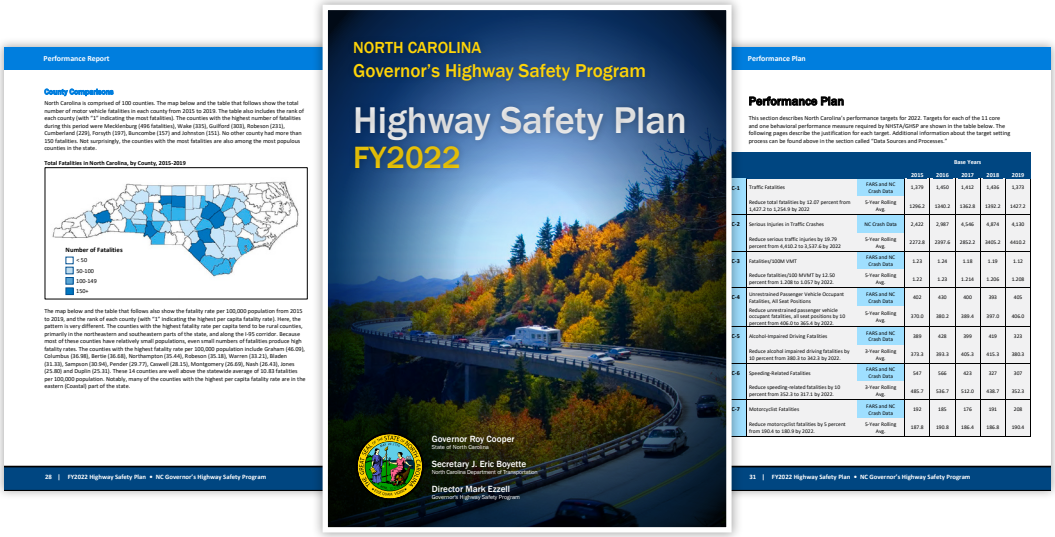
The five-year **North Carolina SHSP,** released in 2019, was developed based on input from numerous agencies and multidisciplinary stakeholders. This document is an important resource for the development and implementation of the Transportation Safety Plan as it can inform potential strategies and actions for local adoption.

The **Highway Safety Plan (HSP)** was developed by the State to identify behavioral safety grants suggests a strong opportunity for the BGMPO Transportation Safety Plan that can effectively contribute to the reduction of fatalities within the region. The HSP indicates safety initiatives that target impaired driving, young drivers, older drivers, occupant protection, distracted driving, and speed.

BGMPO's 2045 Metropolitan Transportation Plan advances viable and affordable public transportation and mobility options, support equitable transportation investments and policies, and support multimodal investments, especially bicycle and pedestrian enhancements.

North Carolina SHSP

Highway Safety Plan (HSP)



BGMPO's 2045 Metropolitan Transportation Plan

6

Data Analysis

The Transportation Safety Plan used a multifaceted approach in analyzing crash and safety trends. The plan used the crash database from the NCDOT for the years 2016–2020. From this dataset, this plan analyzed disproportional crash types, created HINs, compared equity with crash location and severity, and applied a systemic analysis approach.

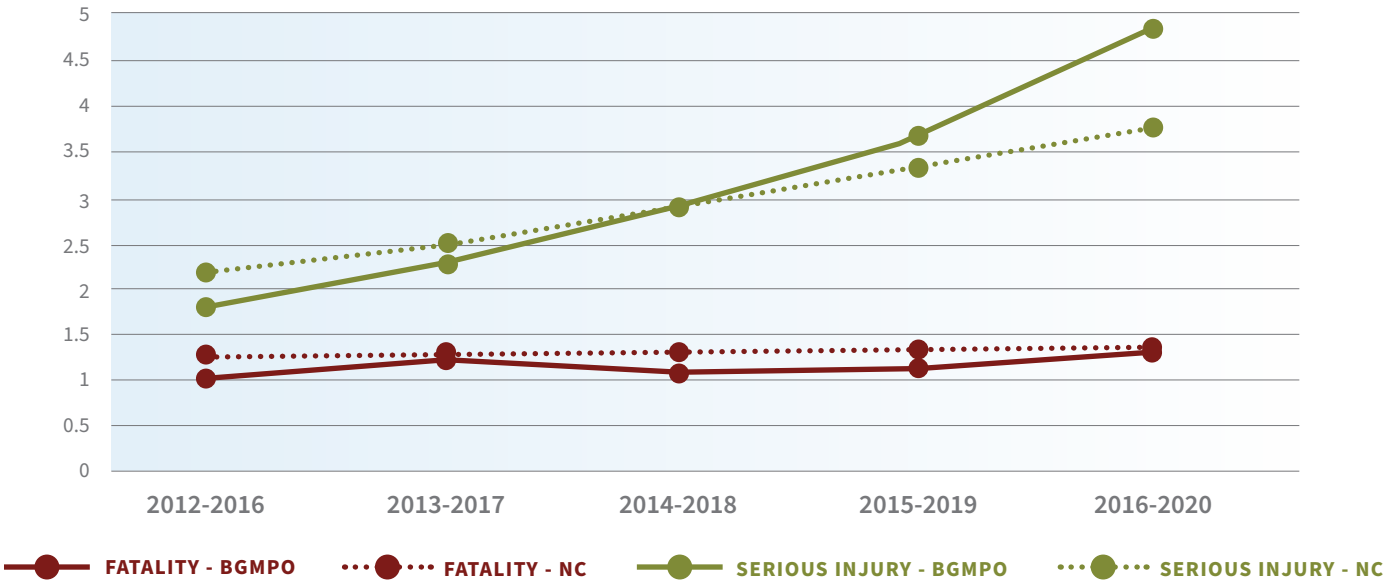
General Trends

North Carolina fatal crash rates had been slowly decreasing or plateauing over the last several years. The fatal 5-year average in 2016 was 1.222 fatal crashes per 100 million vehicle miles traveled (VMT) and dropped to 1.208 per 100 million VMT before slightly increasing to 1.210 per 100 million VMT in 2019. The 2020 5-year average shows a significant increase in the rate of fatalities across North Carolina (**Figure 6.1**). North Carolina serious injury crash rates had been slowly increasing over the last several years. The number of serious injury crashes increased from 31 in 2016 to 139 in 2020. This partially as a result of a revised definition of a serious injury in late-2016; even after the change, the number of serious injuries have continued to rise.

The rate of fatal and serious injury crashes per 100 million VMT in the BGMPO region has increased over the study period. Serious injury crash rates sharply rose from 1.58 per 100 VMT in 2016 to 7.82 in 2020.

In comparison to the statewide average, serious injuries crashes in the BGMPO region are rising significantly compared the rise that North Carolina has seen (**Figure 6.1**). Fatal crashes have been slightly increasing from a 5-year average of 0.98 fatal crashes per 100 million VMT in 2016 to 1.21 crashes per 100 million VMT in 2020. In comparison to the statewide average, fatal crashes in the BGMPO region are trending slightly upward whereas across the state the trend has been trending steady.

Figure 6.1. Fatal & Serious Injury Rate Trends (Crashes per 100 million Vehicle Miles Traveled)

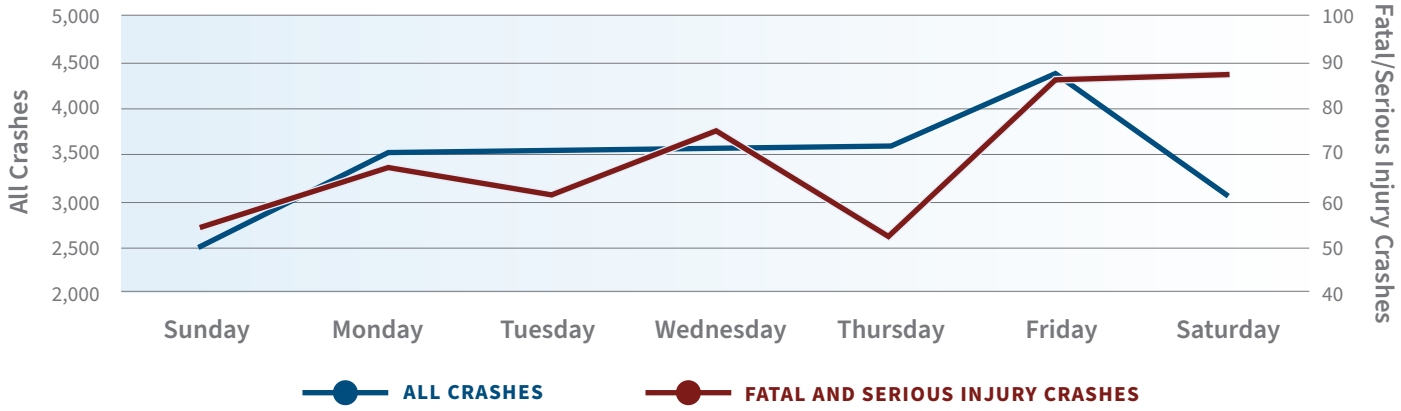


Source: NCDOT Traffic Safety Unit

In the BGMPO region, crash frequency varies by the day of the week (**Figure 6.2**). For all crashes between 2016–2020, the weekend saw the lowest percentage of crashes. During the week, the proportion of all crashes steadily rose from Monday to Thursday before jumping to their highest frequency on Friday. In terms of fatal and serious injury crashes, Friday and Saturday saw more crashes, with Saturday showing a disproportion of fatal and serious injury crashes compared to the other days of the week.

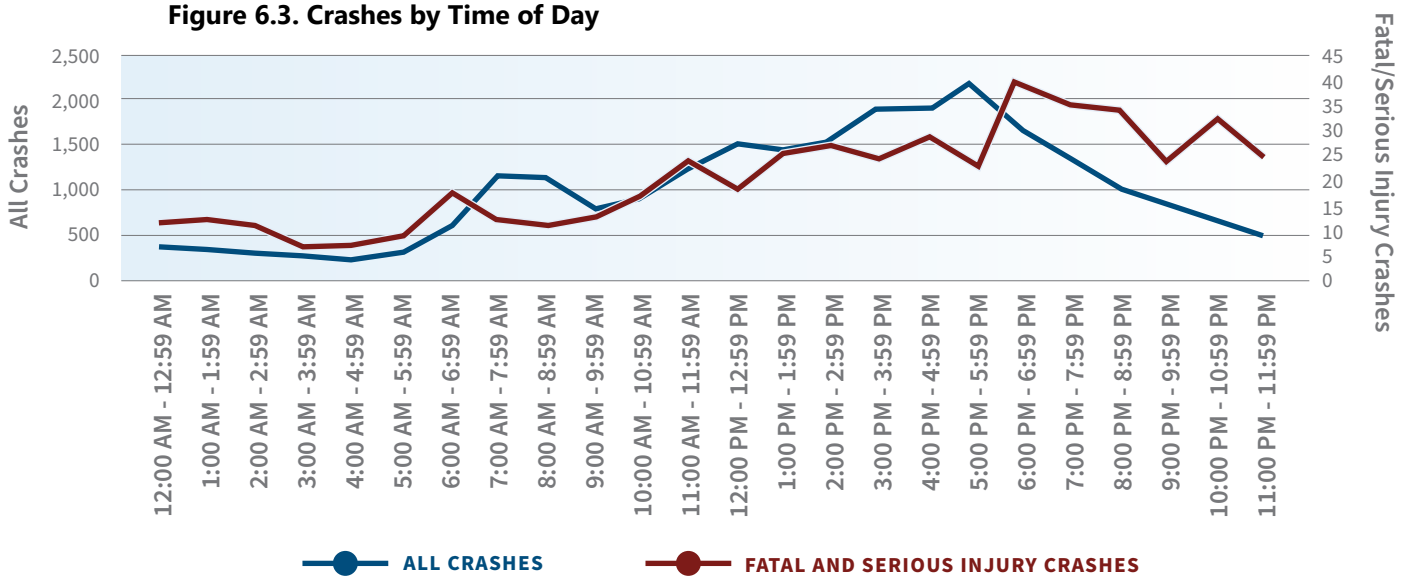
Crashes vary not only by the day of the week, but also by the time of day (**Figure 6.3**). All crashes between 2016–2020 in the BGMPO region show two peaks. The first is the morning commute between 7:00 and 9:00 AM before declining. Throughout the day, the number of crashes slowly increases until it hits its peak between the evening commute between 3:00 and 7:00 PM, with the 5:00 to 6:00PM hour showing the highest share of crashes. The proportion of crashes then declines overnight until the morning commute. Fatal and serious injury crashes generally follow the same trend as all crashes throughout the course of the day, however the evening hours show a greater concentration of fatal and serious injury crashes. Between 2016–2020, the hours of 10:00 to 11:59PM were disproportionate for fatal and serious injury crashes compared to the share of overall crashes.

Figure 6.2. Crashes by Weekday



Source: NCDOT Traffic Safety Unit

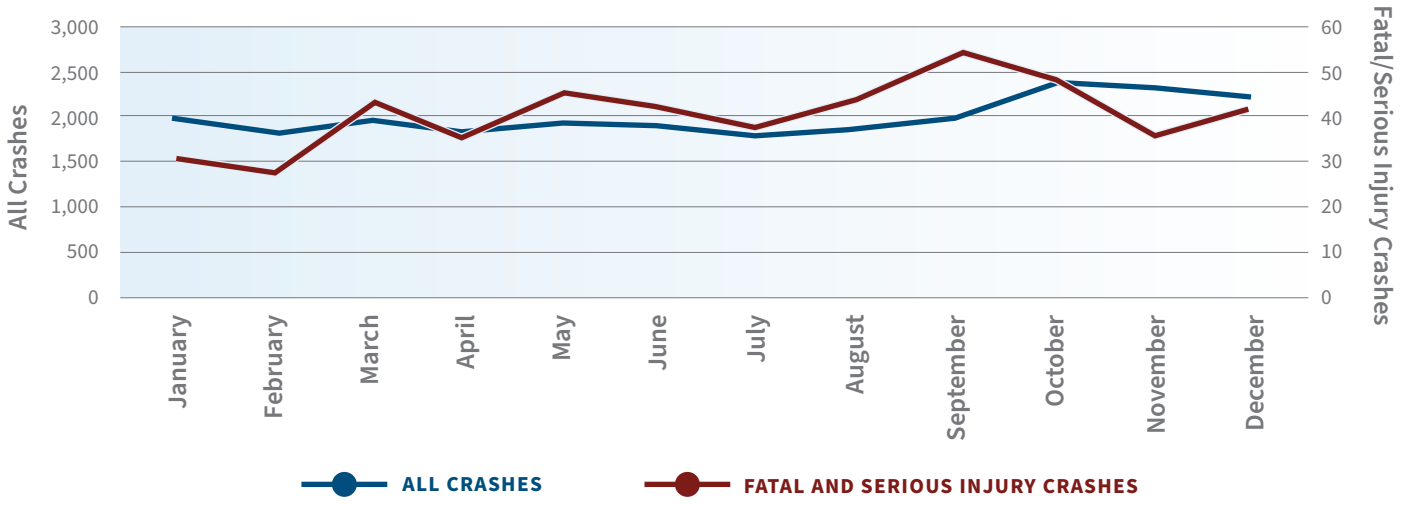
Figure 6.3. Crashes by Time of Day



Source: NCDOT Traffic Safety Unit

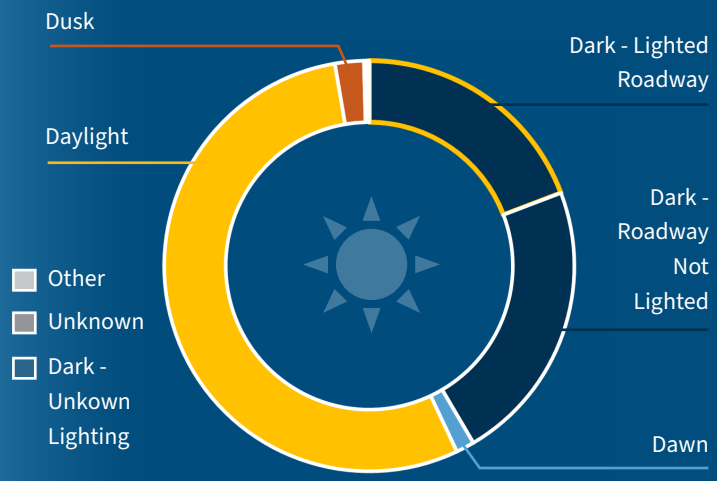
Crashes also vary by month within the BGMPO region. As shown in **Figure 6.4**, the proportion of all crashes remains relatively stable throughout the year, with an increase in crashes peaking in October and remaining above the yearly trend in November and December. For fatal and serious injury crashes, August through October shows the highest proportion of crashes, with September having the greatest share of crashes between 2016–2020. Unlike all crashes, fatal and serious injury crashes have minor peaks as seen in March, May, and December.

Figure 6.4. Crashes by Month



Source: NCDOT Traffic Safety Unit

Figure 6.5. Fatal and Serious Injury Crashes by Light Condition

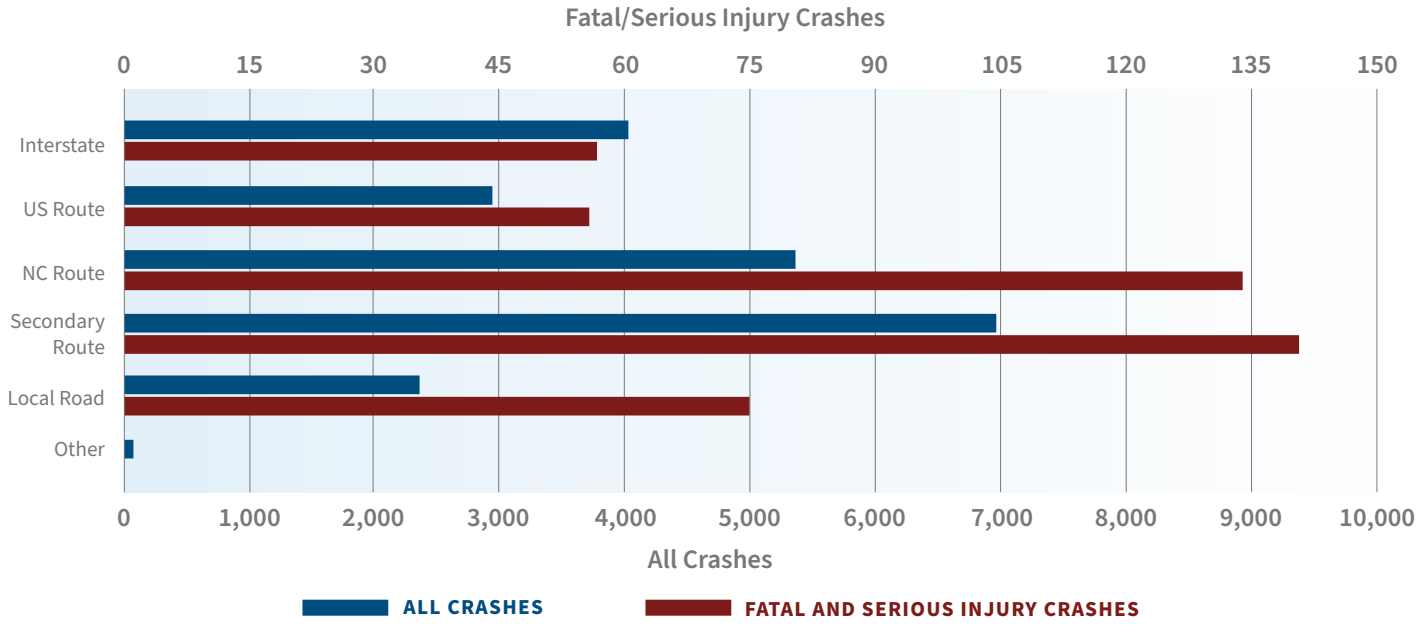


Source: NCDOT Traffic Safety Unit

The lighting condition also played a factor in crashes in the region. **Daylight conditions were present for over 68% of all crashes, while dark conditions were present in nearly 28% of all crashes.** However, fatal and serious injury crashes were much more likely to occur in dark lighting conditions. As shown in **Figure 6.5**, over 41% of all fatal and serious injury crashes in the region occurred in the dark. Of these crashes, approximately 19% occurred on lighted roadways and over 22% occurred where the roadway was not lit.

Crashes within the BGMPO region concentrated primarily on secondary roads and NC Routes (**Figure 6.6**). Over 1 in 3 total crashes in the BGMPO area between 2016–2020 occurred on secondary roads, followed by NC routes were nearly 1 in 4 crashes occurred. For fatal and serious injury crashes, a similar pattern is found with NC routes and state secondary routes each with approximately 30 percent of more severe crashes in the region on these roadway types.

