Summary of 2024 NCDOT HSIP Identification Procedures and Review Locations in the Safe Streets for WNC Plan Region

Land of Sky Regional Transportation Safety Action Plan

July 2024

The North Carolina Department of Transportation (NCDOT) implements the Highway Safety Improvement Program (HSIP)[1] to systematically identify and address specific traffic safety concerns across the state. The goal of the HSIP is to reduce traffic crashes, injuries, and fatalities by focusing on potentially hazardous (PH) locations. The 2024 NCDOT HSIP process provides a comprehensive, data-driven methodology to identify and address traffic safety issues across North Carolina, ensuring a systematic approach void of subjectivity to improving road safety through targeted interventions.

Each year, NCDOT identifies dozens or hundreds of locations for review and potential development into safety projects. The Regional Traffic Engineers lead the review process and submit projects for funding each quarter. Selected projects are funded by the HSIP or Spot Safety funding programs. This memo summarizes the projects identified for review or selected for funding between 2019 and 2024 in the five county region covered by the Safe Streets for WNC (Land of Sky Regional Transportation Safety Action Plan): Buncombe, Haywood, Henderson, Madison and Transylvania Counties.

The objective of this memo is to briefly explain the procedures followed by NCDOT to screen for and review locations for safety improvement and optimize the focus for other safety needs in the Safe Streets for WNC plan. As NCDOT continues to identify and propose more safety projects across the region using these methods, the Safe Streets for WNC plan (Land of Sky region) will focus on other approaches such as systemic safety improvements and projects requiring funding beyond the scope of the HSIP and Spot Safety programs.

HSIP Overview

The 2024 HSIP identifies PH locations across five main categories: intersections, sections, bicycle/pedestrian intersections, bicycle/pedestrian mid-block crossings, and bridges. The aim is not to list the most crash-prone locations but to use a data-driven approach to flag locations with identifiable crash patterns for potential safety interventions. NCDOT published this document to explain procedures and screening methods followed for identifying locations for HSIP review: https://connect.ncdot.gov/resources/safety/HSIP%20Library/2024%20HSIP%20Overview.pdf

Identification Process:

1. Preliminary Data Collection and Weighting: Locations are flagged using various warrants based on crash patterns, frequency, and severity. Each flagged location is potentially exceeding at least one safety warrant and has an existing crash pattern that can be targeted for improvement.

2. Crash Analysis: Detailed analyses including crash listings, maps, and collision diagrams, are conducted. The analysis follows specific guidelines and considers urban and rural settings, non-motorist crashes, and specific roadway features.

3. Field Recommendations: Regional Traffic Engineers conduct field investigations to validate data and recommend countermeasures. This step includes an overview narrative of the location, a historical narrative

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[1] NCDOT HSIP Process Overview

and other relevant information related to the location, current traffic control devices, photographs of the location, detailed descriptions of recommended treatments, and field notes.

Safety Analyses and Criteria:

The Safety Analysis is meant to provide a detailed examination of the most recent crash data and are to be completed prior to field investigation. Analyses are completed for intersections, sections, bicycle/pedestrian intersections, bicycle/pedestrian midblock, and bridges. These analyses are conducted using specific guidelines.

The Intersection Analysis utilizes the most recent 5 years of available data for urban intersections and the most recent 10 years for rural intersections. The data focuses on crash types and severity. Interchanges will be broken out with each intersection of the interchange being analyzed separately. Loop situations are also to be separated and analyzed individually. Collision diagrams are provided to illustrate crash patterns.

The Section Analysis utilizes the most recent 5 years of available data. Minimum crash rates are established based on roadway facility type. Endpoints of each section will be adjusted to be precise and sections within close proximity may be combined into one section. Animal crashes will not be considered in this analysis due to the unpredictability of animal behavior. Collision diagrams are provided to illustrate crash patterns.

The Bicycle and Pedestrian Intersection Analysis utilizes the most recent 10 years of available data, focusing on crash proximity. Only non-motorist crashes will be analyzed and reported on, unless otherwise requested. Collision diagrams are provided to illustrate crash patterns.

