TRIANGLE WEST
Transportation Planning Organization

March 2025 DRAFT

Triangle West Transportation Planning Organization

VISION ZERO PLAN

Appendix A

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Appendix A: Safety Analysis Methodology

High Injury Network Methodology

The purpose of this memorandum is to document the process for a November 2024 update of the regional Triangle West Transportation Planning Organization (Triangle West TPO) High Injury Network (HIN), as well as 7 local HINs for the following jurisdictions:

1. Town of Carrboro
2. Town of Chapel Hill
3. Chatham County
4. City of Durham
5. Durham County
6. Town of Hillsborough
7. Orange County

Note that the July 2024 bicycle/pedestrian HIN, as well as the High Injury Intersections (HIIs; regional and local) remain unchanged.

Data

The project team obtained two sets of crash data from the North Carolina Department of Transportation (NCDOT):

- All crash data from the NCDOT enterprise crash database (2016-2023)
- Bicycle and pedestrian-specific crash data available via NCDOT's Open Data Portal (2013-2022)[1]

These data sources included characteristics such as location, roadway characteristics, and crash severity. There are several considerations for the inclusion of both data sources:

- Crash data from NCDOT's enterprise database have limited crash location data. Generally, crashes are much more likely to be locatable on NCDOT-maintained roads, and therefore able to be used to generate a network of high crash locations.
- By contrast, the crashes in NCDOT's curated Bicycle and Pedestrian dataset are manually located and therefore can be located on all parts of the network with greater confidence.
- Furthermore, NCDOT reviews all potential bicycle and pedestrian crashes for accurate reporting. NCDOT:
  - removes crashes that may be labeled as bicycle or pedestrian that did not actually involve a bicyclist or a pedestrian, as well as
  - removes any crash that did not occur in the public right of way (i.e., excluding parking lots or private driveways).
- Differences in crash frequency and timeliness account for the differences in the year ranges associated with each dataset (i.e., 7 years of total crashes and 10 years of bicycle and pedestrian crashes). Although all bicycle and pedestrian crashes are locatable, they are less frequent than total crashes and more observations are required for meaningful insights.

The project team also obtained NCDOT's route characteristics file and intersection inventory in a geographic information systems (GIS) format. The project team used a spatial join to link crashes with roadway segments based on a common route classification (for the all-crash HIN); this helped reduce the likelihood of erroneous joins between crashes and roadway segments. Crashes were designated intersection-related for the HII if they occurred within 150-foot buffer standard in the NCDOT inventory.

1 NCDOT Non-Motorist Crash Map

Methodology

For this analysis, a Python-based tool was developed that uses a sliding window approach to generate an equivalent property damage only (EPDO) score for each roadway segment. The tool is customizable to different settings that dictate how the tool scans the network. The tool iterates along a centerline one-tenth of a mile at a time and creates a 1-mile segment with an associated EPDO value; note that this creates overlaps, as each one-tenth mile segment is incorporated in several 1-mile segments.

For the purposes of this HIN version, access-controlled roads (I-40, I-885, I-85, NC 147, and the US 15-501 Bypass in Durham County), ramps, and crashes were excluded from local HINs; this left only non-access-controlled roads (except for US 15-501 in Orange County) in the analysis. US 15-501 remained in the Chapel Hill and Carrboro HINs due to the high proportion of local fatal and serious injury crashes. At the end of the analysis, the access-controlled roads identified in the July 2024 HIN were reincorporated into the Triangle West TPO regional HIN to create the complete final version of the regional network.

The following steps summarize the process by which data were processed and HIN segments were synthesized:

- After excluding crashes with a route number flagged as access-controlled, crash points are clipped to the boundaries of each subregion.
- EPDO values are assigned to crashes based on crash severity, and this value is summed during the aggregation process. Table 1 provides the EPDO weights for each severity type.
- A one-tenth mile sliding window captures crashes on segments.
- A spatial join is performed to calculate total EPDO score for each segment.
- To generate final HIN corridors, the top 5 percent of segments region-wide, and top 10 percent of segments for each locality were extracted for final processing.
- Since this produces overlaps, segments are aggregated so that each individual segment is a single feature; more than one HIN segment may be on a single route, but unique segment features are generated if these are not spatially contiguous.
- As noted previously, access-controlled segments identified in July 2024 were re-integrated into Triangle West TPO regional HIN.