Figure 6.6. Crashes by Road Type



Source: NCDOT Traffic Safety Unit

Road character was a significant variable in fatal and serious injury crashes in the BGMPO region. While nearly 58% of fatal and serious injury crashes occurred on straight, level roadways, curved portions of roads accounted for 19% of fatal and serious injuries (**Table 6.1**). Each category of road curvature feature was disproportionate compared to the proportion of total crashes except for curve/bottom, which held the same share of crashes. Further, roadways on a grade accounted for over 24% of all fatal and serious injury crashes in the region.

Table 6.1. Fatal and Serious Injury Crashes by Roadway Character

	LEVEL	BOTTOM	GRADE	HILLCREST
STRAIGHT	279	3	80	23
CURVE	49	1	37	6
TOTAL	328	4	117	29

Source: NCDOT Traffic Safety Unit

Disproportional Crash Analysis

As part of the study, a review of the emphasis area crashes was conducted. **Table 6.2** shows each emphasis area and their proportion of all crashes in the BGMPO region and proportion of all fatal (K) and serious injury (A) crashes. Lane departure-related, intersection-related, alcohol-related, unbelted occupant, and speed-related crashes each account for more than 15% of all fatal and serious injury crashes. An unbelted driver is not the cause of a crash, but does affect the severity of the crash.

Several emphasis areas are also disproportionate as fatal and serious injury crashes compared to the total crashes in the BGMPO region. Those emphasis areas are **bolded** in **Table 6.2** and include alcohol-related, drug-related, speed-related, drowsy driver, unbelted occupant, motorcycle, pedestrian, bicyclist, and lane departure fatal and serious injury crashes are disproportional in the region compared to their share of overall crashes.

Several crash types were disproportional for fatal and severe injury crashes compared to all crashes within the BGMPO region. These crash types include bicycle, fixed object, head on, overturn/rollover, pedestrian, ran off road – straight, and sideswipe – opposite direction.

Lighting conditions were also significant for fatal and serious injury crashes—201 fatal or serious injury crashes occurred in dark lighting conditions where the roadway was either not lighted (108 crashes) or was lit (93 crashes).

Table 6.2. BGMPO Traffic Related Crashes and Emphasis Areas (2016–2020)

		2016–2020 CRASHES			
	Emphasis Area/Attribute	Percent of KA (484)	Number of KA (484)	Percent of All (24,171)	Number of All (24,171)
Emphasis Area represents **15 percent or more** of BGMPO KA Injuries.	Lane Departure Related	**46.1%**	223	20.4%	4,938
	Intersection Related	35.7%	173	37.7%	9,123
	Alcohol Related, Any Driver	**23.8%**	115	4.7%	1,147
	Unbelted Occupant	**23.6%**	114	3.1%	744
	Speed Related	**20.7%**	100	6.4%	1,556
Emphasis Area represents **6 to 15 percent or more** of BGMPO KA Injuries.	Older Driver Involved	14.7%	71	18.9%	4,564
	Teen Driver Involved	13.8%	67	15.9%	3,851
	Motorcycle Involved	**13.0%**	63	1.1%	273
	Pedestrian Involved	**10.7%**	52	0.7%	162
	Distracted Driver	9.9%	48	18.7%	4,529
	Drug Related, Any Driver	**5.6%**	27	1.3%	314
Emphasis Area represents **5 percent or less** of BGMPO KA Injuries.	Heavy Truck Involved	3.1%	15	3.7%	883
	Drowsy Driver	**2.9%**	14	1.3%	303
	Bicyclist Involved	**1.2%**	6	0.2%	52
	Animal Crash	0.6%	3	6.6%	1,593

Source: NCDOT Traffic Safety Unit

Emphasis Area Matrix

The emphasis area matrix shown in **Table 6.3** illustrates the relationship between the selected Transportation Safety Plan emphasis areas. This relationship allows stakeholders to leverage resources and address multiple emphasis areas simultaneously. The matrix is read by selecting the primary emphasis area on the left column and then reading across the row to determine that portion of fatal and serious injuries associated with the other emphasis areas.

Within the BGMPO region, several emphasis areas show high correlations with one another. Teen drivers show strong correlation with speed-related, unbelted occupant, lane departure, and intersection-related fatal and serious injury crashes, while older drivers show strong correlation with intersection-related and lane departure crashes. Fatal and serious injury crashes for pedestrians are correlated with alcohol-related and intersection-related crashes, while bicycle crashes are primarily associated with intersection crashes with older driver and speed-related crashes showing moderate correlation.

Table 6.3. Matrix of Fatal and Serious Injury Crashes by Emphasis Area (2016–2020)

FATAL AND SERIOUS INJURY CRASHES (484 CRASHES BETWEEN 2016 AND 2020)																	
Emphasis Area	**Alcohol Related, Any Driver**	**Drug Related, Any Driver**	**Speed Related**	**Distracted Driver**	**Drowsy Driver**	**Animal Crash**	**Intersection Related**	**Older Driver Involved**	**Teen Driver Involved**	**Unbelted Occupant**	**Motorcycle Involved**	**Heavy Truck Involved**	**Pedestrian Involved**	**Bicyclist Involved**	**Lane Departure**	**Total KA**	**% of Total KA**
Alcohol Related, Any Driver	-	12%	28%	4%	0%	0%	27%	3%	7%	37%	10%	3%	11%	0%	61%	**115**	**24%**
Drug Related, Any Driver	52%	-	26%	4%	0%	0%	7%	4%	7%	44%	4%	4%	11%	0%	70%	**27**	**6%**
Speed Related	32%	7%	-	2%	1%	0%	21%	6%	17%	41%	13%	2%	4%	1%	72%	**100**	**21%**
Distracted Driver	10%	2%	4%	-	2%	0%	52%	21%	8%	19%	15%	4%	17%	0%	25%	**48**	**10%**
Drowsy Driver	0%	0%	7%	7%	-	0%	7%	21%	43%	14%	0%	0%	0%	0%	79%	**14**	**3%**
Animal Crash	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	67%	0%	0%	0%	0%	**3**	**1%**
Intersection Related	18%	1%	12%	14%	1%	0%	-	21%	16%	17%	16%	2%	9%	2%	21%	**173**	**36%**
Older Driver Involved	6%	1%	8%	14%	4%	0%	52%	-	10%	14%	8%	7%	4%	1%	37%	**71**	**15%**
Teen Driver Involved	12%	3%	25%	6%	9%	0%	42%	10%	-	24%	9%	1%	3%	0%	45%	**67**	**14%**
Unbelted Occupant	38%	11%	36%	8%	2%	0%	26%	9%	14%	-	2%	6%	4%	0%	67%	**114**	**24%**
Motorcycle Involved	19%	2%	21%	11%	0%	3%	43%	10%	10%	3%	-	0%	2%	0%	44%	**63**	**13%**
Heavy Truck Involved	27%	7%	13%	13%	0%	0%	20%	33%	7%	47%	0%	-	0%	0%	33%	**15**	**3%**
Pedestrian Involved	25%	6%	8%	15%	0%	0%	29%	6%	4%	10%	2%	0%	-	0%	4%	**52**	**11%**
Bicyclist Involved	0%	0%	17%	0%	0%	0%	50%	17%	0%	0%	0%	0%	0%	-	0%	**6**	**1%**
Lane Departure	31%	9%	32%	5%	5%	0%	16%	12%	13%	34%	13%	2%	1%	0%	-	**223**	**46%**

Source: NCDOT Traffic Safety Unit

High Injury Network

This study mapped crashes in the BGMPO region as a part of the existing conditions assessment. In most communities, most crashes tend to cluster on a small percentage of the roadway network. HINs—first applied in San Francisco, CA as part of the city's Vision Zero efforts—underscore this point. A HIN is a useful tool for prioritizing corridors that may need engineering, enforcement, or emergency services interventions.

This study developed two HINs for the BGMPO as part of the Transportation Safety Plan: 1) a HIN for all modes and users, and 2) a HIN for bicycle, pedestrian, and other non-motorized users. Both HINs used an Equivalent Property Damage Only (EDPO) methodology. The EPDO method identifies high crash frequency locations with an emphasis on more severe crashes by adding additional weight to fatal and injury crashes based on crash costs. This study used NCDOT's 2019 crash costs for the purposes of this analysis (**Table 6.4**).

Table 6.4. NCDOT Cost Per Crash for Total Crashes and Associated EPDO Weight

Severity	Cost	EPDO
K (Fatality)	$10,310,000	825
A (Serious Injury)	$613,000	49
B (Minor Injury)	$206,000	17
C (Possible Injury)	$120,000	10
O (No Apparent Injury)	$12,500	1

Source: NCDOT Traffic Safety Unit

After an initial automated screening in GIS using crash locations between 2016 and 2020, the study team manually reviewed the HIN results for further refinement. This review focused on several criteria including:

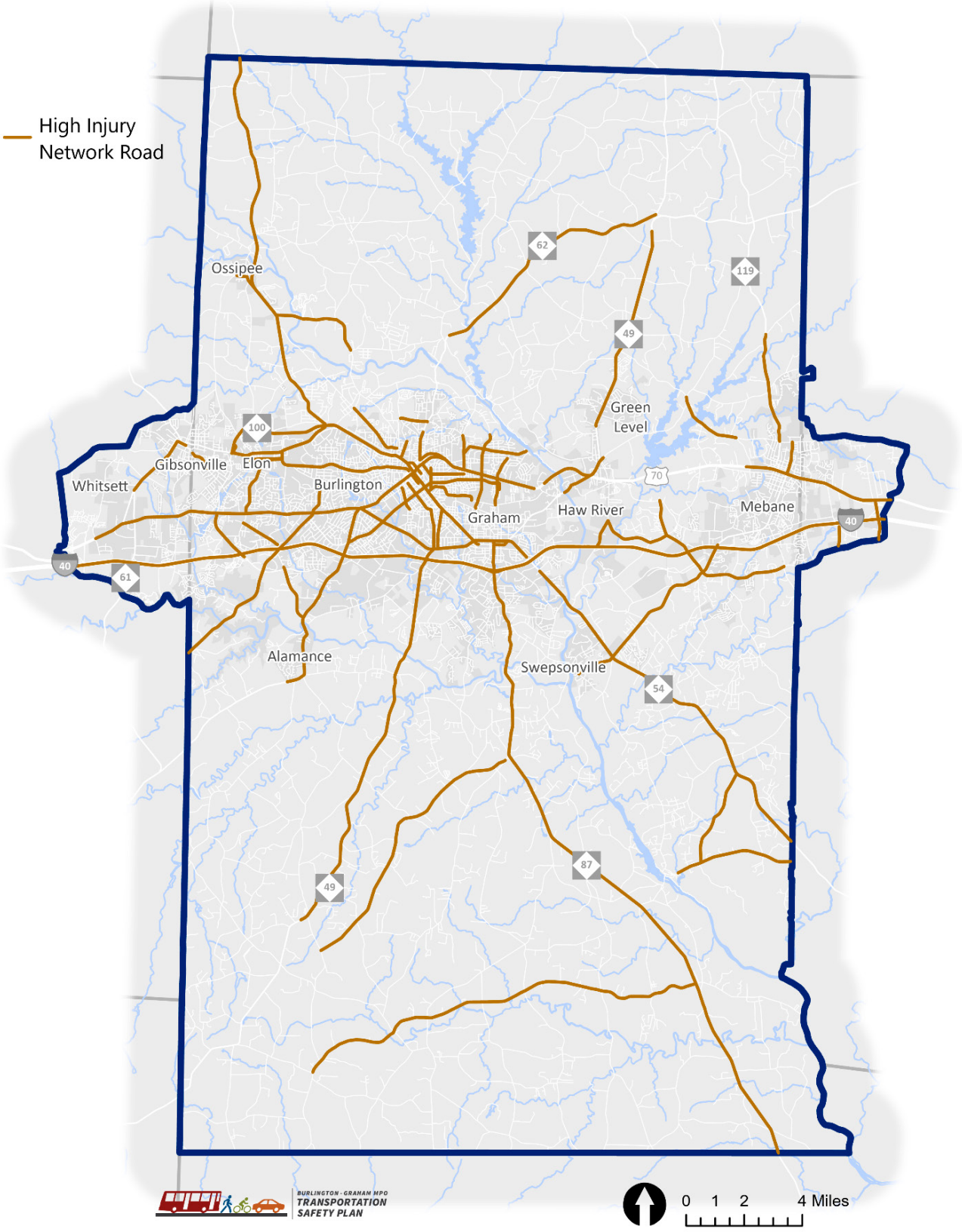
- Corridor contiguity (i.e., avoiding isolated segments that might be especially affected by regression to the mean)
- Segments with high numbers of low severity crashes
- Logical breaks between corridor types

The following sections describe the HIN results for the All Mode and Non-Motorized networks.

All Modes HIN

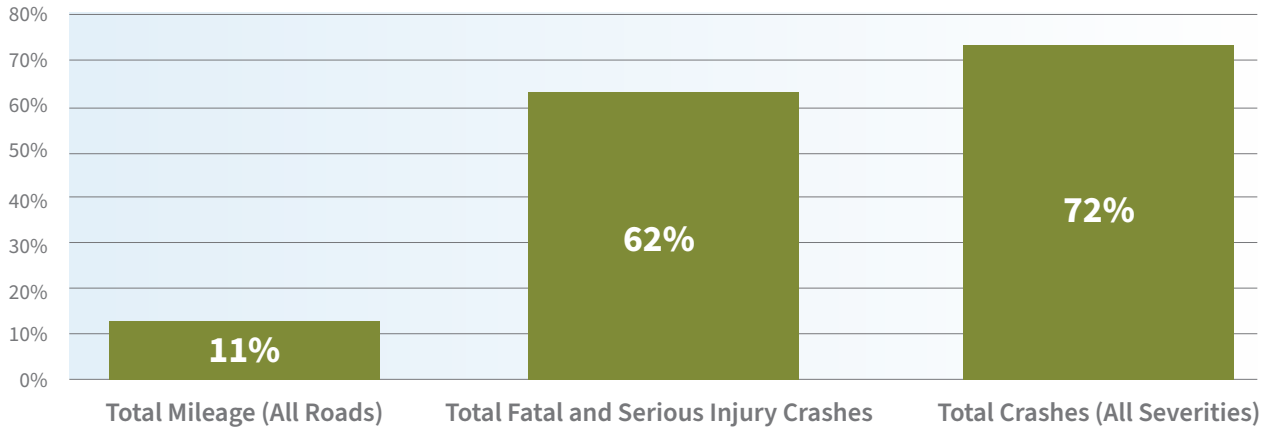
The HIN for the BGMPO region represents 212 miles of roads (11% of total roadway mileage in the region) as shown in **Figure 6.7**. The HIN is spatially concentrated within urban areas and dispersed along NC and secondary routes in rural areas. As shown in **Figure 6.7**, a large proportion (27%) of the high injury network is within the City of Burlington and accounts for 59% of urban HIN roadways in the region. Comparatively, the urban HIN roadways make up 97 miles (51%) of the 191 miles on the HIN, when excluding I-40. Major rural roads on the HIN include NC-49, NC-54, NC-62, NC-87, Greensboro Chapel Hill Road, Mt. Hermon Rock Creek Road, Pleasant Hill Church Road, and Saxapahaw Bethlehem Church Road. The HIN accounts for 72% of all crashes and 62% (302) fatal and serious injury crashes between 2016–2020.

Figure 6.7. High Injury Network – All Modes



Source: NCDOT Traffic Safety Unit

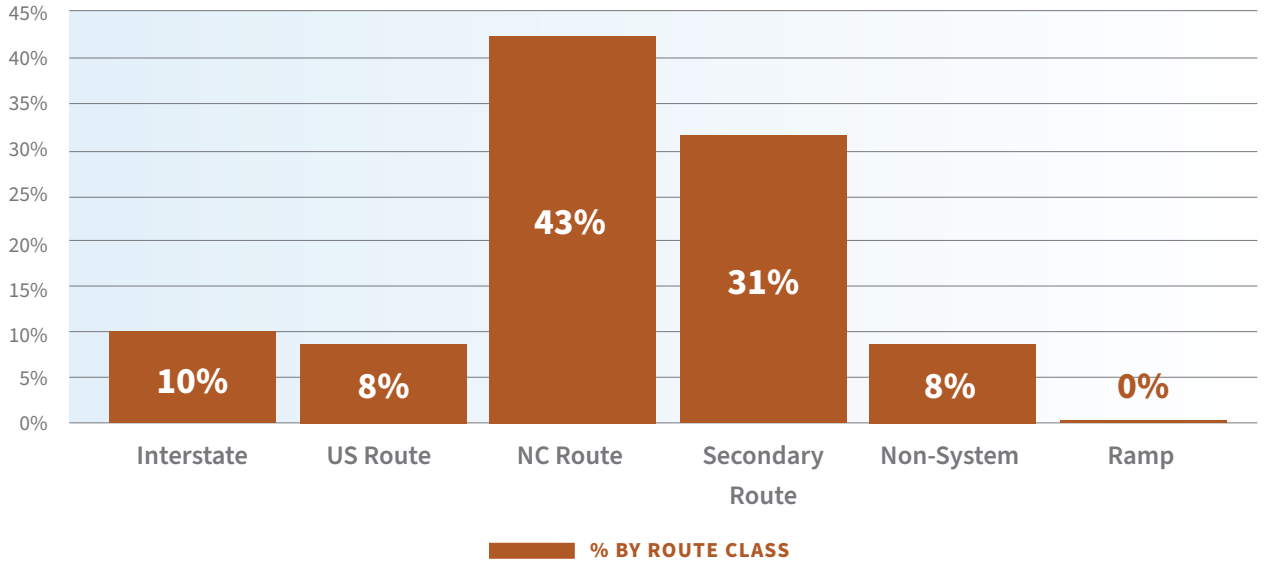
Figure 6.8. Share of Crashes on the High Injury Network – All Modes



Source: NCDOT Traffic Safety Unit

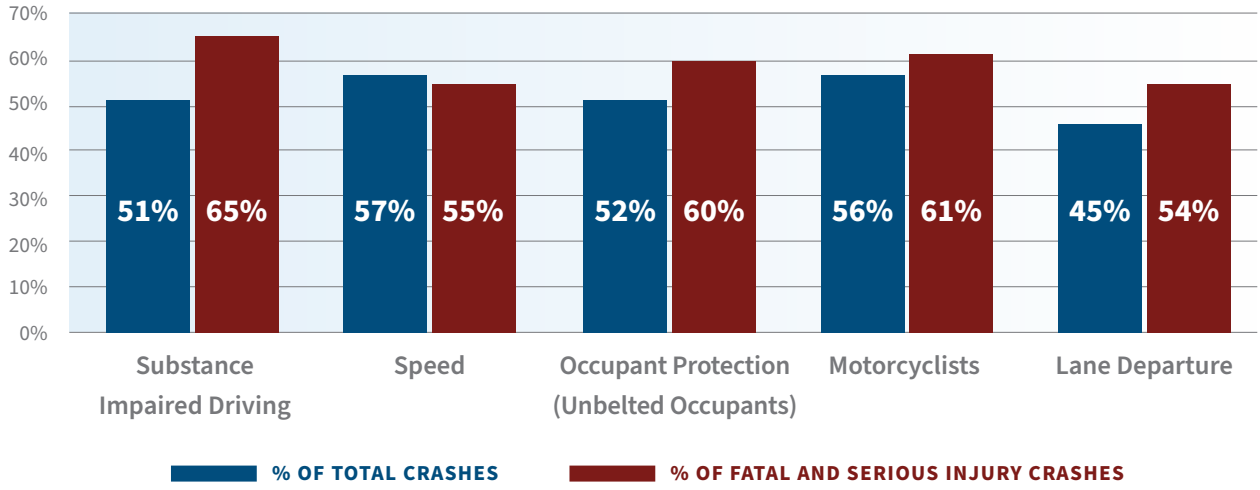
The high injury network for all modes is largely on NC routes (46%) and secondary routes (31%) (**Figure 6.9**), minor arterial roadways (39%), and two-lane roads (74%). Roadways on the HIN are predominately posted at 35MPH (23%) or posted 45MPH or above (44%).