The Bicycle and Pedestrian Midblock Analysis utilizes the most recent 10 years of available data, focusing on crash proximity while excluding previously evaluated intersection crashes. Only non-motorist crashes will be analyzed and reported on, unless otherwise requested. A distance of 350 feet is used to determine midblock locations. The data will exclude crashes that happened within 300 feet of any intersection. Upon further screen processes, a site-specific limit may be adjusted based on the existing roadway conditions such as proximity to adjacent intersections. Collision diagrams are provided to illustrate crash patterns.

The Bridge Analysis utilizes the most recent 10 years of available data for bridge locations, focusing on crash proximity and specific conditions like wet roads or nighttime visibility. A maximum distance of 500 feet from each end of the structure will be used to determine bridge-related crashes. Bridges within 500 feet of each other will be analyzed together. Collision diagrams are provided to illustrate crash patterns.

Categories and Warrants:

Warrants are intended to identify a specific crash type, pattern, or condition. Specific warrants exist for intersections, sections, bicycle/pedestrian intersections, bicycle/pedestrian midblock, and bridges.

Intersections warrants consider locations flagged by crash data and are analyzed for patterns such as frontal impacts, crash frequency, night crashes, and severity. This warrant defines frontal impact crashes as angle, left turn (same or different roads), right turn (same or different roads), and head on. There are 9 sub-warrants which set thresholds for number, percentage, and severity of crashes in a timespan for the warrant to be analyzed.

- Warrant I-1u focuses on urban locations with frontal impact crashes in the past 5 years, specifically locations with 25% of the total crashes having occurred in the last 2 years and at least one of the two following conditions: (1) a minimum of 12 frontal impact crashes and a minimum of 55% of all crashes were frontal impact crashes; (2) a minimum of 35 total crashes and a minimum of 35% of all crashes were frontal impact crashes and a minimum severity index of 6.0 for the frontal impact crashes.

- Warrant I-1r focuses on rural locations with frontal impact crashes in the past 10 years, specifically locations with a minimum of 9 frontal impact crashes and 20% of all crashes having occurred in the last 3 years and a minimum of 60% of all crashes were frontal impact crashes.

- Warrant I-2u focuses on locations with last year increases in urban crashes in the past 5 years, specifically locations with a minimum of 25 crashes and a minimum of 38% of the total crashes occurred in the last year.

- Warrant I-2r focuses on locations with last year increases in rural crashes in the past 10 years, specifically locations with a minimum of 20 total crashes and a minimum of 32% of the total crashes occurred in the last year.

- Warrant I-3u focuses on urban locations with higher crash frequencies and a severity index threshold in the past 5 years, specifically locations with a minimum of 25 total crashes and a minimum severity index of 6.0 and a minimum of 40% of the total crashes occurred in the last 2 years.

- Warrant I-3r focuses on rural locations with higher crash frequencies and a severity index threshold in the past 10 years, specifically locations with a minimum of 20 total crashes and a minimum severity index of 9.0 and a minimum of 30% of the total crashes occurred in the last 3 years.

- Warrant I-3 focuses on urban and rural locations with fatal and severe injuries, specifically locations that have a minimum of 3 fatal or A-injury frontal impact crashes in the last 5 years.

- Warrant I-4u focuses on the past 5 years for nighttime urban locations, specifically locations with a minimum of 25% of the total crashes occurring in the last 2 years and a minimum of 12 crashes occurring at night and a minimum of 40% of the total crashes occurred at night.

- Warrant I-4r focuses on the past 10 years for nighttime rural locations, specifically locations with a minimum of 20% of the total crashes occurring in the last 3 years and a minimum of 10 crashes occurring at night and a minimum of 46% of the total crashes occurred at night.

Sections warrants consider locations flagged by crash rates per mile for various roadway types, excluding animal crashes. This warrant specifies a minimum total number of crashes and a minimum crash per mile rate for 5 road facility types. This warrant identifies 6 specific section crash types: run off road (right, left, or straight), fixed object, overturn/rollover, sideswipe opposite direction, parked motor vehicle, and head on. There are 8 sub-warrants which consider time of day and road conditions.