TABLE 1 EPDO Weights for High Injury Locations

Crash Severity	Crash Cost ($2022)	EPDO Weight
Fatal (K) or Suspected Serious Injury (A)	$3,865,000	268
Suspected Minor Injury (B)	$230,000	16
Possible Injury (C)	$136,000	9
Property Damage Only (PDO)	$14,400	1

High Injury Intersection Network (HII)

To ensure consistency between which crashes are associated with which networks, the HII is created first. Then, any crashes associated with the HII are excluded from the creation of the HIN and the bike-ped HIN. The following steps provide a summary for the development of the HII.

- **Step 1:** Clip intersection polygons and spatially locatable crashes to the Triangle West TPO planning area using the Pairwise Clip geoprocessing tool.
- **Step 2:** Spatial join intersection polygons to crash points with the parameters Join One to Many, Closest, Keep ALL, and a search radius of 25 feet.
- **Step 3:** Run Summary Statistics on the spatial join layer. Sum the EPDO field by KeyIntersectionID.

This provides a sum of EPDO scores by unique intersection An example of this calculation is shown in Figure 3.

- **Step 4:** Use the join field geoprocessing tool to tie the Sum EPDO column to the original intersection layer using fields KeyIntersectionID and KeyIntersectionID.
- **Step 5:** For any locations with a null value in the summed EPDO field, calculate a "0."
- **Step 6:** Calculate the percentile rank of all locations.

This step normalizes the location scores between 0 and 100, where the highest intersection based on EPDO is closest to 100 and the lowest is 0. The script for this analysis is shown in Figure 1. To determine the top 1 percent of scores/locations, for instance, one would select all rows with a value of 99 and above.

- **Step 7:** Create a non-intersection crash layer based on crashes that were not located within the 150-ft influence area of an intersection polygon.

It is important to consider the HII in relationship to a HIN. Assessing the HII and the HIN separately is a safety planning practice that allows a more nuanced view of the safety problems on the road network. Intersection crashes and non-intersection crashes can tell different stories about the safety issues on the road network and create opportunity for more context-specific countermeasure development. By examining intersection crashes and non-intersection crashes in their own layers, we are able to see a network of roadways, as well as a network of intersections that contribute to the High Crash Network in the Triangle West TPO region.

```
In [1]: import arcpy
        from scipy import stats

In [2]: # Define geodatabase path(s)
        gdb = r'\\vhb.com\gis\proj\Raleigh\39600.01 NCDOT_NC SHSP 2024\Project\NC Safety Plans\DCHC_HIN\DCHC_Geodatabase\temp_outputs.gdb'

        # Define geodatabase content(s)
        fc = gdb + r'\\' + r'DCHC_Intersections'

In [3]: # Field containing values to rank
        value_field = 'Pct_Total'

        # Field to which to write the rankings
        rank_field = 'PercentileRank_total'

        # SQL query to limit rankings to certain rows in the table
        # If no query is needed (if performing ranking on all rows of the table) set the clause variable like: clause = None
        clause = None

In [4]: ScoreArray = []
        with arcpy.da.SearchCursor(fc, [value_field]) as sCur:
            for row in sCur:
                if row[0] is not None:
                    ScoreArray.append(row[0])

        print(len(ScoreArray))
        with arcpy.da.UpdateCursor(fc, [value_field, rank_field]) as uCur:
            for row in uCur:
                row[1] = stats.percentileofscore(ScoreArray, row[0], kind='weak')
                uCur.updateRow(row)

        print("Finished.")
```

FIGURE 1 ArcPy Script for Calculating Percentile Rank.

Regional High Injury Network (HIN)- All Crashes

The following steps provide a summary for the development of the HIN for all crashes in the Triangle West TPO planning area. Steps 1 through 6 generate individual high injury segments, and Step 7 generates the HIN from these segments. Based on conversations with Triangle West TPO, the project team can adjust the thresholds for identifying HIN segments and corridors for the final HIN. The proposed and recommended threshold for the regional HIN is the top 1%.