Figure 6.9. Proportion of Route Class on All Mode High Injury Network



Source: NCDOT Traffic Safety Unit

Figure 6.10. Proportion of Route Class on All Mode High Injury Network



Source: NCDOT Traffic Safety Unit

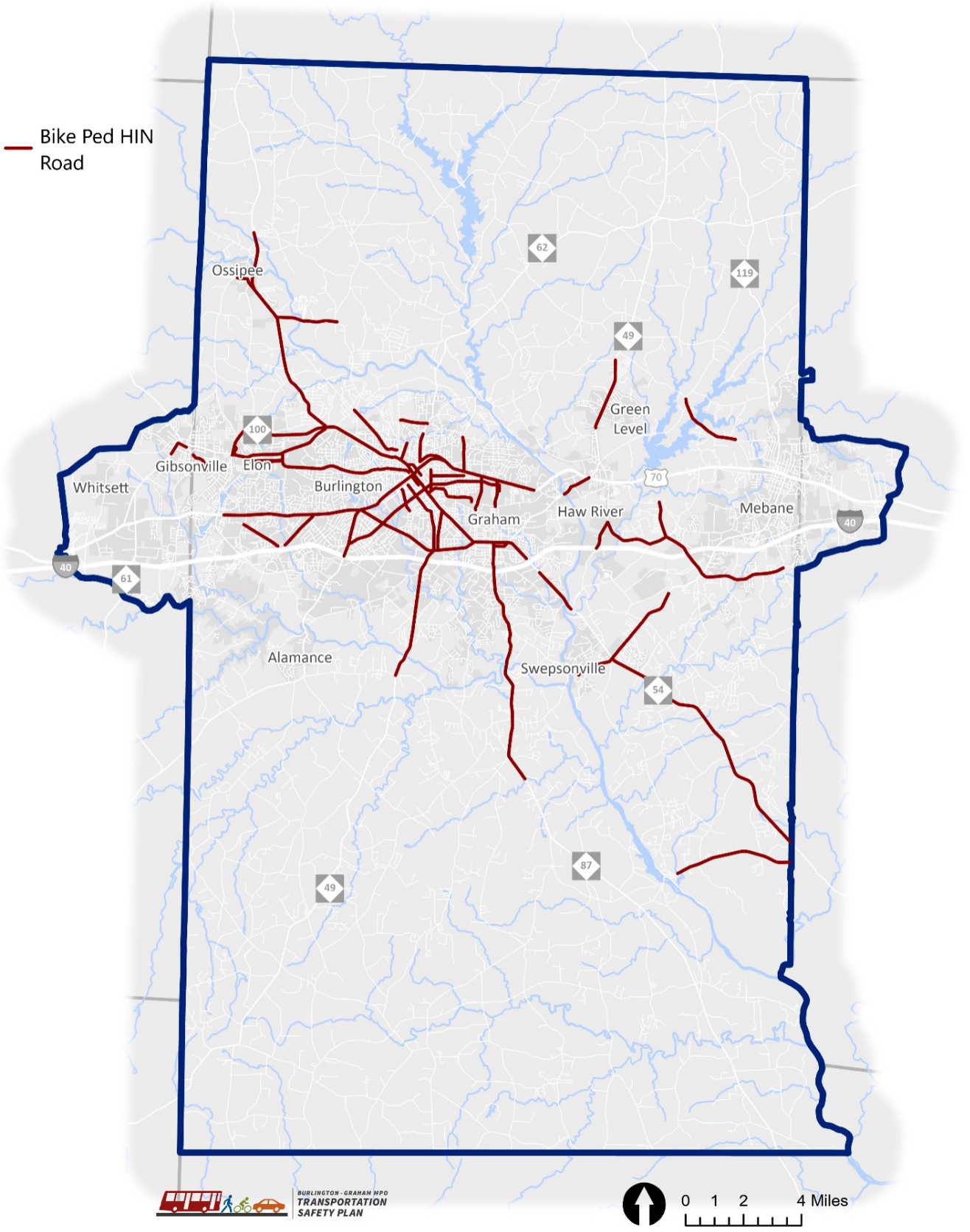
Within the HIN for the BGMPO region, five emphasis areas showed significant overlap with the HIN in regard to disproportion. As seen in **Figure 6.10**, substance impaired driving, occupant protection (unbelted occupants), motorcyclists, and lane departure crashes have a disproportion of fatal and serious injury crashes on the HIN. Speed related crashes are nearly proportional to total crashes and fatal and serious injury crashes along the high injury network.

Bicycle and Pedestrian HIN

The HIN for bicycle, pedestrian, and other nonmotorized transportation accounts for 97.2 miles of roadway in the BGMPO region (**Figure 6.11**). The bicycle and pedestrian HIN accounts for 60% of all bicycle and pedestrian crashes and 61% (54) of all bicycle and pedestrian fatal and serious injury crashes in the region (between 2016–2020), despite only making up 5% of all non-interstate roadway milage (**Figure 6.12**).

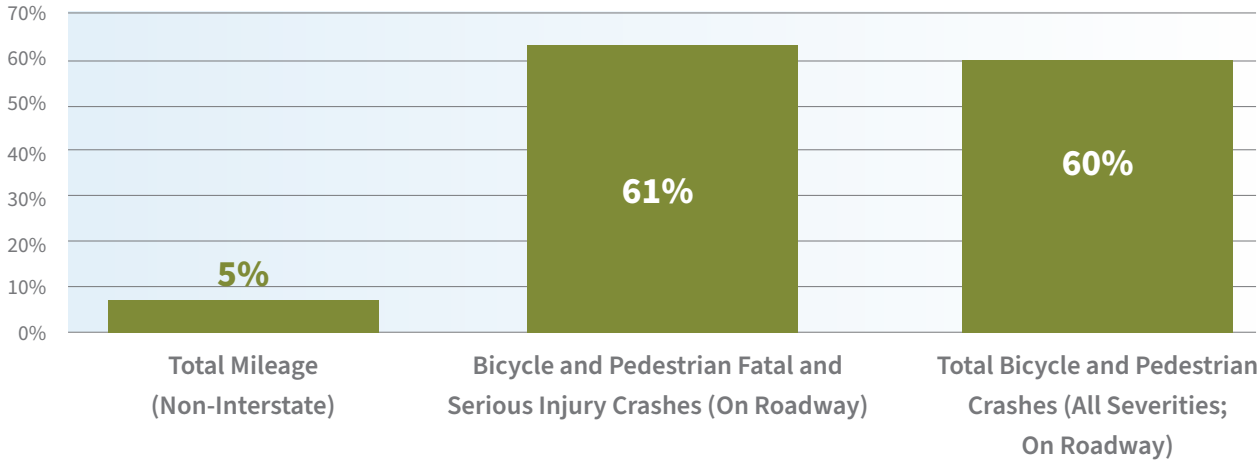
The bicycle and pedestrian HIN is mostly concentrated within urban areas (75%) with 73 miles of HIN roadways inside or along municipal boundaries. As shown in **Figure 6.12**, a large proportion (45%) of the bicycle and pedestrian HIN is located within the City of Burlington. Significant urban roadways that are on the HIN include Mebane Street (Burlington), Front Street (Burlington), US-70 (Burlington), Trollingwood Hawfields Road (Mebane), and Trollingwood Road (Mebane). Rural roadways along the bicycle and pedestrian network of note include NC-49, NC-54, NC-87, and Mebane Rogers Road (Mebane).

Figure 6.11. High Injury Network – Bicycle, Pedestrian, and Other Nonmotorized Transportation



Source: NCDOT Traffic Safety Unit

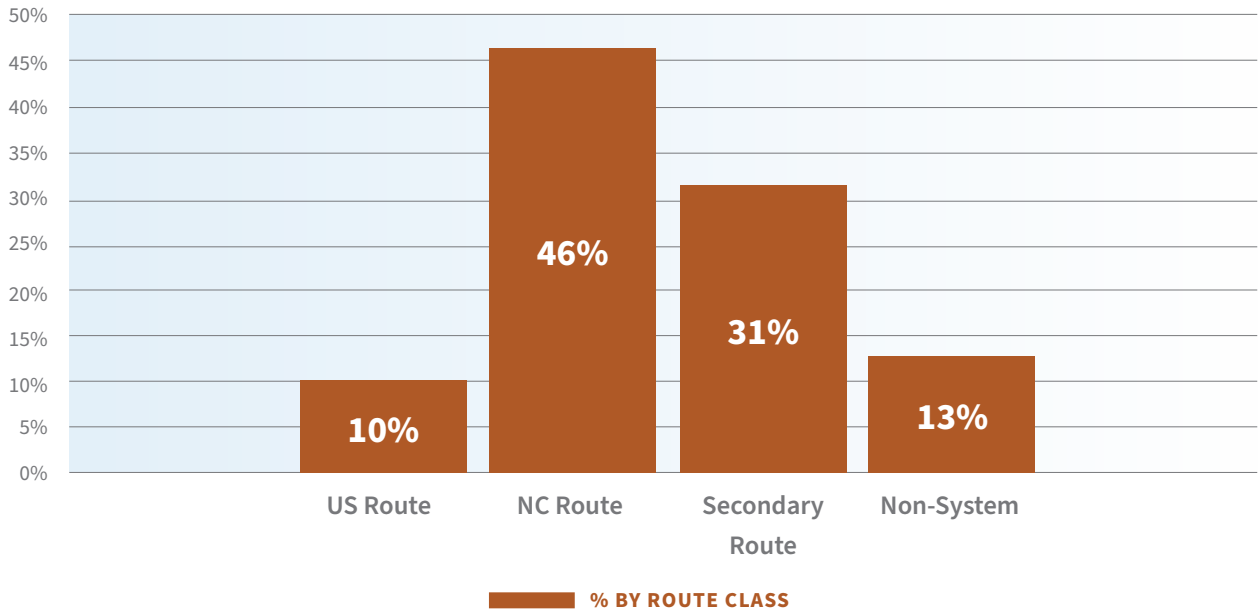
Figure 6.12. Share of Crashes on the Bicycle, Pedestrian, and Other Nonmotorized High Injury Network



Source: NCDOT Traffic Safety Unit

The bicycle and pedestrian HIN is heavily weighted on NC Routes (46%) and secondary routes (31%). The HIN associated with minor arterial (43%) functional classifications, with other principal arterials (22%) and major collectors (18%) also playing a significant factor in bicycle and pedestrian crashes. Similar to the all modes HIN, the bicycle and pedestrian HIN is located along roadways posted predominately 35MPH (39%) or 45MPH and above (44%). The bicycle and pedestrian HIN is largely along two-lane roads (73%) and four-lane roads (19%).

Figure 6.13. Proportion of Route Class on Bicycle, Pedestrian, and Other Nonmotorized HIN



Source: NCDOT Traffic Safety Unit

Equity Analysis

This Transportation Safety Plan uses two metrics for equity. The North Carolina Department of Transportation (NCDOT) Transportation Disadvantaged Index (TDI) utilizes American Community Survey (ACS) data from the 2015–2019 5-year survey at the Census block group level and measures transportation disadvantage population. The second is the United States Department of Transportation (USDOT) Transportation Disadvantaged Census Tracts (TDCT). The USDOT equity analysis utilizes six metrics using data from the CDC Social Vulnerability Index, Census America Community Survey, EPA Smart Location Map, HUD Location Affordability Index, EPA EJ Screen, FEMA Resilience Analysis and Planning Tool, and the FEMA National Risk Index. Both metrics of equity analysis are discussed below.

NCDOT Transportation Disadvantaged Index

The TDI is a metric to identify the propensity of concentrated transportation disadvantaged individuals. The index incorporates ACS block group level population data from the 2015–2019 5-year survey. The TDI is a composite score based on six indicators of potential transportation disadvantage: carless households; individuals with low incomes; mobility-impaired individuals aged 18 years and older (physical, mental, or self-care disability); youth aged 15 and under (non-drivers); seniors; and BIPOC population (Black, Indigenous, and Persons of Color). Each of the indicators is scored based on the relative concentration using the Jenks Natural Breaks method for the entire state of North Carolina. This method creates natural groupings of data values using the Jenks Natural Breaks algorithm, which groups similar values and maximizes differences between classes. This method is used to classify the block group data value for each indicator into one of three groups based on the relative population concentration, where block groups with the lowest concentrations of a given population received a score of 1 and those with the highest concentrations received a score of 3.

To reduce the likelihood of double counting and overlapping indicators, the TDI scores are grouped and reweighted based upon a factor analysis. The factor groups and weights are shown in **Table 6.5**. The scores for the six indicators are then combined for each block group and normalized to a 6 to 18 scale; scores were rounded to the closest integer.

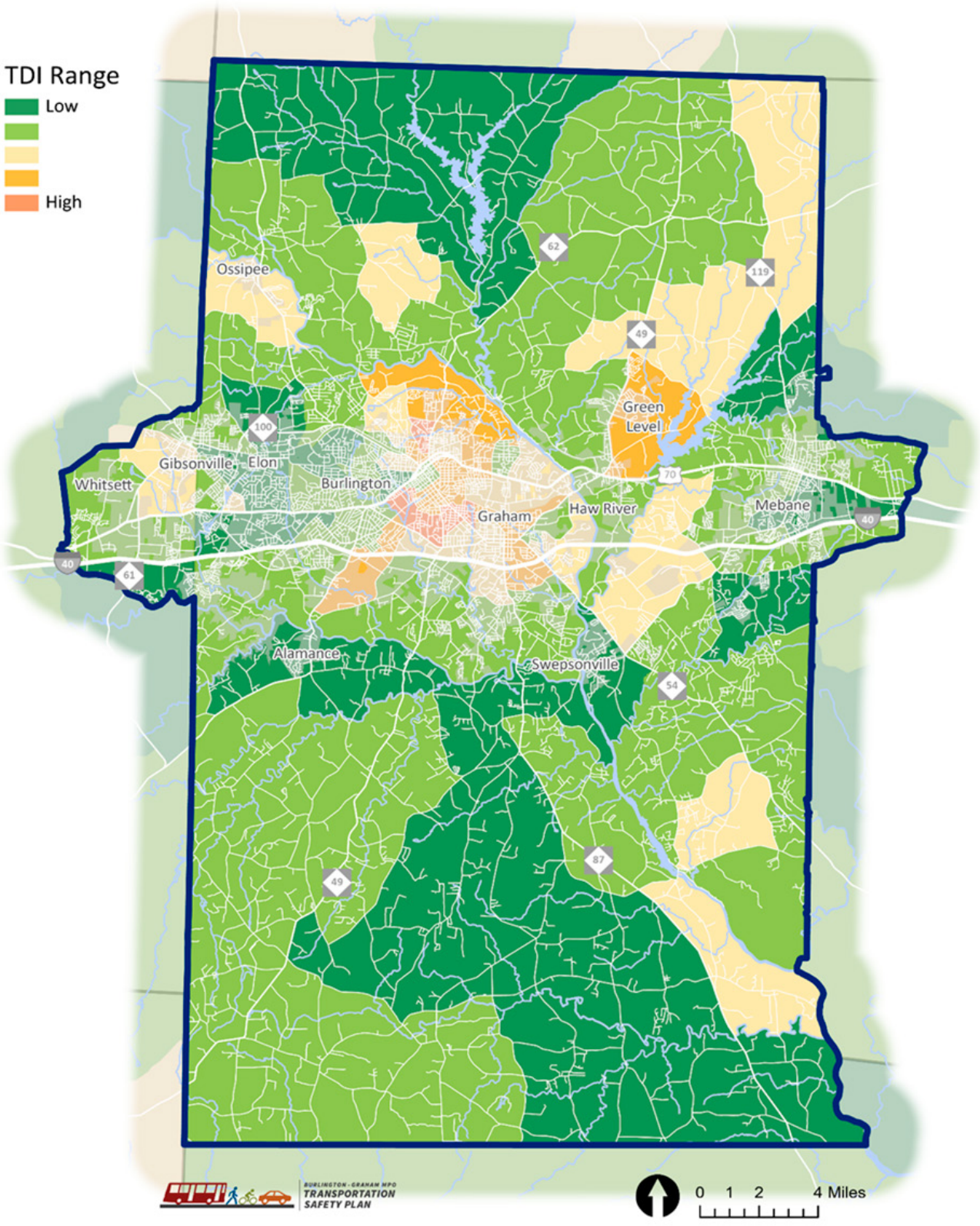
Table 6.5. TDI Factor Analysis Groups and Weights

TDI Component	Factor Group	Adjusted Weight
Poverty Score	1	0.7
Zero Vehicle Household Score	1	0.57
BIPOC Score	1	0.56
Disability Score	2	0.55
Senior Score	2	0.59
Minor Score	3	0.86

Source: NCDOT Traffic Safety Unit

The resulting map from the TDI analysis can be seen in **Figure 6.14**. Areas of low TDI scores, which correlate to a lower propensity for a concentration of transportation disadvantaged populations are shown in green and areas of high TDI score are shown in orange and red. Most BGMPO residents live in communities with a relatively low TDI—approximately 83% of residents live in block groups with low TDI scores. As shown in **Figure 6.14**, there is a concentration of moderate to high TDI scoring block groups in the municipalities of Burlington and Graham with an additional concentration around Green Level. The more rural portions of the BGMPO region tend to have lower TDI scoring block groups, particularly in the southern portion. In the northern rural sections of the BGMPO, more moderate scoring TDI block groups can be found, especially in the northeastern section of the region.

Figure 6.14. Transportation Disadvantaged Index (TDI) Map

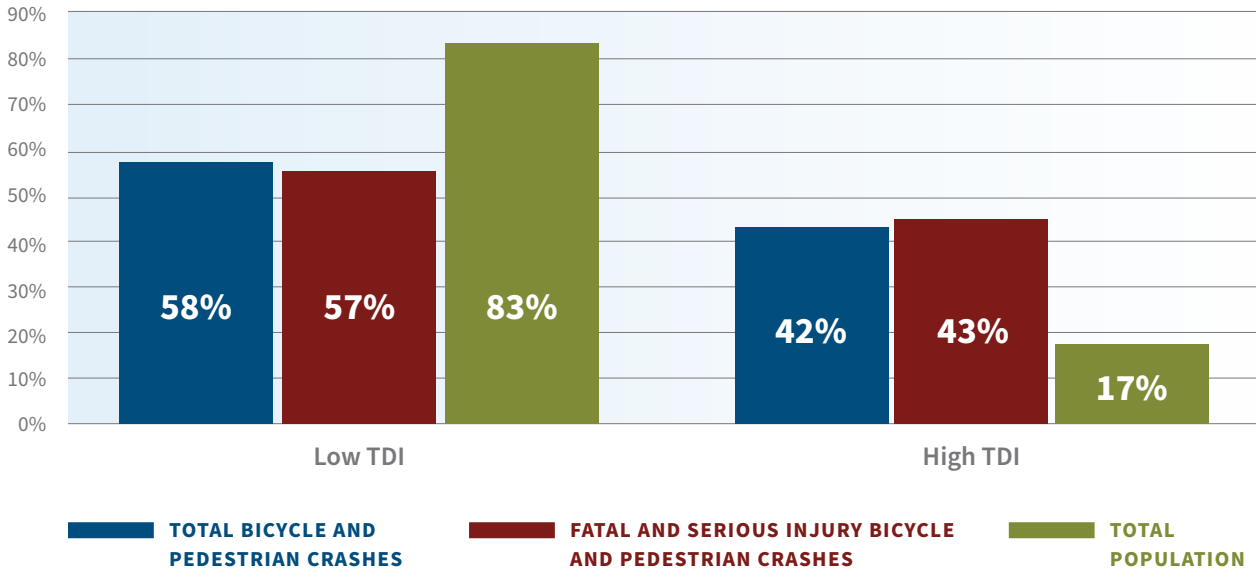


Source: NCDOT Traffic Safety Unit

The TDI serves as a strong indicator of bicycle and pedestrian safety need in the BGMPO region as opposed to total crashes including all modes combined. Bicycle and pedestrian crashes strongly correlate with high TDI communities within the BGMPO region (**Figure 6.15**). 43% of fatal and serious injury bicycle and pedestrian crashes occurred in census block groups with a high TDI score despite only 17% of BGMPO residents living in these areas. Similarly, 31% of all fatal and serious injury crashes in the region occurred in these high TDI communities. Based on the last 5-year crash data, areas of high transportation disadvantage population concentration are disproportionate in fatal and serious injury crashes compared to the rest of the region.