- Warrant F-1 focuses on run off road during wet road condition freeway locations that met the minimum total crash and crash rate for freeways and a minimum of 48% of the total crashes were run off road crashes during wet road conditions.

- Warrant F-2 focuses on run off road freeway locations that met the minimum total crash and crash rate for freeways and a minimum of 80% of the total crashes were run off road crashes.

- Warrant F-3 focuses on wet road condition freeway locations that met the minimum total crash and crash rate for freeways and a minimum of 55% of the total crashes occurred during wet road conditions.

- Warrant F-4 focuses on nighttime freeway locations that met the minimum total crash and crash rate for freeways and a minimum of 52% of the total crashes occurred during dark lighting conditions.

- Warrant N-1 focuses on run off road during wet road condition non-freeway locations that met the minimum total crash and crash rate for the respective facility type and a minimum of 35% of the total crashes were run off road crashes during wet road conditions.

- Warrant N-2 focuses on run off road non-freeway locations that met the minimum total crash and crash rate for the respective facility type and a minimum of 68% of the total crashes were run off road crashes.

- Warrant N-3 focuses on wet road condition non-freeway locations that met the minimum total crash and crash rate for the respective facility type and a minimum of 48% of the total crashes occurred during wet road conditions.

- Warrant N-4 focuses on nighttime non-freeway locations that met the minimum total crash and crash rate for the respective facility type and a minimum of 38% of the total non-intersection crashes occurred during dark lighting conditions.

The Bicycle/Pedestrian Intersection warrant considers locations flagged by multiple crashes in proximity and are analyzed separately from vehicle data. There is 1 sub-warrant which sets thresholds for the number of bicycle and pedestrian crashes, percentage of user types involved, and timespan for analysis.

- Warrant BP-1 focuses on chronic locations, specifically: (1) locations with a minimum of 4 crashes involving pedestrians or bicyclists reported in the last 10 years and a minimum of 50% of all crashes involving pedestrians or bicyclists must have occurred in the last 5 years;(2) locations with a minimum of 3 crashes involving pedestrians or bicyclists reported in the last 5 years.

The Bicycle/Pedestrian Midblock warrant considers locations flagged by multiple crashes in proximity and are analyzed separately from vehicle data. There is 1 sub-warrant which sets a threshold for the number of non-intersection related bicycle and pedestrian crashes and timespan for analysis.

- Warrant MB-1 focuses on chronic locations with a minimum of 4 non-intersection related crashes involving a pedestrian or bicyclist reported in the last 10 years.

The Bridge warrant considers locations flagged by a high number of specific crash types and only applies to 2-lane roadways. There is one sub-warrant which sets a threshold for the number of run off road crashes, percentage of run of road crashes, and timespan for analysis.

- Warrant B-1 focuses on locations with a minimum of 5 run off road crashes type crashes in the last 10 years and a minimum of 50% of all crashes were run off road.

This site contains reports of all HSIP locations reviewed between 2010-2024: https://connect.ncdot.gov/resources/safety/HSIP%20Library/Forms/AllItems.aspx

HSIP locations (2020-2024) in each of the 5 counties included in the WNC Safe Streets Plan are summarized in Table 1.

2020-2024 HSIP Review Locations Meeting Warrant Criteria[2]

	INT	SEC	BP INT	BP Midblock	Bridges	TOTAL
Haywood	64	43	0	0	2	109
Henderson	183	107	7	0	9	306
Buncombe	278	175	131	1	11	596
Transylvania	38	18	5	0	3	64
Madison	9	8	0	0	0	17
TOTAL	572	351	143	1	25	1,092