- **Step 1:** Clip road centerlines and remaining non-intersection crashes to the Triangle West TPO planning area using the pairwise clip geoprocessing tool.
- **Step 2:** Segment roadway centerlines to generate segments between intersections using the intersection inventory and generate a unique ID for each road segment in the study area.
- **Step 3:** Using route class as a common attribute, join roadway segments to crashes with the parameters Join One to Many, Closest, Keep ALL, and a search radius of 150 ft.
- **Step 4:** Run the Merge and Summarize Script with appropriate inputs and outputs to get final route segments with sum EPDO for each segment.
- **tep 5:** For any locations with a null value in the summed EPDO field, calculate a "0"
- **Step 6:** Calculate the percentile rank of all locations.
- **Step 7:** Using the 99th percentile segments (top 1% of EPDO scores), connect any HIN segments that share the same RouteID (i.e. are objectively the same roadway) and are within 0.5 miles of each other, and delete any HIN segments that are not within 0.5 miles of another HIN segment. Minimum length for HIN segments included in the final map are 1.0 miles.

This step is sometimes referred to as "smoothing". This smoothing process takes a disconnected network of short segments and smooths it into a legible road network. This process serves a number of benefits: 1) Improves data interpretability by removing segments between HIN segments that may not show up on the analysis because several severe crashes may not have occurred on that block specifically , but it is representative of the same safety concern, 2) enhances countermeasure application by removing isolated one-block segments and considering the relationship between high injury segments and corridors

Localized High Injury Network (HIN)- All Crashes

The following steps provide a summary for the development of a localized HIN for all crashes in the Triangle West TPO planning area. Based on conversations with Triangle West TPO, the project team has identified the need to develop a localized HIN for all crashes in the following communities within the Triangle West TPO planning area: City and County of Durham, Town of Chapel Hill/Town of Carrboro, Town of Hillsborough, Orange County/Chatham County. The development of these localized HINs starts with clipping the crashes and road centerlines to the identified community boundaries and then follows the same steps 2 through 7 outlined in the Region HIN. An objective of the localized HINs would be to create more detailed networks for local agencies; however, any locations identified on the regional network should also be present in the local network. Based on conversations with the individual communities, the project team can adjust the thresholds for identifying HIN segments and corridors for the final localized HINs. The proposed thresholds for the localized HINs will vary between 1% and 5% based on local contexts.

Through this curated approach, each community identified in this step will have the regional HIN and a localized HIN, which provides greater opportunity to identify nuances safety issues, foster local support for safety countermeasures, and identify funding opportunities (local, state, federal) for safety countermeasure implementation.

High Injury Network (HIN)- Bicycle and Pedestrian Crashes

The following steps provide a summary for the development of the HIN for bicycle and pedestrian crashes only in the Triangle West TPO planning area. The primary difference between the "All Crashes" version and the "Bicycle and Pedestrian Crash" version is the segmentation of the roadway. Since bicycle and pedestrian crashes are much less frequent than other crash types, road segments are developed using dynamic segmentation[2]; this creates longer contiguous segments than the intersection-to-intersection approach. This process creates homogenous segments based on selected attributes. For the Triangle West TPO analysis, the project team used RouteID, functional class, and number of lanes to create homogenous segments of similar characteristics.

Step 1: Clip road centerlines and remaining, non-intersection crashes to the Triangle West TPO planning area using the pairwise clip geoprocessing tool.

Step 2: Segment roadway using RouteID, functional class, and number of lanes fields with no multi-part features and generate a unique ID for each road segment in the study area.

Step 3: Exclude road segments and crashes with the "Interstate" route class (road segments layer) or road class (crashes layer).

Step 4: Use Spatial Join (join setting Closest, search radius 150 feet) on study area crashes and study area segments.

Step 5: Use Summary Statistics geoprocessing tool on the crash layer to get EPDO and Frequency (i.e., total number of crashes) by SegmentID.

Step 6: Use Join Field to join crash frequency and sum of EPDO back to original segments using join fields SegmentID.

Step 7: Calculate the percentile rank of all locations based on EPDO score.

Key Distinctions from the Previous Methodology & Conclusions

There are important distinctions between the November 2024 version of the analysis and the July 2024 version. Previous HIN versions separated midblock and intersection-related crashes to avoid redundancy between these two networks. However, this creates a more segmented, block-by-block visualization to the HIN. There is no appreciable difference in "coverage" of historic fatal and serious injury crashes or mileage between either approach; however, the more continuous corridors may be more intuitive for presentation or discussion with stakeholders. Furthermore, as a result of combining midblock and intersection-related crashes, most HIIs are also on corridors identified in the regional and/or local HINs. Only 2 intersections are uniquely (i.e., not on an HIN) regional or local HIIs after this update.