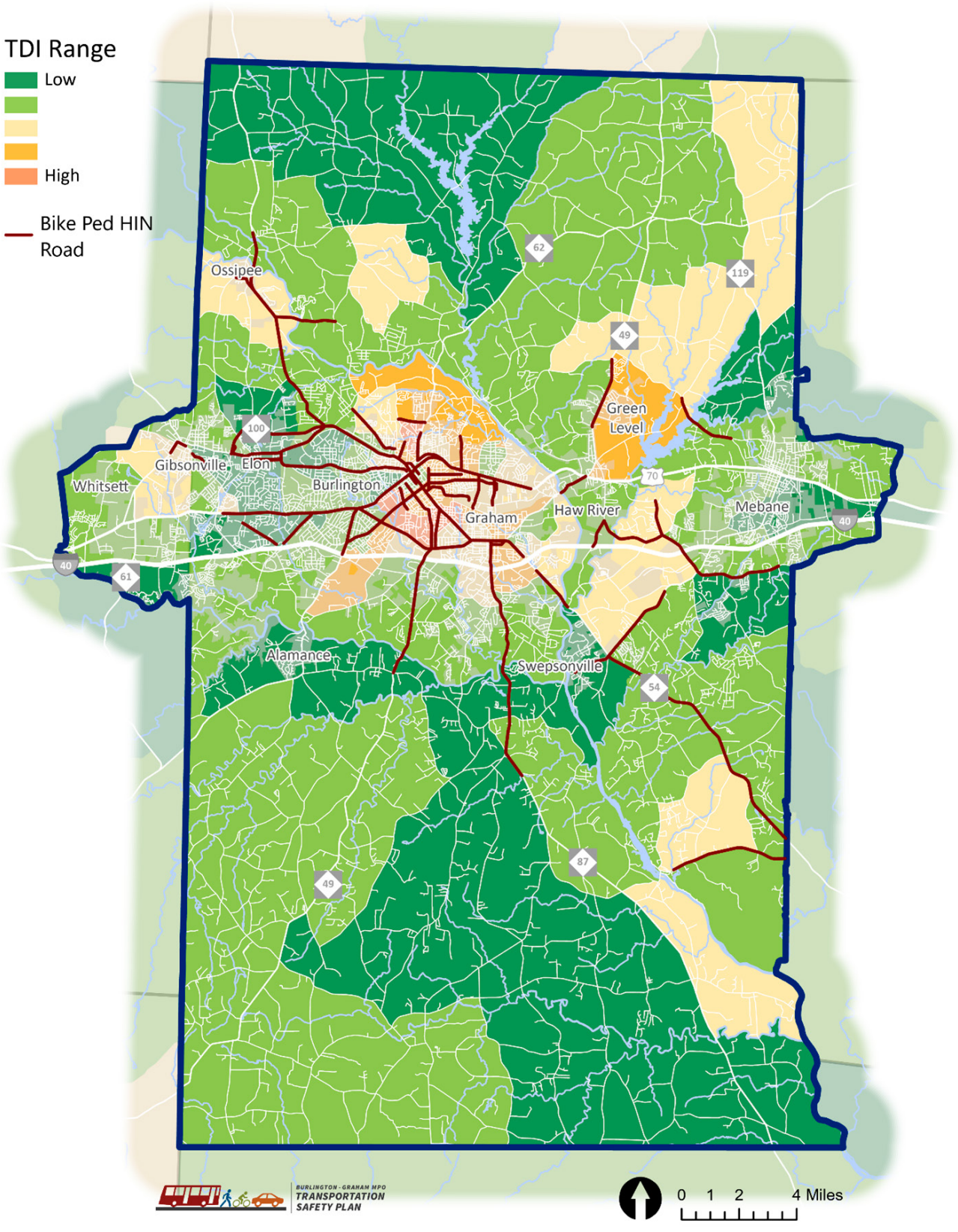
The TDI also serves as a basemap on which additional data can be overlaid on top. This capability is shown with the TDI in relation to the high injury network (HIN) as discussed previously. There is a concentration of HIN roadways that overlap or border Census block groups that are classified as high scoring TDI (**Figure 6.16**). While there are several other HIN roadways throughout the region that do not cross or border a high scoring TDI block group, the spatial clustering of the network in and around those high TDI areas should not be dismissed. When examining the bicycle and pedestrian HIN there is spatial clustering of roadways in both Burlington and Graham in and around those high TDI scoring block groups.

Figure 6.15. Bicycle and Pedestrian Crashes and TDI



Source: NCDOT Traffic Safety Unit

Figure 6.16. TDI and Bicycle, Pedestrian, and Other Nonmotorized Transportation HIN Map



Source: NCDOT Traffic Safety Unit

USDOT Transportation Disadvantaged Census Tracts

The USDOT TDCT is a new equity analysis tool brought forth as part of the Justice40 Initiative. The TDCTs are comprised of 22 indicators collected at the U.S. Census tract level, which were then grouped into six categories of transportation disadvantage. The disadvantaged Census tracts, defined by the USDOT TDCTs tool, exceeded the 50th percentile (75th for resilience) across at least four of the six transportation disadvantaged indicators. Each of the six disadvantage indicators are assembled at the Census tract level using data from the CDC Social Vulnerability Index, Census America Community Survey, EPA Smart Location Map, HUD Location Affordability Index, EPA EJ Screen, FEMA Resilience Analysis and Planning Tool, and FEMA National Risk Index. The six transportation disadvantage indictors include:

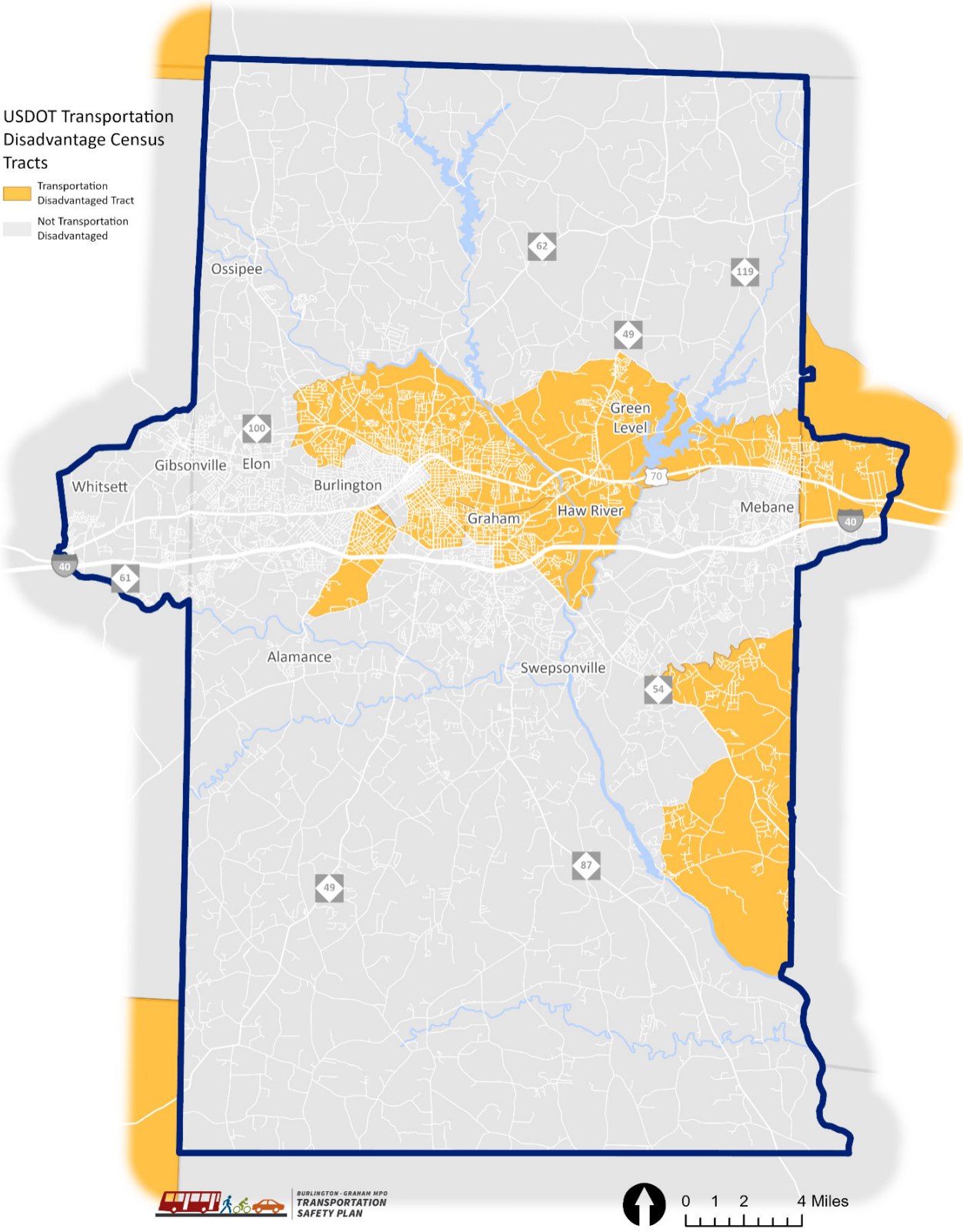
- Transportation Access disadvantage
- Health disadvantage
- Environmental disadvantage
- Economic disadvantage
- Resilience disadvantage
- Equity disadvantage

Unlike the NCDOT TDI, the USDOT TDCT approach utilizes 22 indicators which were then grouped into six overarching indicators. The transportation access disadvantage metric identifies communities and places that spend more, and travel longer, to get where they need to go. Health disadvantage identifies communities based on variables associated with adverse health outcomes, disability, as well as environmental exposures. Environmental disadvantage identifies communities with disproportionate pollution burden and inferior environmental quality. Economic disadvantage identifies areas and populations with high poverty, low wealth, lack of local jobs, low homeownership, low educational attainment, and high inequality.

Resilience disadvantage identifies communities vulnerable to hazards caused by climate change. Equity disadvantage identifies communities with a high percentile of persons (age 5+) who speak English “less than well”.

Within the BGMPO region, 13 Census tracts meet the USDOT TDCT threshold. As shown in **Figure 6.17**, 12 of the 13 Census tracts fall within the urban area of the BGMPO region. The City of Burlington, City of Graham, City of Mebane, Town of Elon, Town of Green Level, and Town of Haw River have portions of their municipality that fall within a TDCT. Unincorporated Alamance County along the NC-54 corridor and unincorporated Orange County east of Mebane are also classified as Disadvantage Communities. Understanding the location of these Census tracts help with prioritizing project types identified in this Transportation Safety Plan for these locations.

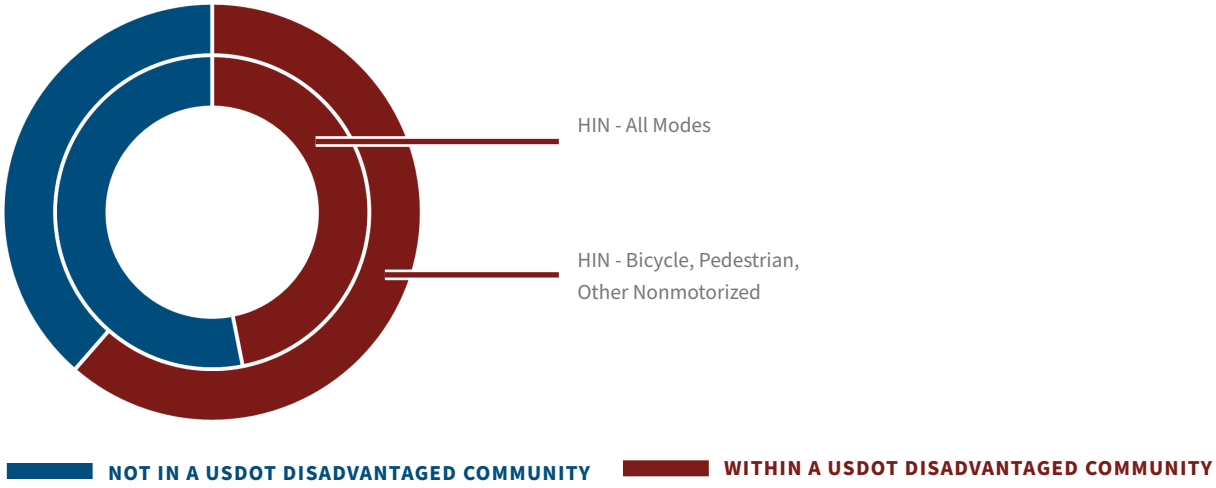
Figure 6.17. USDOT Transportation Disadvantaged Communities Map



Source: NCDOT Traffic Safety Unit and USDOT

The HINs in the Burlington-Graham MPO region show considerable overlap with the USDOT Disadvantage Communities. Of the 212 miles of All Modes HIN, 99.4 miles are within a USDOT Disadvantage Community. The Bicycle, Pedestrian, and Other Nonmotorized Transportation HIN shows an even greater proportion, with 59.7 miles of the 97.2-mile HIN being within a USDOT Disadvantage Community (**Figure 6.18**). A map showing the overlap of the HIN to this equity metric is shown on the following page (**Figure 6.20)**.

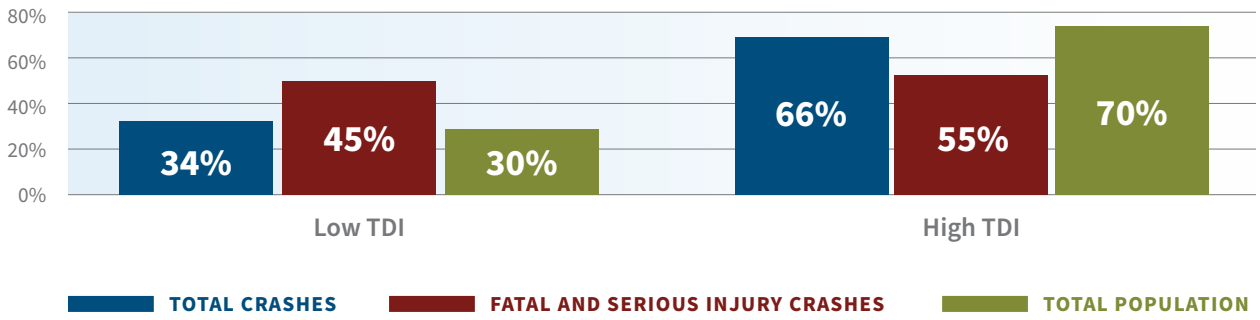
Figure 6.18. Share of High Injury Networks within USDOT Transportation Disadvantaged Census Tracts



Source: NCDOT Traffic Safety Unit and USDOT

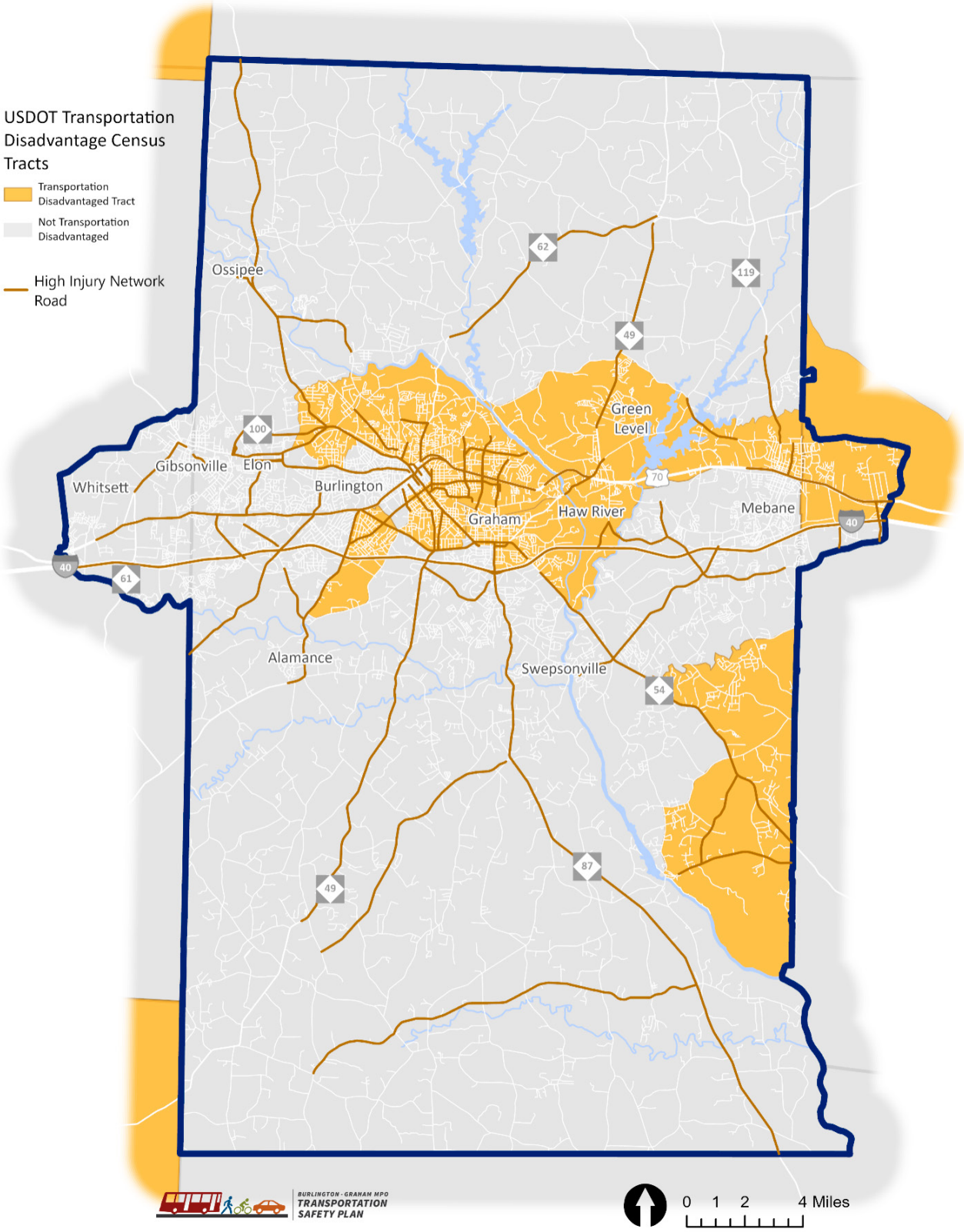
The USDOT DACs shows similarities of higher concentration of crashes and fatal and serious injury crashes in proportion to population to the NCDOT TDI discussed above. Just 30% of the region's population resides in the USDOT DACs, however, 45% of all fatal and serious injury crashes occurred in these designated Census tracts (**Figure 6.19**). While the proportion of all crashes and fatal and serious injury crashes are not as disparate compared to the NCDOT TDI, the high rate of fatal and serious injury crashes in the USDOT DACs is significant.

Figure 6.19. All Crashes and USDOT Transportation Disadvantaged Census Tracts



Source: NCDOT Traffic Safety Unit and USDOT

Figure 6.20. USDOT Transportation Disadvantaged Communities and HIN – All Modes Map



Source: NCDOT Traffic Safety Unit and USDOT

Systemic Safety Analysis

A system-based approach looks beyond crashes at a specific location, evaluates risk across an entire roadway system, and proactively treats locations with identified risk where crashes have not yet occurred. Systemic safety analysis evaluates crash data to identify key combinations of factors that contribute to predominate crash types and guides the selection and systemic implementation of low-cost proven safety countermeasures. This proactive technique complements traditional site-specific analysis and supports the Safe System Approach.

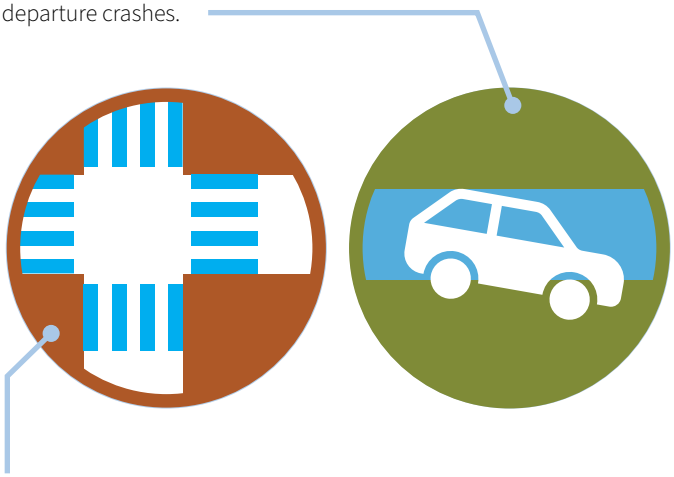
The systemic safety analysis used crash trees that align with the Transportation Safety Plan emphasis areas to evaluate the local roadways within the limits of the Burlington-Graham MPO region.

Older Drivers. Older driver crashes are slightly more prevalent in urban areas (52%) over rural areas (48%). In urban crashes, they are more likely to occur on local streets, at intersections, and likely to happen during the day. In rural areas, crashes are more likely on state secondary routes, not at intersections, and in daylight conditions.