Table 1: Highway Safety Improvement Project Review Locations from 2020 to 2024

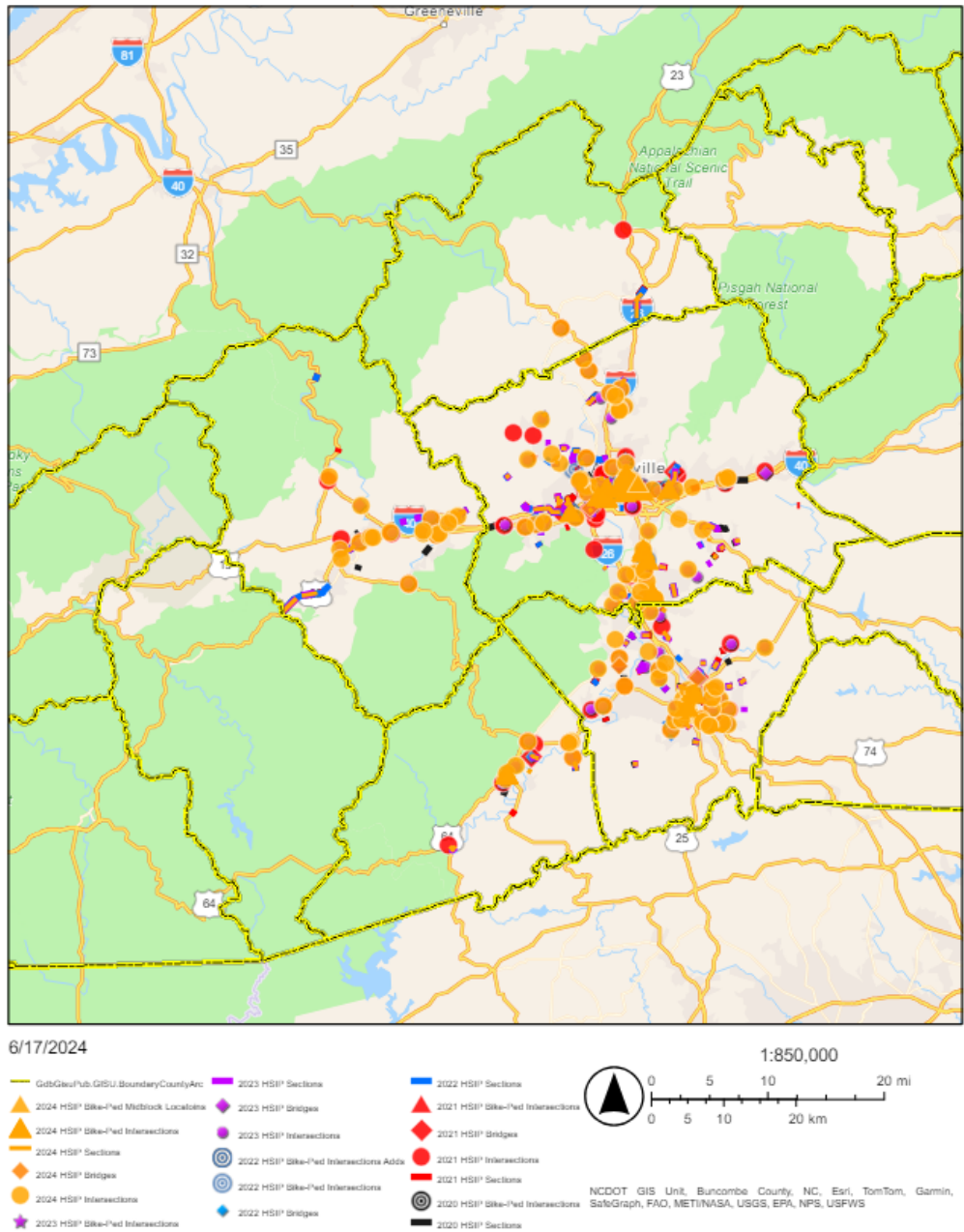[2] [NCDOT 2024 HSIP Review Locations](#)

Figure 1: Highway Safety Improvement Project Review Locations from 2020 to 2024

Countermeasure Recommendation and Implementation Process:

1. Identification of Countermeasures: During field investigations, traffic engineers assess PH locations and identify applicable countermeasures. These recommendations may range from traditional traffic engineering interventions like signal adjustments or improved signage to innovative approaches tailored to specific crash patterns, such as pedestrian refuge islands or increased lighting.