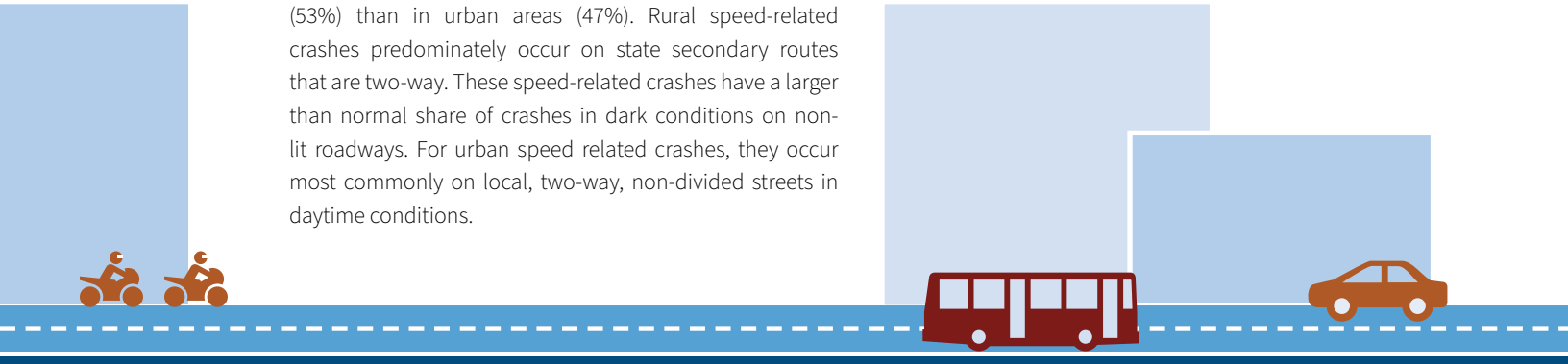
Motorcyclists. Fatal and serious injury crashes for motorcyclists in the region are equally split between urban and rural areas. In urban areas, crashes are less related to lane departure whereas rural crashes are more likely to involve lane departure. These crashes mostly occur in clear weather conditions.

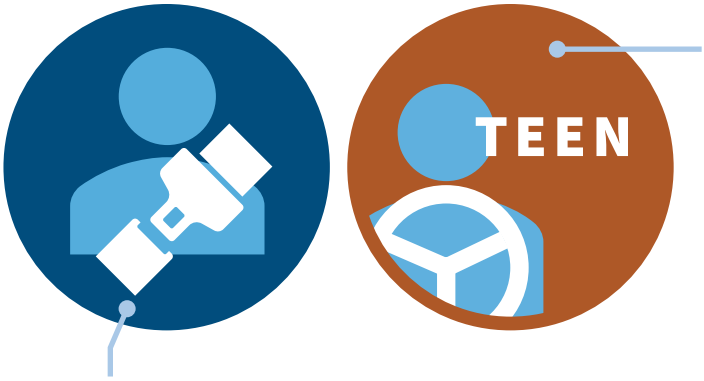
Speed Related. Speed-related fatal and serious injury crashes are slightly more prominent in rural areas (53%) than in urban areas (47%). Rural speed-related crashes predominately occur on state secondary routes that are two-way. These speed-related crashes have a larger than normal share of crashes in dark conditions on non-lit roadways. For urban speed related crashes, they occur most commonly on local, two-way, non-divided streets in daytime conditions.

Lane Departure. Lane departure crashes have a higher share of crashes in rural areas, mostly occurring on State Secondary or NC Route roads. The most prominent road configuration of lane departure crashes is two-way, non-divided roadways. In rural areas, straight-level roads in dark, non-lit conditions are most prominent for lane departure crashes.



Intersections. Intersection related crashes have a higher share of crashes in urban areas, predominately occurring at four-way intersections (55% of urban crashes) followed by T-intersections (26% of urban crashes). With urban four-way intersections, more fatal and serious injury crashes are occurring at signalized crashes whereas T-intersection crashes are more often occurring at non-signalized intersections. At signalized, four-way intersections, angle is the most common crash type mostly occurring in daylight conditions and a typical share of unlit road conditions. Unsignalized urban T-intersection crashes are more likely to be left turn, different roadway crashes occurring in daylight conditions.





Occupant Protection. Unbelted occupant crashes are more common on rural roadways. They are distributed among road classes, but the largest share occurs on state secondary routes followed by NC Routes. On rural state secondary routes, a majority of fatal and serious injury crashes involve lane departure, most of which occur during daylight conditions; however, 42% of those crashes occur on dark, non-lit roadways. For unbelted occupant crashes on NC routes, the majority involve lane departure on dark, non-lit roadways.

Bicyclist Involved. Bicyclist crashes were analyzed for fatal, serious injuries, and obvious injuries due to the limited dataset within the region. Bicyclist-involved crashes were likely to occur in urban areas on local streets at an intersection during daylight conditions. Non-intersection-related bicycle crashes were evenly split between daylight and dark, non-lit roadway conditions.

Pedestrian Involved. Pedestrian crashes that resulted in fatal or serious injury outcomes occurred primarily in urban areas. Pedestrians were more likely to be involved in a crash on local streets at non-intersection locations in dark, lit-roadway conditions. NC Routes accounted for a quarter of fatal and serious injury pedestrian crashes at non-intersection locations in dark, lit-roadway conditions.

Due to the limited nature of fatal and serious injury crashes, obvious injuries were also included in this analysis. When obvious injury crashes were accounted for, local streets in urban areas remained the most common location of pedestrian crashes. They tended to be non-intersection related and occurred in dark, lit-roadway conditions.

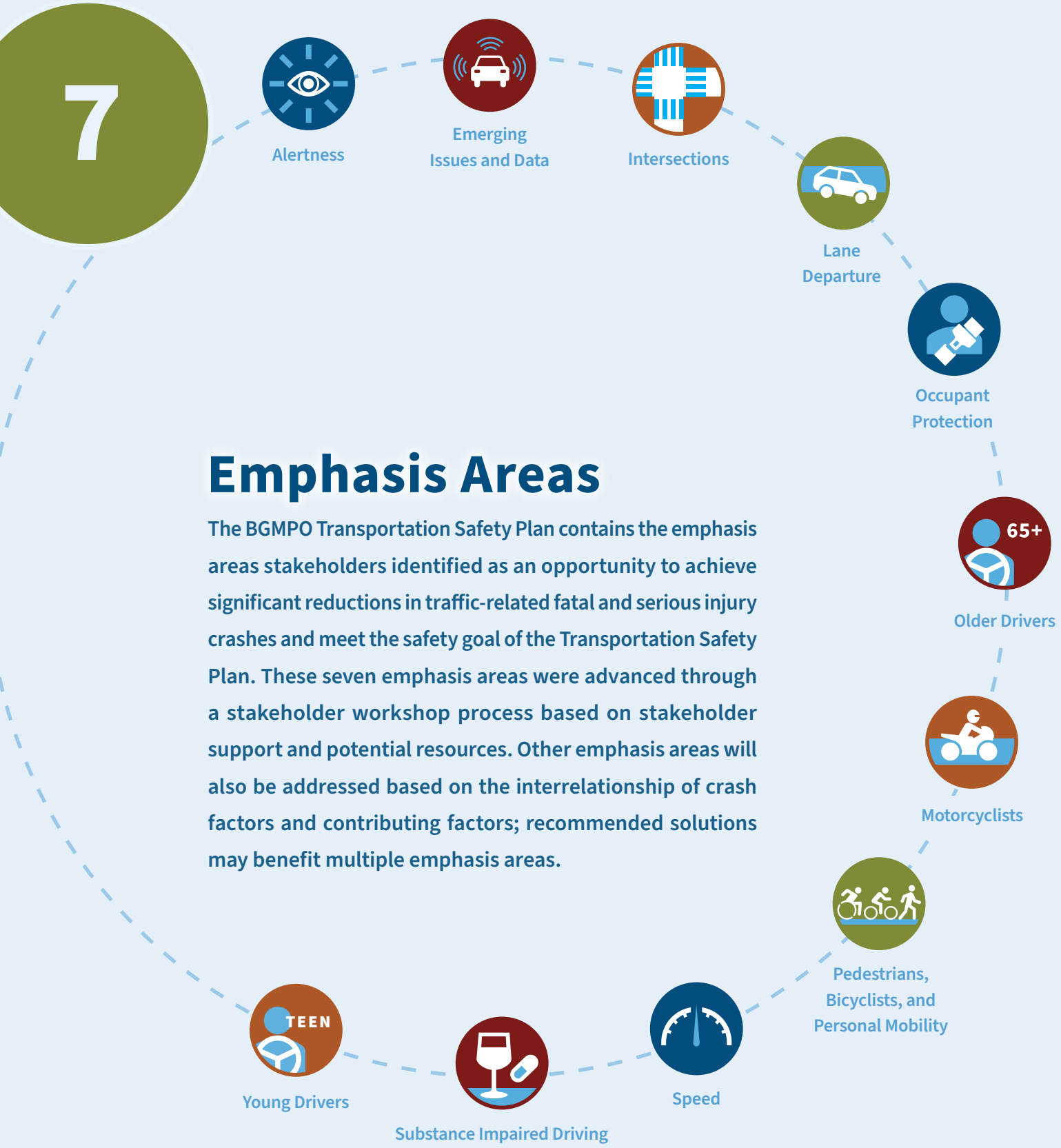
Younger Drivers. Younger driver fatal and serious injury crashes are more likely to occur in rural areas, however, a significant number of crashes occur in urban areas (45%). In rural crashes, most occur on state secondary routes and are not intersection nor speed related but are likely to occur in dark conditions on non-lit roadways. In urban crashes, younger driver crashes are more common on local streets at intersections during daylight conditions.

Impaired Drivers. Fatal and serious injury crashes involving impaired drivers are evenly split between rural and urban areas. In rural impaired driving crashes, lane departure was prominent with occupants not wearing seatbelts accounting for more than half of these crashes. Dark conditions on non-lit roadways are common in these crash types. In the urban context, non-lane departure crashes are more common with occupants wearing their seatbelt, however dark, lit roadways are more pronounced.

Drug Related. Drugged driver crashes occur more often in rural areas with a significant proportion occurring in urban areas. In rural crashes involved a drugged driver, lane departure was a common feature with occupants not wearing a seat belt. These crashes are more likely to occur in dark conditions on non-lit roadways. In urban areas, drugged drivers were more likely to be involved in lane departure crashes, not wearing their seatbelt, and occuring in daylight conditions.

Distracted Driving. Distracted driving crashes are more likely to occur in urban areas, with no lane departure, on straight roadways during the day. In dark conditions, which account for 27% of these crashes, they occur on lighted roadways.

The Emphasis Areas identified through the data analysis and confirmed by the stakeholders included:



Emphasis Areas

The BGMPO Transportation Safety Plan contains the emphasis areas stakeholders identified as an opportunity to achieve significant reductions in traffic-related fatal and serious injury crashes and meet the safety goal of the Transportation Safety Plan. These seven emphasis areas were advanced through a stakeholder workshop process based on stakeholder support and potential resources. Other emphasis areas will also be addressed based on the interrelationship of crash factors and contributing factors; recommended solutions may benefit multiple emphasis areas.

8

Strategy Tables

BGMPO and its stakeholders evaluated the results of the data analysis and the safety concerns and priorities of the region, and using the Safe System Approach as the framework, established the strategies and action items represented in the Transportation Safety Plan. The strategies are organized by each Safe System element.

Each of these elements identifies Transportation Safety Plan emphasis areas, strategies, and action items which when implemented with leadership and partnership support and input will achieve the BGMPO Transportation Safety Plan safety goals. However, in a cost-constrained environment, not all actions are proposed to take place simultaneously.

Safe Speeds

The BGMPO Transportation Safety Plan data analysis and stakeholder input led to including speed as an emphasis area and this aligns with the Safe System element, Safe Speeds. Such crashes include those where the vehicle operator is driving too fast for conditions and/or exceeding the posted speed limit. As speeds increase, the risk of death and serious injury dramatically increase, especially when pedestrians and bicyclists are involved. Higher speeds require longer stopping distances and influence the ability of drivers to control their vehicle, quickly react and avoid a crash.

Safe speeds increase the likelihood of an individual surviving a crash and can be accomplished through the implementation of strategies such as speed management, enforcement, and outreach efforts. Designing roadways with all users in mind and establishing appropriate speed limits help reduce the speed of users. This is further enhanced using proper signing, including radar speed feedback signs. These can be reinforced with enforcement and education campaigns. It is important to ensure the speed limit posted is appropriate for the facility.

Emphasis Areas


Alertness


Motorcyclists


Emerging Issues and Data


Pedestrians, Bicyclists, and Personal Mobility


Intersections


Speed


Lane Departure


Substance Impaired Driving


Occupant Protection

Young Drivers

Older Drivers

1. Safe System Element: Safe Speeds

Table 8.1. Safe System Element: Safe Speeds

Strategy/Action and Source of Strategy	Lead Agency	Partners	Priority Location	Timeline	Crash Modification Factor/Star Rating	Emphasis Area
1. Conduct Speed Management						
1.1 Set speed limits on new roadways based on roadway context and target speed. *Source: NCDOT SHSP*	Multi-Jurisdictional	NCDOT, Local jurisdictions	N/A	Short, Ongoing	N/A	
1.2 Re-evaluate speed limits on existing roadways and implement projects (e.g., gateway treatments, chicanes) to calm traffic. *Source: FHWA PSC*	Multi-Jurisdictional	NCDOT, Local jurisdictions	High Injury Network	Medium	N/A	
1.3 Implement Complete Streets and roadway reconfiguration to provide context-sensitive street design.*Source: FHWA PSC*	Multi-Jurisdictional	NCDOT, Local jurisdictions	High Injury Network; Equity Areas	Medium	0.53-0.81	
1.4 Use radar speed feedback signs to notify drivers they are speeding based on the posted speed limits. *Source: FHWA Speed Management Countermeasures* [8]	County Sheriffs, City Police	NCDOT, Local jurisdictions	High Injury Network	Short-Term	0.95	
1.5 Implement traffic calming measures.[9] *Source: FHWA PSC*	Multi-Jurisdictional	NCDOT, Local jurisdictions	High Injury Network	Short-Term	Varies	
1.6 Improve quality and availability of speed data collection	BGMPO	NCDOT, Local jurisdictions	N/A	Medium	N/A	
2. Conduct Speed Enforcement						
2.1 Conduct high visibility speed enforcement. *Source: NHTSA Countermeasures That Work*	County Sheriffs, City Police	NCDOT, NC DPS	High Injury Network	Short-Term, Ongoing	★★	
3. Conduct Outreach Efforts						
3.1 Conduct educational campaigns in conjunction with enforcement efforts to reinforce safe speeds. *Source: NHTSA Countermeasures That Work*	BGMPO	NCDOT, NC DPS	Regionwide	Short	★★★	
3.2 Coordinate with high schools to deploy national speed awareness education campaigns. *Source: NHTSA Countermeasures That Work*	BGMPO	NCDOT, NC DPS, School Districts	Regionwide	Short	★★★	

8 https://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa16077/fhwasa16077.pdf

9 https://safety.fhwa.dot.gov/ped_bike/univcourse/pdf/swless11.pdf and https://www.ite.org/technical-resources/traffic-calming/traffic-calming-measures/

Safe Roads

The roadway is the platform on which users generally move across the system. The Safe System element, safe roads, consider the interaction of all users and incorporates engineering-related strategies during planning, design, construction, maintenance, and operations of the system to prevent crashes and manage impacts to keep kinetic energy at tolerable levels should a crash occur. The BGMPO region has a limited infrastructure network to accommodate pedestrians and bicyclists.

There is a need for pedestrian and bicycle facilities, improved connectivity of these facilities, and enhanced visibility of the existing traffic control devices and crosswalks at intersections across the network. Implementing strategies associated with these three key findings addresses crashes related to intersections, pedestrians, bicyclists, older drivers, and younger drivers. Enhanced delineation of curves on the road network can reduce roadway departure crashes.

2. Safe System Element: Safe Roads

Table 8.2. Safe System Element: Safe Roads

Strategy/Action and Source of Strategy	Lead Agency	Partners	Priority Location	Timeline	Crash Modification Factor/Star Rating	Emphasis Area
1. Conduct Road Safety Audits						
1.1 Conduct RSA on priority corridors. *Source: FHWA PSC (Road Safety Audits)*	Multi-Jurisdictional	NCDOT	High Injury Network, Equity Areas	Medium	0.40-0.90	
2. Reduce Lane Departure Crashes						
2.1 Install, enhance, or maintain center line and edge line markings on paved roadways. *Source: FHWA PSC (Wider Edge Lines, Enhanced Delineation for Horizontal Curves, Longitudinal Rumble Strips and Stripes)*	Multi-Jurisdictional	NCDOT	High Injury Network	Short	Edge lines: 0.63-0.78	

2. Safe System Element: Safe Roads *Continued...*

Strategy/Action and Source of Strategy	Lead Agency	Partners	Priority Location	Timeline	Crash Modification Factor/Star Rating	Emphasis Area
2. Reduce Lane Departure Crashes *Continued...*						
2.2. Curve delineation using advance curve warning signs, chevrons, reflective strips on signposts, and pavement markings. *Source: FHWA PSC (Enhanced Delineation for Horizontal Curves)*	Multi-Jurisdictional	NCDOT	High Injury Network	Short	0.75-0.85	
2.3. Install SafetyEdge[SM] to gives drivers the opportunity to return to their travel lane while maintaining control of their vehicle. *Source: FHWA PSC (SafetyEdgeSM); First Workshop (SafetyEdgeSM discussion)*	Multi-Jurisdictional	NCDOT	High Injury Network	Short	0.79-0.89	
2.4. Widen shoulders. *Source: FHWA PSC*	Multi-Jurisdictional	NCDOT	High Injury Network	Medium	Varies	
2.5. Install centerline and shoulder rumble strips. *Source: FHWA PSC (Rumble Strips)*	Multi-Jurisdictional	NCDOT	High Injury Network	Short	Centerline: 0.46-0.56 | Shoulder: 0.49-0.87	
2.6. Improve clear zones. *Source: FHWA PSC*	Multi-Jurisdictional	NCDOT	High Injury Network	Medium	0.56-0.78	
2.7. Implement high friction surface treatment. *Source: FHWA PSC (Pavement Friction Management)*	Multi-Jurisdictional	NCDOT	High Injury Network	Medium	0.52	
3. Improve Intersection Safety						
3.1 Systemic application of low-cost countermeasures (signing, delineation, and pavement markings) at stop-controlled intersections. *Source: FHWA PSC (Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections)*	Multi-Jurisdictional	NCDOT, Cities	High Injury Network	Short	0.73-0.95	
3.2 Implement Innovative Intersections (e.g., roundabouts, RCUT, Restricted Crossing U-Turn). *Source: FHWA PSC (Reduce Left-Turn Conflict Intersections, Roundabouts)*	Multi-Jurisdictional	NCDOT, local jurisdictions	Divided Highways (East Stone Drive, West Stone Drive)	Medium	Roundabout: 0.18-0.22 | RCUT: 0.36-0.78	
3.3. Manage Corridor Access. *Source: FHWA PSC (Corridor Access Management)*	Local planners	NCDOT, local jurisdictions	High Injury Network	Medium	0.69-0.75	

Safe Road Users

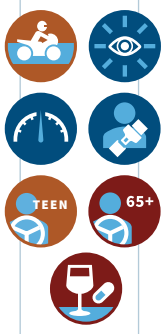
This represents all users of all modes of travel. Their capabilities are influenced by factors such as age, level of impairment, and other behaviors. System owners and other stakeholders can use strategies such as signing, enforcement, and education campaigns to address these limitations and encourage behavior change.

3. Safe System Element: Safe Road Users

Table 8.3. Safe System Element: Safe Road Users

Strategy/Action and Source of Strategy	Lead Agency	Partners	Priority Location	Timeline	Crash Modification Factor/Star Rating	Emphasis Area
1. Coordinate efforts to address impairment, restraint use, distraction, and young drivers						
1.1 Continue the Safety Subcommittee to focus on strategies to improve driving behavior.	BGMPO	NCDOT, County Sheriffs, City Police, Education, Emergency response	Regionwide	Short	N/A	
2. Conduct community outreach to address impairment, restraint use, distraction, and young drivers						
2.1 Host informational meetings and press events and provide editorials to local news to inform the public of the region's safety activities. *Source: NHTSA Countermeasures That Work*	BGMPO	NC HSO	Regionwide	Short	★★★	

3. Safe System Element: Safe Road Users *Continued...*

Strategy/Action and Source of Strategy	Lead Agency	Partners	Priority Location	Timeline	Crash Modification Factor/Star Rating	Emphasis Area
2. Conduct community outreach to address impairment, restraint use, distraction, and young drivers *Continued...*						
2.2 Highlight campaigns on regional, county, city, and other stakeholders' websites. *Source: NHTSA Countermeasures That Work*	BGMPO	NC GHSP	Regionwide	Short	★★★	
2.3 Implement driver education programs to reduce aggressive and risky behavior by drivers. *Source: NHTSA Countermeasures That Work*	NC GHSP	County Health Departments	Regionwide	Short	★	
2.4 Address youth alcohol and drug use and driving and restrict minor access to alcohol. *Source: NHTSA Countermeasures That Work*	NC DHHS	County Health Departments	Regionwide	Short	★★★	
2.5 Implement outreach campaigns that address non-motorized users of the transportation system about their conspicuity. *Source: NHTSA Countermeasures That Work*	NC GHSP		Regionwide	Short	★★★	

3. Safe System Element: Safe Road Users *Continued...*

Strategy/Action and Source of Strategy	Lead Agency	Partners	Priority Location	Timeline	Crash Modification Factor/Star Rating	Emphasis Area
3. Enforce the Rules of the Road						
3.1 Conduct High Visibility saturation patrols for impaired driving. *Source: NHTSA Countermeasures That Work*	County Sheriffs, City Police	NC DPS	High Injury Network	Short	★★★★	
3.2 Perform integrated enforcement of impaired driving, speed, occupant protection, and distracted driving. *Source: NHTSA Countermeasures That Work*	County Sheriffs, City Police	NC DPS	High Injury Network	Short	★★★	
3.3 Engage LEL for training, grant assistance, and coordination of enforcement activities and initiatives.	County Sheriffs, City Police	NC DPS	Regionwide	Short	N/A	

Post-Crash Care

Post-crash care is one of the five Safe System elements and is critical to the survivability of a crash victim. The ability of emergency responders' to quickly locate and respond to a crash and stabilize and transport an individual injured in a crash influences the chances of survivability. The crash location is a major factor related to the response time.

The distance away from the necessary emergency care plays a significant role in whether an injured person survives a crash. For these reasons, accurate and complete data collection and sharing of the data is important to facilitate improved decision-making and investments specific to safety. Communication and collaboration between all stakeholders are necessary to improve post-crash care and reduce the potential of crashes resulting in fatalities and serious injuries.

4. Safe System Element: Post-Crash Care

Table 8.4. Safe System Element: Post-Crash Care

Strategy/Action and Source of Strategy	Lead Agency	Partners	Priority Location	Timeline	Crash Modification Factor/Star Rating	Emphasis Area
1. Coordinate Post Crash Efforts						
1.1 Coordinate with emergency response officials to determine and address roadway issues related to getting crash victims medical care as well as desired training	County EMS Departments	NC DPS	Regionwide	Short	N/A	
1.2. Partner on providing quick clearance of incidents	County Sheriffs, City Police	NC DPS	Regionwide	Short	N/A	
1.3. Reinforce the Move Over Law through outreach campaigns	BGMPO	NC DPS	Regionwide	Short	N/A	

Safe Vehicles

Safe vehicles incorporate new technology and other features to prevent crashes from occurring and, if they do occur, reduce the severity of a crash.

5. Safe System Element: Safe Vehicles

Table 8.5. Safe System Element: Safe Vehicles

Strategy/Action and Source of Strategy	Lead Agency	Partners	Priority Location	Timeline	Crash Modification Factor/Star Rating	Emphasis Area
1. Coordinate efforts to address Safe Vehicles						
1.1 Maintain and increase alternative transportation options in the region, especially in underserved communities. *Source: NHTSA Countermeasures That Work*	BGMPO	NCDOT	Regionwide	Medium	★★★	
1.2. Provide training on the safe operation of county vehicles to county employees.	Counties		Regionwide	Medium	N/A	
1.3. Implement Intelligent Transportation System infrastructure-related technologies to enhance vehicular safety and communication.	NCDOT	BGMPO	Regionwide	Long	N/A	

9

Priority Locations

Identification of Priority Roadways

To identify a priority set of roadways for funding and implementation of programs and improvements, shown in Tables 9.1 and 9.2, a tiered approach was used.

This approach utilized the HIN – All Modes developed as part of this plan (discussed in Section 6) as an initial screening of priority roadways. From the HIN – All Modes selection, a three-tiered approach was implemented to identify the priority corridors. This approach utilizes both the EDPO methodology and the emphasis areas (see Section 6) as the primary data points of analysis.

The **first step** in this approach was to analyze the HIN – All Modes by Route ID. This approach allowed an entire roadway across the BGMPO region to be analyzed as a whole unit. The weighted EPDO crashes along each route were summed to create a proxy metric for the number and severity of crashes along the entire route. Crashes related to each emphasis area were also summed along the route. Routes that were selected to move on to the second phase of priority selection were either in the top 10% of the summed EPDO proxy score or were in the top 10% of any emphasis area.

The **second step** breaks down the routes from their entirety (Route ID) into their street name to refine the routes as they cross into and out of varying jurisdictions. The same selection process was utilized as in step 1, with the exception that streets were selected to move on to the final phase of priority selection if they were either in the top 15% of the summed EPDO proxy score or if they were in the top 15% of any emphasis area.

The **final step** in this multi-tiered approach is breaking down the priority streets into street segments. As some streets within the region can be long and crash frequencies and severity vary over their length, narrowing down to specific segments targets the locations in most need. The final priority roadways were identified as being within the top 15 roadway segments with the highest summed EPDO proxy score or being within the top 5 roadway segments of any emphasis area. This process identified a priority list of 26 roadway segments, as many of the identified segments had significant overlap with other emphasis areas.

To improve the ease of implementation and enhance continuity, some priority roadways were extended to close gaps between priority segments or to better align with municipal boundaries.

For each identified non-local corridor, the number of high crash frequency intersections located with the segment is also listed. The listing shows the number of intersections with 5–9, 10–19, 20–29, 30–39, 40–49, and 50+ crashes as identified by NCDOT between 2017 and 2021. This provides additional context for BGMPO stakeholders to prioritize the identified corridors for future project implementation. In addition, the table also indicates if the corridor is in a particular project design stage and if it was previously identified as a NCDOT Spot Safety location.

Local Priority Roads

Potential treatments are listed for these local priority roads that could help address identified safety concerns at these locations. The local priority road network was identified in a condensed approach of the priority roadway methodology and shown in **Table 9.2**. Roadways identified as local, non-NCDOT system roads were only considered for this second set of priority roadways. Local priority roads were identified due to the large proportion of priority roads under NCDOT jurisdiction and a desire from local municipalities to further engage in the process.

Local roads were analyzed with each other based on the EPDO proxy variable and share of emphasis area crashes. EPDO values assigned to individual crashes were summed along the local roads as a point of comparison to simulate the number of and severity of crashes, akin to the priority roads selection methodology. Emphasis areas of each crash were summed along the local roadways as a point of comparison. Local roadways with the top 10 EPDO proxy scores in the region were selected for priority status due to their frequency and severity of crashes. The top 5 local roads in each emphasis area were also selected for prioritization. Due to the significant overlap between emphasis areas, a total of 20 roadways were selected for prioritization.

To improve the ease of implementation and enhance continuity, some priority local roadways were extended to better align with their termini, significant destinations, or connection to the priority corridor network.

Figure 9.1 *on page 9-7 shows the location of the identified non-local corridors.*

Figure 9.2 *on page 9-12 shows the location of the identified local priority roads.*

Table 9.1. State Priority Routes

LEGEND

Safe Road Users | Safe Vehicles | Safe Speeds | Safe Roads | Post-Crash Care

\# *Location corresponding to Figure 9.1 on page 9-7.*

Table 9.1. State Priority Routes

	Priority Route, Route Class, Primary Agency, Equity, and Planning Stage of Corridor	Emphasis Area	NCDOT Spot Safety Improvement	High Crash Frequency Intersection	Safe System Element
1	**I-40 / I-85** from BGMPO Western Boundary to BGMPO Eastern Boundary *Route Class:* Interstate *Primary Agency:* NCDOT *Equity (USDOT / NCDOT):* Yes/Yes *Planning Stage of Corridor:* In Design	✓ Alcohol Related ✓ Drug Related ✓ Speed Related ✓ Distracted Driver ✓ Drowsy Driver ✓ Intersection ✓ Older Driver ✓ Teen Driver ✓ Unbelted Occupant ✓ Motorcycle ✓ Heavy Truck ✓ Pedestrian ✓ Lane Departure	SS-6207C|07-21-5979|1 Intersection improvement at NC 87 at I-40 Eastbound On-ramp in Graham.	20-29: 1 40-49: 1 50+: 9	
2	**NC 100 (University Dr)** from Manning Ave to Ossipee Rd *Route Class:* NC Route *Primary Agency:* NCDOT *Equity (USDOT / NCDOT):* Yes/No	✓ Pedestrian			
3	**NC 119** from I-40 Interchange to NC 54 *Route Class:* NC Route *Primary Agency:* NCDOT *Equity (USDOT / NCDOT):* No/No	✓ Speed Related		5-9: 1 10-19: 1 20-29: 2 30-39: 1	
4	**NC 49** from NC 62 to Sandy Cross Rd *Route Class:* NC Route *Primary Agency:* NCDOT *Equity (USDOT / NCDOT):* No/No	✓ Drowsy Driver ✓ Heavy Truck ✓ Lane Departure		5-9: 2 10-19: 1 20-29: 1	

	Priority Route, Route Class, Primary Agency, Equity, and Planning Stage of Corridor	Emphasis Area	NCDOT Spot Safety Improvement	High Crash Frequency Intersection	Safe System Element
5	**NC 54** from the Haw River to Orange County Line *Route Class:* NC Route *Primary Agency:* NCDOT *Equity (USDOT / NCDOT):* **Yes**/**No**	✓ Drowsy Driver ✓ Lane Departure		5-9: 2 10-19: 2 30-39: 1	
6	**NC 62 (Rauhut St)** from Sharpe Rd to N Fisher St *Route Class:* NC Route *Primary Agency:* NCDOT *Equity (USDOT / NCDOT):* **Yes**/**Yes** *Planning Stage of Corridor:* Complete	✓ Drowsy Driver ✓ Unbelted Occupant ✓ Pedestrian ✓ Bicycle	SS-6007H|07-19-9135|1 Install pedestrian heads at existing crosswalks at NC 62 (Rauhut Street) at SR 1537 (Sharpe Road).	5-9: 2 10-19: 1 20-29: 3	
7	**NC 87 (W. Webb Ave)** from Ossipee Rd to W. Harden St *Route Class:* NC Route *Primary Agency:* NCDOT *Equity (USDOT / NCDOT):* **Yes**/**Yes** *Planning Stage of Corridor:* Not funded	✓ Drug Related ✓ Speed Related ✓ Distracted Driver ✓ Drowsy Driver ✓ Intersection ✓ Older Driver ✓ Teen Driver ✓ Heavy Truck ✓ Pedestrian ✓ Lane Departure	|07-21-3761|1 Install pedestrian signal and crosswalks at NC 87 (E Webb Ave) at Flanner St in Burlington.	5-9: 14 10-19: 10 20-29: 6 50+: 1	
8	**NC 87** from Mt. Hermon Rock Creek Rd to Chatham County Line *Route Class:* NC Route *Primary Agency:* NCDOT *Equity (USDOT / NCDOT):* **No**/**No** *Planning Stage of Corridor:* Not funded	✓ Alcohol Related ✓ Drug Related ✓ Speed Related ✓ Drowsy Driver ✓ Teen Driver ✓ Unbelted Occupant ✓ Motorcycle ✓ Heavy Truck ✓ Bicycle ✓ Lane Departure			

	Priority Route, Route Class, Primary Agency, Equity, and Planning Stage of Corridor	Emphasis Area	NCDOT Spot Safety Improvement	High Crash Frequency Intersection	Safe System Element
9	**NC 87** from Caswell County Line to the Reedy Fork *Route Class:* NC Route *Primary Agency:* NCDOT *Equity (USDOT / NCDOT):* **No**/**No**	✓ Pedestrian ✓ Lane Departure			
10	**E. Greensboro Chapel Hill Rd (SR 1005)** from Snow Camp Rd to NC 87 *Route Class:* NC Secondary Route *Primary Agency:* NCDOT *Equity (USDOT / NCDOT):* **No**/**No** *Planning Stage of Corridor:* SS-6007AE|07-21-4036|1 is funded - InDesign SS-6007AE|07-21-4036|1 is complete	✓ Speed Related ✓ Bicycle ✓ Lane Departure	SS-6007AE|07-21-4036|1 SR 1005 (E. Convert two-way to all-way stop at Greensboro Chapel Hill Road) at SR 2351 (Bethel South Fork Road) in Snow Camp. SS-6007Y|07-21-3745|1 Convert from two-way to all-way stop with flasher at SR 1005 (Greensboro Chapel Hill Road) at SR 1004 (Snow Camp Road), in Snow Camp.		
11	**Huffman Mill Rd (SR 1158)** from S. Church St to I-40 Interchange *Route Class:* NC Secondary Route *Primary Agency:* NCDOT *Equity (USDOT / NCDOT):* **No**/**No**	✓ Drug Related ✓ Distracted Driver ✓ Intersection ✓ Older Driver ✓ Teen Driver ✓ Unbelted Occupant ✓ Motorcycle			
12	**University Dr (SR 1226)** from Boone Station Dr to Bonnar Bridge Pkwy *Route Class:* NC Secondary Route *Primary Agency:* NCDOT *Equity (USDOT / NCDOT):* **No**/**No**	✓ Heavy Truck			

	Priority Route, Route Class, Primary Agency, Equity, and Planning Stage of Corridor	Emphasis Area	NCDOT Spot Safety Improvement	High Crash Frequency Intersection	Safe System Element
13	**S. Mebane St (SR 1363)** from NC 54 to NC 87 *Route Class:* NC Secondary Route *Primary Agency:* NCDOT *Equity (USDOT / NCDOT):* **Yes**/**Yes**	✓ Alcohol Related ✓ Drug Related ✓ Distracted Driver ✓ Drowsy Driver ✓ Intersection ✓ Older Driver ✓ Unbelted Occupant ✓ Pedestrian ✓ Bicycle			
14	**Trollingwood Hawfields Rd (SR 1981)** from Gregory Poole Ln to NC 119 *Route Class:* NC Secondary Route *Primary Agency:* NCDOT *Equity (USDOT / NCDOT):* **No**/**No**	✓ Drowsy Driver ✓ Heavy Truck ✓ Bicycle		10-19: 1 40-49: 2	
15	**US 70 (Church St)** from Guildford County Line to the Haw River *Route Class:* US Highway *Primary Agency:* NCDOT *Equity (USDOT / NCDOT):* **Yes**/**Yes**	✓ Alcohol Related ✓ Drug Related ✓ Speed Related ✓ Distracted Driver ✓ Drowsy Driver ✓ Intersection ✓ Older Driver ✓ Teen Driver ✓ Unbelted Occupant ✓ Motorcycle ✓ Heavy Truck ✓ Pedestrian ✓ Lane Departure			

Figure 9.1. Location of State Priority Routes

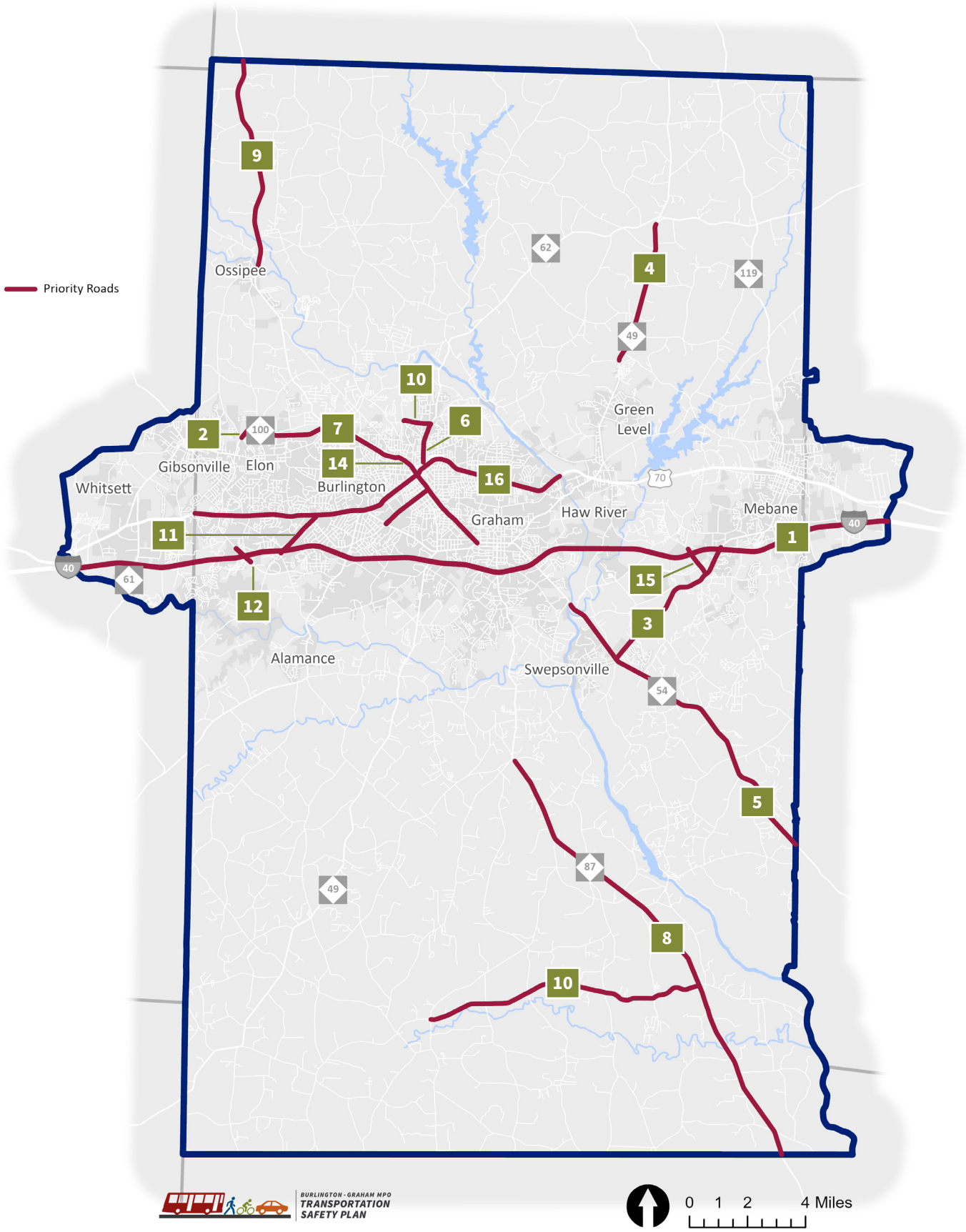


Table 9.2. Local Priority Routes

LEGEND

Safe Road Users | Safe Vehicles | Safe Speeds | Safe Roads | Post-Crash Care

\# *Location corresponding to Figure 9.2 on page 9-12.*

Table 9.2. Local Priority Routes

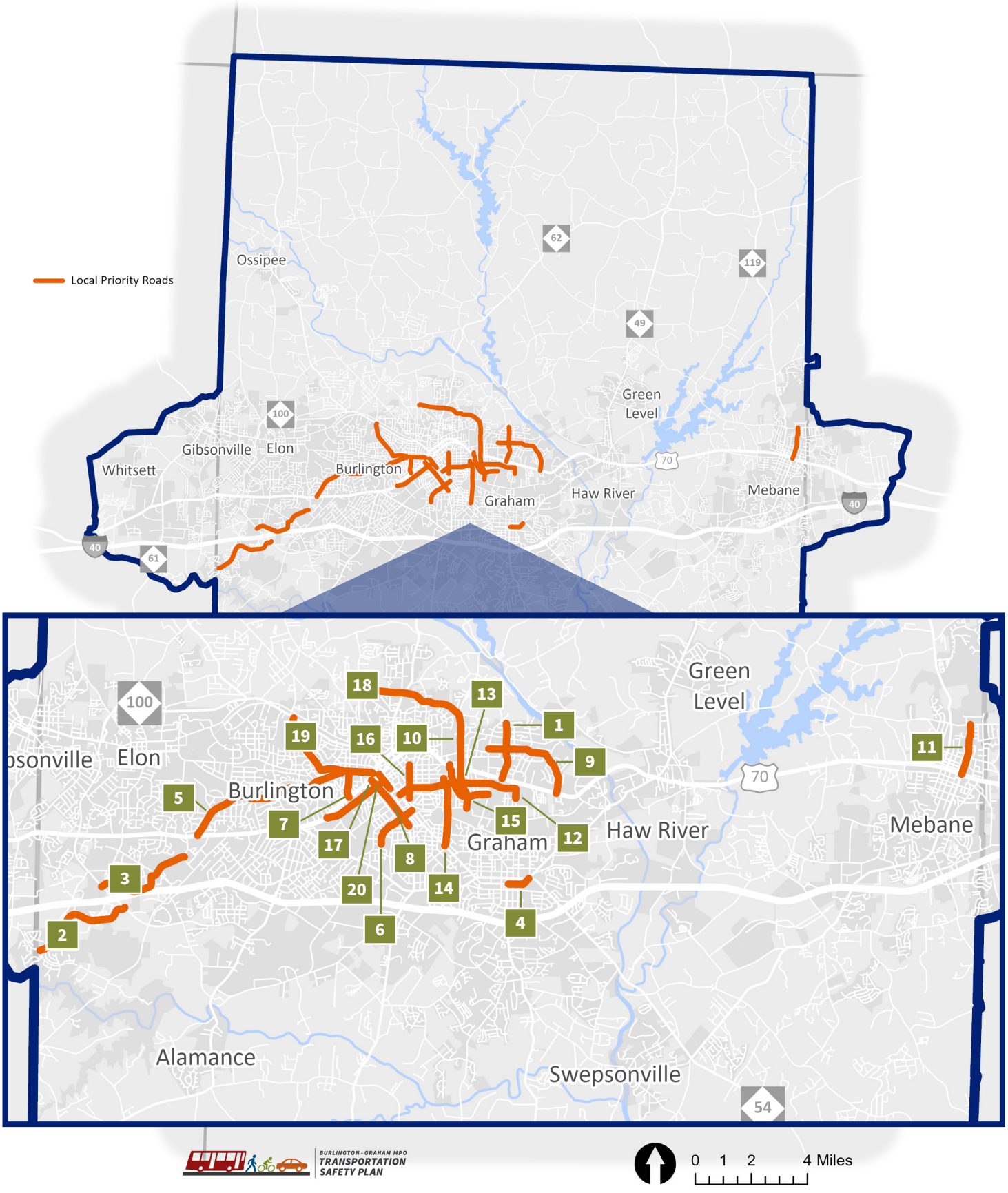
	Priority Route, Route Class, Primary Agency, Equity, and Planning Stage of Corridor	Emphasis Area	Safe System Element
1	**Bland Blvd** from N. Ashland Dr to US 70 *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* Yes/No	✓ Unbelted Occupant **Potential Treatment(s): Seat Belt Use Awareness Outreach**	Safe Road Users
2	**Bonnar Bridge Pkwy** from Loch Ridge Dr to University Dr *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* No/No	✓ Drowsy Driver **Potential Treatment(s): Speed Humps**	Safe Road Users Safe Roads
3	**Boone Station Dr** from University Dr to Forestdale Dr *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* No/No	✓ Drugged Driver ✓ Speed Related ✓ Distracted Driver ✓ Intersection ✓ Older Driver ✓ Teen Driver ✓ Unbelted Occupant ✓ Lane Departure **Potential Treatment(s): Speed Feedback Signs**	Safe Road Users Safe Roads Safe Speeds
4	**E. Elm St** from Court Square to NC 54 *Route Class:* Local Road *Primary Agency:* City of Graham *Equity (USDOT / NCDOT):* Yes/Yes	✓ Speed Related ✓ Heavy Truck **Potential Treatment(s): Speed Feedback Signs**	Safe Road Users Safe Speeds
5	**Edgewood Ave** from US 70 to Central Ave *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* No/No	✓ Alcohol Related ✓ Drug Related ✓ Speed Related ✓ Distracted Driver ✓ Intersection ✓ Older Driver ✓ Teen Driver ✓ Unbelted Occupant ✓ Lane Departure **Potential Treatment(s): Traffic Calming (Speed Humps, Speed Feedback signs, Chicanes**	Safe Road Users Safe Roads Safe Speeds