2. Documentation and Approval: Before implementation, the recommended treatments are documented in the HSIP Tracker, which includes detailed narratives, current conditions, historical changes, crash patterns, and proposed countermeasures. Approval is sought from relevant stakeholders, ensuring that recommendations are practical and feasible.

3. Implementation: Depending on the cost and nature of the countermeasures, the proposed countermeasures may result in several actions. These actions can include requesting Division maintenance crews to implement changes or repairs, developing Spot Safety projects, initiating Hazard Elimination projects, making adjustments to current Transportation Improvement Program (TIP) project plans, or utilizing other funding sources to implement the recommended countermeasures.

4. Evaluation: Field investigation results are documented, including narratives, diagrams, and photographs. The effectiveness of treatments is continuously monitored to develop crash modification factors and enhance program effectiveness.

Countermeasures proposed by the Regional Traffic Engineer are developed considering local conditions, specific safety problems and/or crash patterns. However, NCDOT proposes some countermeasures or treatments more frequently than others. The following are improvements typically recommended:

- Intersections:
    - Retroreflective backplates, all-way stops, stop bar relocation, upgrade/replace signage, reduced conflict intersection, construct turn lane, convert intersection to roundabout,, mini roundabout, 3-section flashing yellow arrow (FYA) signal head, four-section in-line signal head, left-turn lanes, high-visibility pavement markings, channelization islands, offset T-intersection construction, improved lighting, flashing yellow right-turn arrow, signage improvements, install curb ramps and ADA improvements, reduced conflict intersection, pedestrian sidewalk improvements

- Sections:
    - Shoulder and centerline rumble strips, upgrade/replace signage, guardrail, advanced warning flashers and signage, long-life pavement markings, sinusoidal center-line and edge-line rumble strips, raised concrete medians, curve warning signs, non-energy absorbing guardrail end units, paved shoulders, create 2-way roads, improved lighting

- Bicycle/Pedestrian Intersections:
    - Retroreflective backplates, high visibility crosswalks, pedestrian push-buttons and countdown signals, pedestrian sidewalk improvements, install curb ramps and ADA improvements, pedestrian refuge islands, pedestrian signal heads, , audible/countdown pedestrian signal heads, leading pedestrian intervals, improved lighting, accessible pedestrian signals (APS), curb bump outs

- Bicycle/Pedestrian Midblock:
    - Pedestrian sidewalk improvements, shoulder improvements, high visibility crosswalks, RRFB's, paved shoulders, HAWK beacon, flex posts, grade separation, median fencing to channelize pedestrians, improved lighting

- Bridges:
    - Bridge removal, bridge approach and departure guardrail, bridge approach, and departure guardrail

Typical or Frequent Safety Projects Proposed for the WNC Region

The following is a summary of the total number of projects and types of improvements programmed for HSIP[3] and Spot Safety[4] funding in the Land of Sky region (Buncombe, Haywood, Henderson, Madison and Transylvania Counties). These projects are at different stages of completion. Projects conducted across a large area (e.g., countywide, divisionwide) are not shown on the map. Construction let may occur up to several years after the project is awarded funding.

2020-2024 Active Safety Projects in WNC / Land of Sky Region[5]