	Priority Route, Route Class, Primary Agency, Equity, and Planning Stage of Corridor	Emphasis Area	Safe System Element
6	**Everett St** from Rainbow Ave to NC 87 *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* **Yes**/**Yes**	✓ Motorcycle ✓ Pedestrian **Potential Treatment(s): Sidewalks**	
7	**Fountain Pl** from W. Davis St to US 70 *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* **No**/**No**	✓ Unbelted Occupant **Potential Treatment(s): Seat Belt Use Awareness Outreach**	
8	**Maple Ave** from S. Church St to S. Anthony St *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* **Yes**/**Yes**	✓ Alcohol Related ✓ Drug Related ✓ Distracted Driver ✓ Intersection ✓ Older Driver ✓ Teen Driver ✓ Lane Departure **Potential Treatment(s): High Visibility Enforcement**	 
9	**McKinney St** from N. Graham Hopedale Rd to US 70 *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* **Yes**/**Yes**	✓ Alcohol Related ✓ Drug Related ✓ Speed Related ✓ Distracted Driver ✓ Teen Driver ✓ Unbelted Occupant ✓ Lane Departure **Potential Treatment(s): Traffic calming (Speed Humps, Chicanes, Speed Feedback Signs)**	  
10	**N Beaumont Ave** from Pinnix Rd to US 70 *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* **Yes**/**Yes**	✓ Alcohol Related ✓ Drug Related ✓ Speed Related ✓ Distracted Driver ✓ Intersection ✓ Older Driver ✓ Teen Driver ✓ Unbelted Occupant ✓ Pedestrian ✓ Lane Departure **Potential Treatment(s): Traffic Calming and High Visibility Enforcement**	  

	Priority Route, Route Class, Primary Agency, Equity, and Planning Stage of Corridor	Emphasis Area	Safe System Element
11	**N. Fifth St** from E. Stagecoach Rd to US 70 *Route Class:* Local Road *Primary Agency:* City of Mebane *Equity (USDOT / NCDOT):* **Yes/Yes**	✓ Alcohol Related ✓ Drug Related ✓ Speed Related ✓ Distracted Driver ✓ Drowsy Driver ✓ Intersection ✓ Older Driver ✓ Teen Driver ✓ Unbelted Occupant ✓ Heavy Truck ✓ Lane Departure **Potential Treatment(s): Traffic Calming**	
12	**N. Mebane** St from NC 87 to Richards Ave *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* **Yes/Yes**	✓ Alcohol Related ✓ Drug Related ✓ Speed Related ✓ Distracted Driver ✓ Intersection ✓ Older Driver ✓ Teen Driver ✓ Unbelted Occupant ✓ Pedestrian ✓ Lane Departure **Potential Treatment(s): High visibility crosswalks**	
13	**Piedmont Way** from US 70 to S. Graham Hopedale Rd *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* **Yes/Yes**	✓ Alcohol Related ✓ Lane Departure **Potential Treatment(s): Curve Delineation**	
14	**Queen Ann St** from Grace Ave to NC 87 *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* **Yes/Yes**	✓ Bicycle ✓ Lane Departure **Potential Treatment(s): Edge delineation**	
15	**S. Beaumont Ave** from US 70 to Graham St *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* **Yes/Yes**	✓ Alcohol Related ✓ Drug Related ✓ Speed Related ✓ Distracted Driver ✓ Intersection ✓ Older Driver ✓ Teen Driver ✓ Unbelted Occupant ✓ Pedestrian ✓ Lane Departure **Potential Treatment(s): Traffic Calming and High Visibility Enforcement**	

	Priority Route, Route Class, Primary Agency, Equity, and Planning Stage of Corridor	Emphasis Area	Safe System Element
16	**S. Ireland St** from N. Main St to Gilmer St *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* **Yes**/**Yes**	✓ Drowsy Driver ✓ Heavy Truck ✓ Pedestrian **Potential Treatment(s): High Visibility Crosswalks**	
17	**S. Main St** from US 70 to E. Front St *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* **No**/**Yes**	✓ Unbelted Occupant ✓ Heavy Truck **Potential Treatment(s): Seat Belt Use Awareness Outreach**	
18	**Sharpe Rd** from Lakeside Ave to Pinnix Rd *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* **Yes**/**Yes**	✓ Speed Related ✓ Lane Departure **Potential Treatment(s): Speed Feedback Signs, Transverse Rumble Strips**	 
19	**W. Davis St** from NC 87 to S. Fisher St *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* **Yes**/**No**	✓ Drowsy Driver ✓ Older Driver ✓ Unbelted Occupant ✓ Heavy Truck **Potential Treatment(s): Improved Lighting**	
20	**W. Front St** from S. Church St to S. Lexington Ave *Route Class:* Local Road *Primary Agency:* City of Burlington *Equity (USDOT / NCDOT):* **No**/**No**	✓ Drugged Driver ✓ Distracted Driver ✓ Intersection ✓ Older Driver ✓ Heavy Truck ✓ Pedestrian **Potential Treatment(s): High Visibility Crosswalks**	 

Figure 9.2. Location of Local Priority Routes



10

Implementation and Evaluation

For a Safe System to be fostered and for fatalities and serious injuries from crashes to reduce, the Transportation Safety Plan must move beyond being merely a document.

Implementation of the strategies identified within the plan must take place to achieve safety goals. With the multiple stakeholders and partner localities within the BGMPO, it is easier to maintain accountability and work together towards shared goals. **No one town must act alone; all in the region must work together.** To continue to keep the Transportation Safety Plan relevant and addressing newest safety concerns in the region, the plan should be updated to the update of the MTP. Evaluation using a data-driven approach will allow monitoring of the effects of transportation safety policies and guide future changes within the plan.

For implementation, of the strategies in the Transportation Safety Plan, there are multiple sources of funding available.

Federal Funding

Federally funded through the Federal Highway Administration (FHWA), the Highway Safety Improvement Program (HSIP) has limited funding available for safety improvements made on highways. The National Highway Traffic Safety Administration (NHTSA) has multiple grants in different categories awarded to states to implement behavioral safety projects. These topics include many of the focus areas in the Transportation Safety Plan, such as occupant protection, impaired driving, distracted driving, non-motorist, and motorcyclist safety grants.

The Safe Streets and Roads for All (SS4A) is a discretionary program that will provide $5-6 billion in grants over the next five-year funding to support regional, local, and Tribal programs in preventing roadway deaths and serious injuries.

State Funding

Aside from administering the federal HSIP funds, NCDOT and its divisions also administer a variety of rural, operating, capital, urban, and InterCity grants. Many of these funding sources may be matched in some percent by the local government they are servicing.

This Transportation Safety Plan outlines a variety of strategies and actions; it will be difficult for BGMPO and its stakeholders to pursue every single one. Therefore, it is important for BGMPO and stakeholders to consider the priority of the strategies and to consider disparate impacts, project costs, implementation schedules, funding, etc. in prioritizing project sites. This prioritization also helps to inform project selection for the BGMPO Metropolitan Transportation Plan (MTP) and Transportation Improvement Program (TIP). It is important to prioritize projects to help meet the annual target safety setting goals set by BGMPO; staying on track with safety goals and to continue following Federal and State guidance helps to strengthen BGMPO's applications for potential funding.

Coordination

The Transportation Safety Plan should be updated on the same five-year-update-cycle required for the Strategic Highway Safety Plan. This would give enough time for data collection to view changes in safety trends prompted by the Transportation Safety Plan, while still being a short enough time frame that the document is being frequently improved upon.

The plan should also be updated in advance of the MTP Update, allowing the two plans' updates to be staggered.

BGMPO created a safety subcommittee to guide the formulation of the Transportation Safety Plan, ensuring that the goals set were appropriate and could be balanced with future development.

The committee included 21 members from agencies involved in transportation safety. The multidisciplinary group included diverse representatives, from NCDOT's Safety Unit to insurance agencies to healthcare, as well as from the public.

The committee also includes representatives from municipalities within BGMPO's jurisdiction. Burlington, Graham, and Mebane, as well as Orange, Alamance, and Guilford Counties, were included. The subcommittee met five times throughout the project to review the Transportation Safety Plan process, approach, and the development of the plan. The committee should continue to convene periodically to support the plan and ensure that the Transportation Safety Plan remains actionable and relevant.

The TAC and the TCC will also be involved in implementation and support. These internal committees are made up of members from within the BGMPO area and can help to further advise and support action items from the Transportation Safety Plan. During the plan's development, they met five times to review various deliverables and milestones. Each group was composed of voting members with a stake in the Transportation Safety Plan. The membership of the TAC elected officials from member jurisdictions, NCDOT Board of Transportation, NCDOT Division 7, and the FHWA. The TCC brought in representatives from the jurisdictions and from involved transit agencies. The TCC consisted of key staff from member municipalities and counties, NCDOT, and FHWA.

Appendix A

Memorandum

This memo describes a process for Burlington-Graham Metropolitan Planning Organization (BGMPO) area public transit agencies to prioritize bus stops for safety improvement and a listing of countermeasures to address identified issues. A pilot intersection is chosen to show how countermeasure implementation can help to address identified access and safety concerns. Cost information on these countermeasures can be found in the North Carolina Department of Transportation (NCDOT) reference **Cost of Independent Bicycle and Pedestrian Facilities in North Carolina**.[11]

Selection Criteria

These are the types of considerations for prioritizing bus stop locations for safety improvements. There are five criteria that can be used to prioritize bus stops: location on the BGMPO Transportation Safety Plan (TSP) bicycle and pedestrian High Injury Network (HIN), history of pedestrian crashes, crashes involving key emphasis areas, location in a transportation disadvantaged area, and bus stop ridership.

High Injury Network

The BGMPO Transportation Safety Plan (TSP) identified two HINs: one for all modes and one for bicycle, pedestrian, and other non-motorized users. A HIN is a subgroup of the region's roadways where a significant proportion of fatal and serious injury crashes occur. These HINs were developed using an Equivalent Property

11 https://connect.ncdot.gov/projects/BikePed/Documents/Bicycle%20and%20Pedestrian%20Facility%20Cost%20Tool%20-%20Report.pdf

Damage Only (EPDO) methodology, which identifies high crash frequency locations with an emphasis on more severe crashes by adding additional weight to fatal and severe injury crashes based on crash costs. The BGMPO TSP used NCDOT 2019 crash costs to develop the HINs. The bicycle, pedestrian, and other non-motorized users HIN accounts for 97.2 miles of roadway, and is the location of 60 percent of bicycle, 61 percent of pedestrian, and 61 percent of all fatal bicycle and pedestrian crashes in the region.

Bus stops along the bicycle, pedestrian, and other non-motorized users HIN may be at a higher risk for a pedestrian crash compared to those that are not on the HIN. Those stops that are on this HIN or immediately adjacent to the HIN roadway should be considered for priority implementation of pedestrian safety countermeasures.

Crash History

Between 2016–2020, there were 163 pedestrian-involved crashes in the BGMPO region, of which 52 involved a fatal or serious injury. Along the bus routes in the region, 70 pedestrian crashes occurred within 200 feet of a bus route, of which 23 were of a fatal or serious injury severity.

Bus stop prioritization should focus on bus stops where a pedestrian crash has occurred within 200 feet of a stop, regardless of crash severity. Based on the crash data between 2016–2020, bus stops on or near intersections should be prioritized as they have the highest crash rate of all emphasis areas discussed in the BGMPO TSP.

Emphasis Areas

Using the data from the BGMPO TSP, crashes related to the emphasis areas studied should be considered when prioritizing bus stop locations. Of the identified 15 emphasis areas, nine overlapped pedestrian crashes that occurred within 200 feet of a bus stop. Crashes that occurred near bus stops involved intersection related crashes (22), alcohol related crashes (8), drug related crashes (6), distracted drivers (6), older drivers (3), teen drivers (2), and one instance of speed related and lane departure crashes. The prioritization of bus stops should be focused on those near intersections and where behavior issues are a concern.

Equity

The BGMPO TSP used two equity metrics: the USDOT TDCTs and the NCDOT Transportation Disadvantage Index. Within the BGMPO region, there are 96 bus stops along LINK, PART, and Orange County Public Transit routes that fall within a USDOT TDCT and 84 within a high NCDOT Transportation Disadvantage Index block group.

Bus stops within a USDOT TDCT or high NCDOT Transportation Disadvantage Index Block Group should be prioritized for safety countermeasure implementation. Prioritizing stops based off these equity measures will align with the TSP and equity goals for federal and state funding grants.

Ridership

Bus stops should additionally be prioritized by their ridership levels. Higher boardings and alightings at a bus stop has a higher propensity of a pedestrian crash occurring due to the pedestrian activity generated there. The ridership prioritization selection criterion should be the least weighted and should serve as a prioritization guide from the four previous criteria.

Priority Locations

The process for identifying priority locations is taken from the five selection criteria discussed above. For this process, bus stops within either USDOT TDCTs or high scoring NCDOT Transportation Disadvantage Index block groups were first identified. Then, bus stops were sub-selected from the initial list if they were on a Bicycle, Pedestrian, and Other Non-Motorized User High Injury Network roadway. In the final step, bus stops were selected as a priority location if they had a pedestrian crash within 200 feet of any severity. This resulted in eight bus stops for priority implementation of safety countermeasures. The additional criteria of crash emphasis area and ridership are to be used as guides when selecting appropriate safety countermeasures and prioritization within the priority list.

Priority Bus Stop Locations

Stop ID	Stop Name	HIN[1]	Crash History[2]	Emphasis Areas	Equity[3]	Ridership[4]
107	W. Webb Ave @ Lakeview Ave (IB)	Yes	1 Serious Injury	Alcohol	USDOT	20
126	Sharpe Rd @ Morgantown Rd (OB)	Yes	1 Fatal and 1 Serious Injury	Alcohol, Drug, Speed, Intersection, Teen	USDOT / NCDOT	20
128	Rauhut St @ Sharpe Family Dollar (OB)	Yes	1 Fatal and 1 Serious Injury	Alcohol, Drug, Speed, Intersection, Teen	USDOT / NCDOT	0
138	N. Mebane St @ Walmart (OB)	Yes	1 Property Damage Only	None	USDOT / NCDOT	556
157	N. Mebane St @ S. Beaumont Ave (OB)	Yes	1 Minor Injury	Intersection	USDOT	21
188	N. Mebane St @ Walmart (IB)	Yes	1 Property Damage Only	None	USDOT / NCDOT	385
206	E. Webb Ave @ Gilmer St (IB)	Yes	2 Moderate Injury	Intersection	USDOT / NCDOT	112
385	Durham @ James Dr (IB)	Yes	1 Minor Injury	None	USDOT	20

1 HIN defined as the Bicycle, Pedestrian, and Other Non-Motorized High Injury Network (2016-2020)
2 Crash history from the 5-year 2016–2020 period
3 Equity is regarding USDOT TDCT and NDOT Transportation Disadvantaged Index – High Scoring Block Groups
4 Transit stop ridership based on July 2022 reported ridership

Table A.1. Priority Bus Stop Locations

Selected Pilot Bus Stop Location

The pilot bus stop location is W. Webb Avenue at Lakeview Avenue (Stop IDs 107/118) and is chosen to reflect the variety of potential safety improvements for implementation at this location and can also inform improvements at other bus stops in the region. **Figures A.1** and **A.2** show the location of the bus stop.

Description of Bus Stop

The bus stop of W. Webb Ave at Lakeview Ave is located northwest of downtown Burlington along the LINK Green line. The stop is located along a three-lane principal arterial roadway with a center turn lane posted at 35mph. In 2020, there were 10,500 annual average daily trips along the road. The stop is within walking distance of a shopping plaza, fast food restaurant, gas station convenience store, and a drug store; however, no pedestrian facilities or formal crossing opportunities are present. For the month of July 2022, there were 20 monthly boarding and alightings.

The bus stop signs are posted on a utility pole (outbound) and speed limit sign (inbound) on the north leg of the intersection with Lakeview Avenue. The stop lacks pedestrian facilities such as sidewalks, crosswalks, curb ramps, ADA warning buffers, and the roadway does not have a paved shoulder, leading to bus riders waiting on a grass shoulder. There is a single overhead light at the intersection of W. Webb Avenue and Lakeview Avenue.

This stop met several of the priority criteria described above and shown in **Figure A.3**. The roadway is part of the bicycle, pedestrian, and other non-motorized HIN based on crash data from 2016–2020. There was one pedestrian crash in 2017 that occurred within 200 feet of the bus stop that resulted in a serious injury and involved alcohol. The bus stop is located at an intersection and has a history of alcohol related pedestrian crashes, two emphasis areas that were identified in the prioritization criteria. The bus stop is also located within a USDOT TDCT however it is not located within a high NCDOT Transportation Disadvantage Index block group.

Identified Issues

The bus stop at W. Webb Ave at Lakeview Ave has several concerns related to pedestrians and bus riders. The lack of sidewalks, formal pedestrian crossings, adequate lighting, and a vehicle-centric environment are concerning for potential bus riders. There is also a lack of bus stop amenities such as a landing pad for those with limited mobility or ADA needs and seating.

Map of Bus Stop Location

Figure A.1. Map of Bus Stop Location. (Source: Link Transit, ESRI, 2022.)

Map of Bus Stop Location – Zoomed In

Figure A.2. Map of Bus Stop Location – Zoomed In. (Source: Link Transit, ESRI, 2022.)

Map of Bus Stop with overlay of HIN, Equity Census Tracts, Crashes

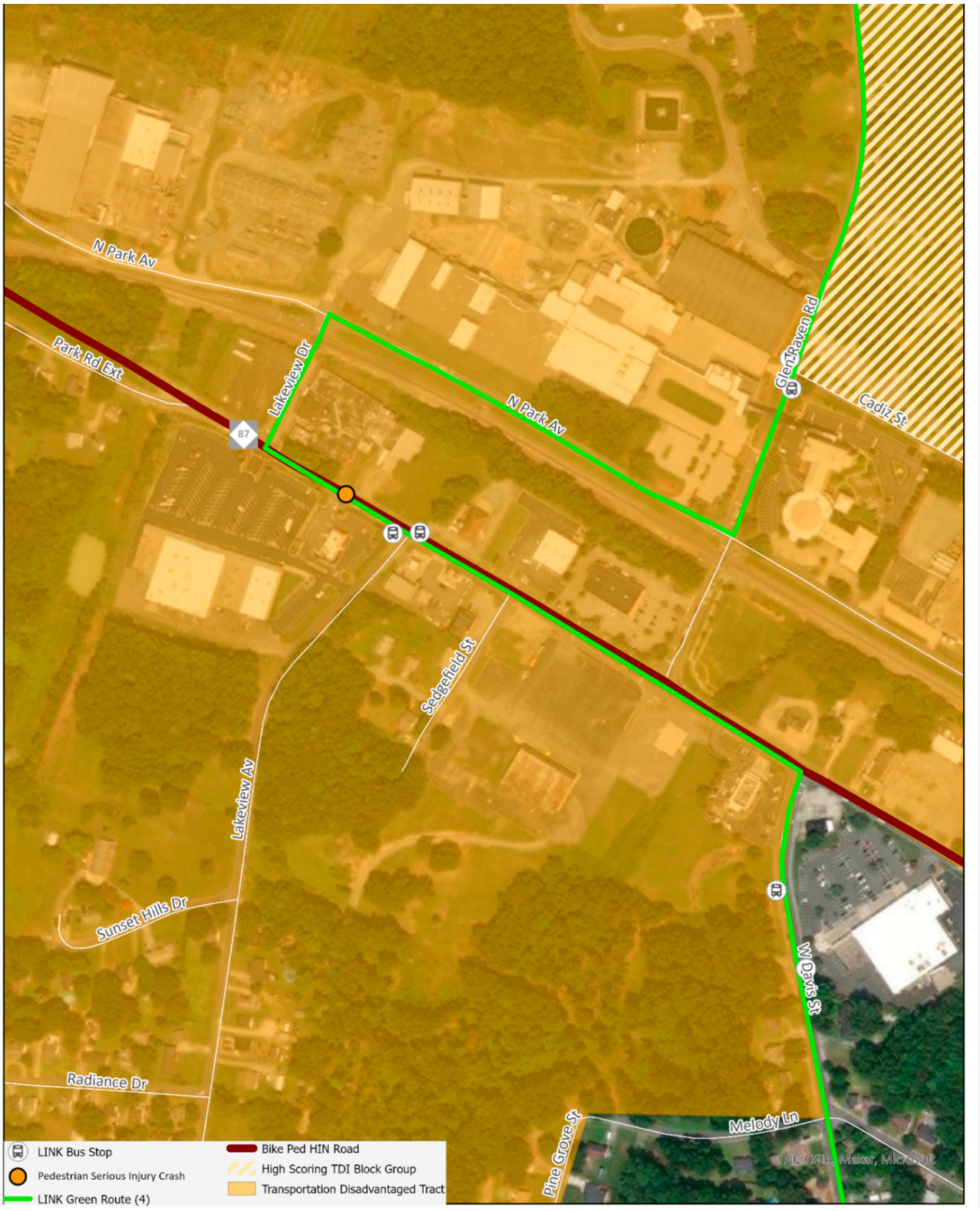


Figure A.3. Map of Bus Stop with overlay of HIN, Equity Census Tracts, Crashes. (Source: NCDOT, USDOT, 2022.)

Recommended Countermeasures

The following recommendations are typical treatments that can be applied at bus stops in the BGMPO region. Additional narrative is shown to describe their implementation at the W. Webb and Lakeview intersection.

Sidewalks

Sidewalks can help guide roadway users into safe crossings and prevent them from being in the roadway. By separating pedestrians from vehicles, pedestrians can safely access spaces where they interact with the roadway, like boarding a bus. Having a sidewalk leading to a bus stop keeps this separation and sets the path for crosswalks. By having sidewalk on both sides of a crosswalk, pedestrians are able to cross the road and continue use of a pedestrian-designated facility to bring them to their destination at the bus stop. **Figure A.4** shows how a sidewalk can be designed to ADA standards to ensure that those who are aided by mobility devices such as wheelchairs, scooters, and walkers, can travel and cross streets safely.

At the pilot location, there are no sidewalks on any of the intersection approaches. As part of roadway reconstruction efforts on W. Webb Avenue and/or Lakeview Avenue, there may be opportunities to construct sidewalks alongside other infrastructure improvements as a larger project.

Figure A.4. Sidewalk with tactile warning surface. (Source: Colchester, CA)

High Visibility Crosswalk

High visibility crosswalks mitigate the issue of drivers being unaware of a crossing, which can lead to them continuing to drive through it. When a crosswalk is marked with retroreflective signage, a painted design or striping pattern, it is easier for motorists to see the approaching crosswalk and give ample time to stop. When accessing a bus stop, it is likely pedestrians will need to cross the roadway at some point in their trip, so ensuring that oncoming vehicles receive a visual cue and are aware that they are approaching a crossing can improve pedestrian safety. **Figure A.5** shows a visualization of how a high visibility crosswalk could be installed with appropriate markings and signage. This also includes the installation of in-street pedestrian crossing signs, which are for roadways with speed limits of 30 miles per hour (mph) or less. A rectangular rapid flashing beacon (RRFB) can enhance conspicuity by installing in conjunction with crossing signs two rectangular-shaped yellow indications, each with an LED-array-based light source, that flash with high frequency when activated.

A complement to the high visibility crosswalk is to install curb extensions which extend the sidewalk or curb line into the street or parking lane, thus reducing the street width and improving sight distance between the driver and pedestrian. A curb extension is a candidate treatment for any uncontrolled pedestrian crossing, particularly where parking lanes exist. Curb extensions should not extend into paths of travel for bicyclists.

Figure A.5. High Visibility Crosswalk (Source: FHWA)

Another variation of the high visibility crosswalk is to install a pedestrian refuge island to break the crossing distance into two parts. The island is in the middle of a 2-way street and provides a place for pedestrians to stand and wait for motorists to stop or yield. This countermeasure is highly desirable for midblock pedestrian crossings on roads with four or more lanes and should be considered for undivided crossings of four or more lanes with speed limits of 35 mph or greater and/or AADTs of 9,000 or greater. Median islands may also be a candidate treatment for uncontrolled pedestrian crossings on three- or two-lane roads, especially where the street is wide and/or where vehicle speed or volumes are moderate to high. The minimum pedestrian refuge island width is approximately 6 feet.

At the W. Webb and Lakeview intersection, a high visibility crosswalk would be ideal on the western leg of the intersection adjacent to the bus stops. The two-way left-turn lane could also be used to construct a pedestrian refuge island.

HAWK Signal

The High-Intensity Activated crossWalk beacon (HAWK), or Pedestrian Hybrid Beacon (PHB), helps alert motorists of pedestrians crossing the roadway. **Figure A.6** shows that this signal has two red lenses above a single yellow lens that is mounted above a crosswalk. When a pedestrian desires to cross, they activate it with a push button or other detection method, and the signal displays a sequence of flashing and solid lights. This controls traffic while the pedestrian signal heads give a walk interval to indicate crossing. This countermeasure can improve bus stop safety as it facilitates a crossing for a pedestrian with greater signaling to oncoming motorists. These signals are especially useful to pedestrians who are traveling to a bus stop and need to make a mid-block crossing or are attempting to cross a road with higher speeds. A 55 percent reduction in pedestrian crashes has been observed after HAWK signals are installed[12].

The current MUTCD guidance is to locate PHBs at least 100 feet away from an intersection, engineering judgment/engineering study must be carefully applied if considering an installation at an intersection.

Figure A.6. Pedestrian Hybrid Beacon (Source: Maricopa Association of Governments)

12 Development of Crash Modification Factors for Pedestrian Crossing Treatments, (170823.pdf (trb.org))

Lighting

Lighting enhances visibility of pedestrians by motorists, ensuring that they are seen as they are using the roadway. Adequate lighting around the bus stop keeps the pedestrian visible when light conditions could obscure visibility, including during poor weather and at night. Lighting on the bus stop approaches is important to maintain pedestrian visibility by other roadway users, especially around a bus stop where pedestrians may be crossing the roadway or existing a vehicle. Nighttime pedestrian crashes at intersections may be reduced by 42 percent, nighttime crashes at rural and urban intersections by 33 to 38 percent and nighttime injury crashes on rural and urban highways by 28 percent[13].

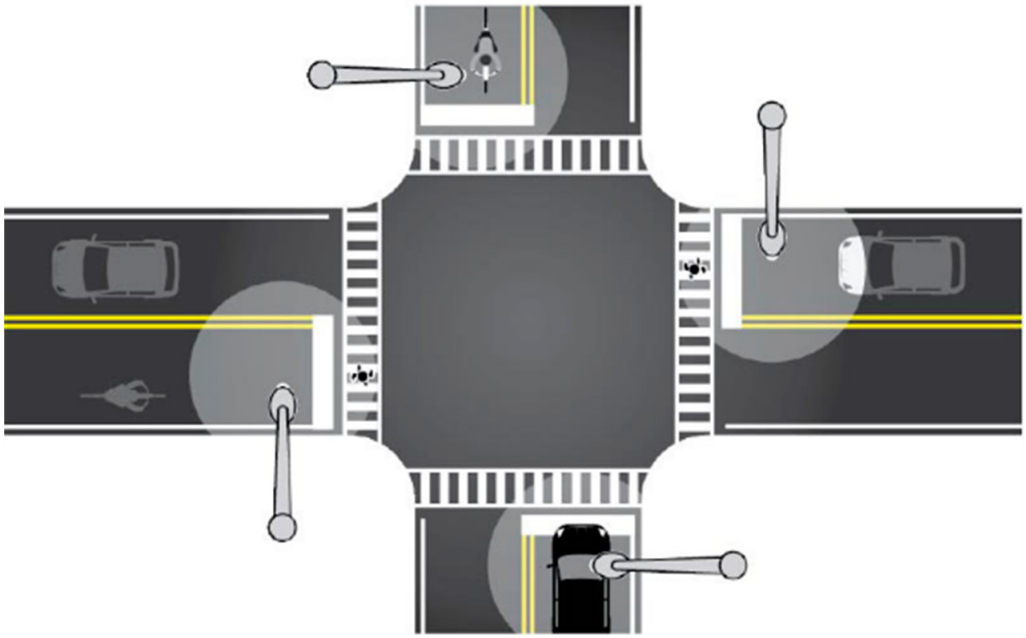


Figure A.7. Lighting (Source: FHWA)

Summary

Sidewalks, high-visibility crosswalks, HAWK signals, and lighting can increase safety at bus stops. Implementing these countermeasures at the stops in BGMPO's jurisdiction area with safety issues can create a system of safer conditions for pedestrians using public transit. Any combination of these treatments when appropriate can increase visibility for pedestrians, alert motorists of their presence, and improve connectivity for pedestrians accessing bus stops. Improvements should be prioritized based on the bus stop's presence in the HIN, if there is a crash history at the location, if the crashes fall under key emphasis areas, if the stop is in a USDOT TDCT or high NCDOT Transportation Disadvantage Index Block Group and based off ridership counts.

13 Lighting, (Lighting - Safety | Federal Highway Administration (dot.gov))

Appendix B

BGMPO Safety Target Setting Methodology

In 2016, the Federal Highway Administration (FHWA) established five highway safety performance measures that state departments of transportation and metropolitan planning organizations (MPOs) must incorporate into their performance management processes. These five safety performance measures are:

- Number of fatalities;
- Rate of fatalities per 100 million vehicle miles traveled (VMT);
- Number of serious injuries;
- Rate of serious injuries per 100 VMT; and
- Number of combined non-motorized fatalities and non-motorized serious injuries.

Each measure is based on the five-year rolling average baseline trend. This calculation is based on adding together the most recent five consecutive years then divided by five, and then rounding to the tenth decimal place. For each rate measure, the number of fatalities or serious injuries is determined per 100 million VMT, then divided by five, and round to the thousandth decimal place.

The North Carolina Department of Transportation (NCDOT) establishes targets for these performance measures each calendar year which are based on five-year rolling averages. Each year, BGMPO can either adopt the targets set by NCDOT or establish their own targets. Since the introduction of the safety performance measures, the BGMPO Transportation Advisory Committee (TAC) has chosen to adopt the NCDOT targets. NCDOT establishes targets to align with the goals of the State Strategic Highway Safety Plan (SHSP) which is to reduce fatalities and serious injuries by half by 2035 and moving towards zero by 2050.

Fatality and serious injury rates have been steadily increasing in the BGMPO region the last few years. In 2021, BGMPO failed to reach or make progress on each of its safety targets. An MPO is considered to have met or made progress on its targets when at least four out of five safety targets are met, or when the actual safety performance is better than the baseline performance for the period for four out of five measures.

Although there is no federal- or state-imposed consequence or penalty for an MPO that does not demonstrate they have met or made significant progress toward target achievement, BGMPO does find the increasing fatality and serious injury rate trend to be alarming. With targets set based on an aspirational SHSP goal, increasing fatalities and serious injury trends will make it difficult to make significant progress towards meeting the safety performance targets.

Therefore, BGMPO undertook the effort of developing a Safe System-based Transportation Safety Plan (TSP) to spread awareness of traffic safety and to change public attitudes and behaviors with the outcome of reducing crash rates and severity within the region and meeting safety targets.

As part of the development of the TSP, consideration was given on the process of safety target setting – whether to continue use State-developed targets or for BGMPO to establish its own targets. When setting its targets, BGMPO stakeholders need to be aware that this TSP has a goal of reducing fatalities and serious injuries by half by 2035 which is an annual reduction of 5.2 percent using a baseline year of 2022.

Factors to Consider

For BGMPO to develop its own safety targets, consideration should be given to the factors that can influence safety performance.

Exogenous Factors

Exogenous factors can influence the number of traffic fatalities and serious injuries. Recent research in the report Identification of Factors Contributing to the Decline of Traffic Fatalities in the United States from 2008 to 2012 (published 2020)[4], showed the varying levels of correlation between variables and traffic fatalities (**Table A** on the next page).

The report findings suggest that:

- Teens and young adults contributed disproportionately to the reduction in traffic fatalities from 2008 through 2011; however, economic constraints that reduced total travel and risky (discretionary and leisure) travel.
- Median household income is consistent with an income effect. The report suggests further investigation to explore interventions aimed at lower-income groups that may have a disproportionately positive effect.
- Driving under the influence laws showed a significant positive effect in reducing traffic fatalities. Reduced beer consumption similarly showed a significant positive effect.
- Rural VMT bears a higher risk of fatal crashes across all road types; reduction in the proportion of rural VMT was significant in all models. Programs aimed at reducing the risk of rural travel can substantially reduce traffic fatalities.

4 https://nap.nationalacademies.org/download/25590

Table A: Correlation between traffic fatalities and variables (Source: National Academies, 2020)

Variable	2007 Mean	2011 Mean	Percent change in predictor 2007–2011	Percent change in predicted fatalities 2007–2011
Total VMT	3,031,124	2,962,740	−2.3%	−1.2%
Proportion rural VMT	0.33	0.32	−1.6%	−0.1%
Pump price change	3.11	3.20	2.6%	−0.1%
Gross domestic product per capita change	59,687	54,519	−7.5%	−1.2%
Median income change	56,081	53,621	−4.3%	−2.2%
16–24 unemployment change	10.59	16.69	55.7%	−6.1%
Capital spending/mile (lag) change	73.69	81.27	7.9%	−0.1%
Safety spending/mile (lag) change	13.61	14.68	9.3%	0.1%
Belt-use rate change	85.77	88.10	2.4%	−0.1%
DUI law rating change	19.77	20.50	4.0%	−0.7%
Motorcycle helmet law rating change	2.91	2.91	0.0%	0.0%
Beer consumption change	1.21	1.15	−3.5%	−0.7%
Wine consumption change	0.37	0.39	5.0%	−0.1%
MY>1991 change	95.80	97.11	1.4%	0.1%

The report also suggests that it may be difficult to discern in any given year the effects of safety countermeasures, due to the significant influence of other factors on traffic fatalities. There is a need to more fully document and assess safety advances from countermeasures because these exogenous factors may obscure them. Shocks in the economy can overwhelm the effect of safety interventions that generally influence crash risk. The report emphasizes that economic trends should be accounted for in setting realistic goals and evaluating traffic safety programs.

Noting the variables from the study, a growing population in the BGMPO area will have a positive correlation with an increase in road fatalities. While the expected population growth in the area could lead to an increase in fatalities, the uncertain economy with growing inflation will slow economic growth and consumer spending which leads to reduced travel and fewer crashes. However, as seen with driving and crash statistics during the pandemic, fatalities increased despite decreases in travel.

TSP Strategy Implementation

While exogenous factors can influence safety performance, the implementation of the identified strategies in the TSP has the potential to reduce fatalities and serious injuries. The scale of this reduction will depend on the funding, project type, timeline, and multiplying effects.

» Funding – this factor has the greatest influence on implementation as investment levels will dictate the number and breadth of projects that can be implemented.

» Project type – the varied projects in the TSP include those that are specific to a location to those that are implemented regionwide. For example, an infrastructure project may be designed for a spot location and therefore the benefits of the project (i.e., reduction in crashes) are localized at that spot. However, if an infrastructure project (e.g., improved signage, rumble strips, enhanced lane markings) is implemented in a systemic manner across several high-risk locations across the region, then a greater set of benefits can be accrued. Similarly, behavioral types of projects such as education or outreach campaigns could be deployed for the entire region and influence behavior for a larger group of road users. A targeted enforcement campaign may be specific for a location, however, there can be benefits achieved regionwide as road users gain awareness of or reminded of road safety laws. The strategy tables in the TSP, particularly those that are infrastructure oriented, provide information on the Crash Modification Factor (CMF) which is an expected benefit from the implementation of a countermeasure. The benefit should only be applied to the location(s) where the project is implemented, and the benefit should only apply to the crash type addressed—a CMF may only apply to a specific crash type (e.g., fatal crash, injury crash, urban crash, etc.).

» Timeline – the type of project, and likely funding, will determine when benefits can be realized. Quick build or low-cost infrastructure projects can bring benefits immediately, whereas a project with a longer construction timeline means that benefits may not be achieved until a future year. Annual safety target setting will need to account for when projects are completed.

» Multiplying effects – this is to acknowledge that the benefits from projects are not necessarily additive. For example, if three types of projects are implemented at the same location, the estimated benefit from each cannot be simply added together as they are not mutually exclusive. Common practice from the Crash Modification Factors (CMF) Clearinghouse is to multiply no more than three CMFs.

Target Setting Approach Scenarios

Understanding the influence of exogenous factors and the implementation of TSP projects helps to inform annual target setting. These influences help to determine the degree to which BGMPO will need to deviate from its 5.2 percent annual reduction trajectory to meet to goal of halving fatalities and serious injuries by 2035.

An approach to determine benefits is to tabulate the expected benefits from various projects. Using the sample worksheet in **Table B**, BGMPO can list all the projects proposed for implementation in the left column and then choose which year the project will first realize a benefit and assign the same benefit to subsequent years in the columns to the right. Additional columns can be added to account for the desired number of analysis years.

The total benefit per year can be tabulated at the bottom of the table, however, as mentioned earlier, a limit of three CMFs at a single location is recommended so as not to overestimate benefits. If the proposed projects are disparate and do not overlap, the benefits can be totaled at the bottom of the table.

The total benefits can then be compared against the 5.2 percent annual reduction to see if there is an opportunity for BGMPO to pursue a more aggressive annual target. The historical five-year trend and exogenous factors should also be considered to determine if the 5.2 percent annual reduction is achievable. If the five-year historical trend and economic conditions suggest a reduction target is not realistic, this may either 1) suggest greater investments in projects to achieve larger benefits, 2) adopt an increasing target, or 3) accept the target proposed by NCDOT regardless if it is increasing or decreasing.

Table B: Sample Worksheet to Estimate Benefits

Project	Year 1	Year 2	Year 3	Year n
Spot				
Project 1	SpotB	SpotB	SpotB	SpotB
Project 2			SpotB	SpotB
Systemic				
Project 1	SysB	SysB	SysB	SysB
Project 2		SysB	SysB	SysB
Regionwide				
Project 1		RegB	RegB	RegB
Project 2				RegB
TOTAL BENEFIT	**B**	**B**	**B**	**B**

Spot Benefit (SpotB) = (1-CMF) x Number of Annual Crashes of Crash Type at Location

Systemic Benefit = (1-CMF) x Number of Annual Crashes of Crash Type for all Applicable Locations

Regionwide Benefit = (1-CMF) x Number of Annual Crashes of Crash Type for Region

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