Active safety projects denote projects that have been funded and are either in-progress or completed from 2020 through 2024.
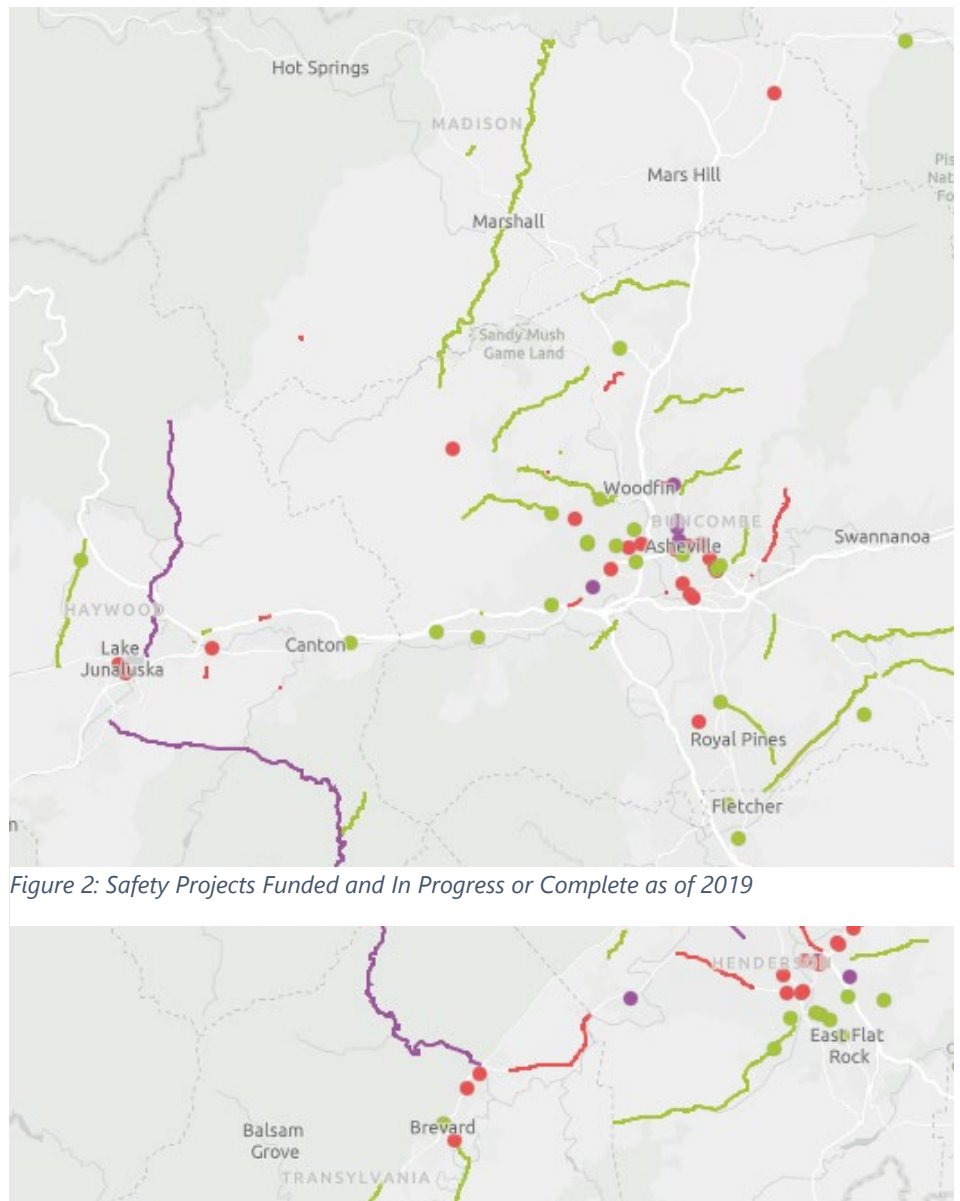

Figure 2: Safety Projects Funded and In Progress or Complete as of 2019

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[3] Active HSIP Projects (through 2/28/2024)
[4] Active Spot Safety Projects (through 2/28/2024)
[5] NCDOT 2024 Active HSIP Projects

	HSIP Projects	HSIP $	Spot Safety	Spot Safety $	TOTAL	TOTAL $ INVESTED
Haywood	3	$576,000	5	$2,269,000	8	$2,845,000
Henderson	7	$3,854,000	10	$755,000	17	$4,609,000
Buncombe	8	$3,980,000	11	$1,695,000	19	$5,675,000
Transylvania	4	$1,205,000	2	$527,000	6	$1,732,000
Madison	1	$565,000	1	$35,000	2	$600,000
Multi-County	5	$2,205,000	0	$0	5	$2,205,000
TOTAL	28	$12,385,000	26	$5,281,000	54	$17,666,000

Table 2: Active Highway Safety Improvement Projects from 2020 to 2024 (based on Project Selection Date) and Active Spot Safety Projects

References:

- NCDOT Traffic Safety Systems Highway Safety Improvement Program
- HSIP GIS Portal
- HSIP 2024 GIS Locations
- Active HSIP Locations
- Active Spot Safety Projects