2 Dynamic Segmentation: https://pro.arcgis.com/en/pro-app/latest/help/production/roads-highways/apply-dynamic-segmentation.htm

Risk Analysis

This memorandum summarizes the data analysis conducted to support the Triangle West TPO Vision Zero Safety Action Plan. This includes a review of historic crashes to identify high crash locations (reactive analysis), as well as a systemic, risk-based analysis to identify locations that share factors that contribute to certain crash types even if a crash has not occurred in recent history at all locations that share these characteristics (proactive analysis).

High Injury Network (HIN) and Intersections (HII)

Analysis

The project team submitted a draft summary of the High Injury Network and High Injury Intersections to Triangle West TPO in summer 2024. The Results section in this memorandum provide the coverage statistics for the following networks:

- Regionwide HIN and HII for all modes (Total Crash)
- Regionwide HIN and HII for bicyclist- and pedestrian-involved crashes (Bike/Ped Crash)
- Local HINs and HIIs for:
    - Chatham County (unincorporated, within Triangle West TPO)
    - Durham City and County
    - Orange County (unincorporated, within Triangle West TPO)
    - Town of Carrboro
    - Town of Chapel Hill
    - Town of Hillsborough

Regional HIN and HII

Figure 2 displays the coverage statistics for Regional HIN and HII. These statics cover the total percentage of public road miles and intersections included in their respective high injury analysis, contrasted with the total percentage of fatal (also referred to as "K" injuries) and serious injury (also referred to as "A" injuries) crashes during the study period that are included on the network.

The Triangle West TPO Total Crash HIN covers 63.5% of fatal and serious injury crashes between 2016 and 2023 and 9.1% of road mileage. The Bike/Ped Crash HIN covers 48.6% of fatal and serious injury bike/ped crashes between 2013 and 2022 while only consisting of 3.8% of road mileage. The Bike/Ped Crash HIN and HII combined cover 100% of fatal, non-interstate highway, bike/ped crashes between 2013 and 2022.

The Triangle West TPO Total Crash HII (the top 1% of intersections) covers 29% of intersection-related fatal and serious injury crashes, as well as 100% of all bike/ped intersection-related fatal and serious injury crashes.

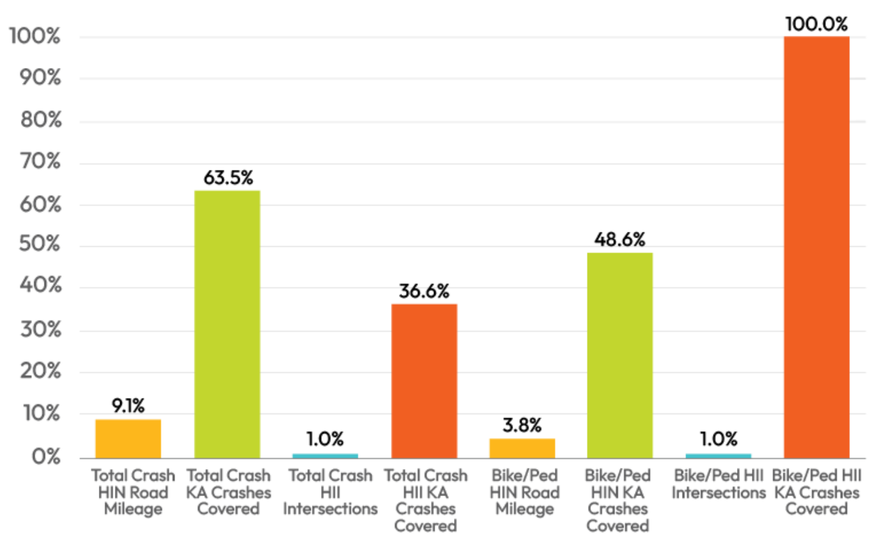

FIGURE 2 Regional HIN Coverage Statistics

Figure 3 displays the coverage statistics for the HIN when routes signed as interstates (e.g., I-40, I-885, and I-85) are excluded. The Triangle West TPO non-interstate HIN covers 58% of fatal and serious injury (KA) crashes and 7.5% of road mileage.

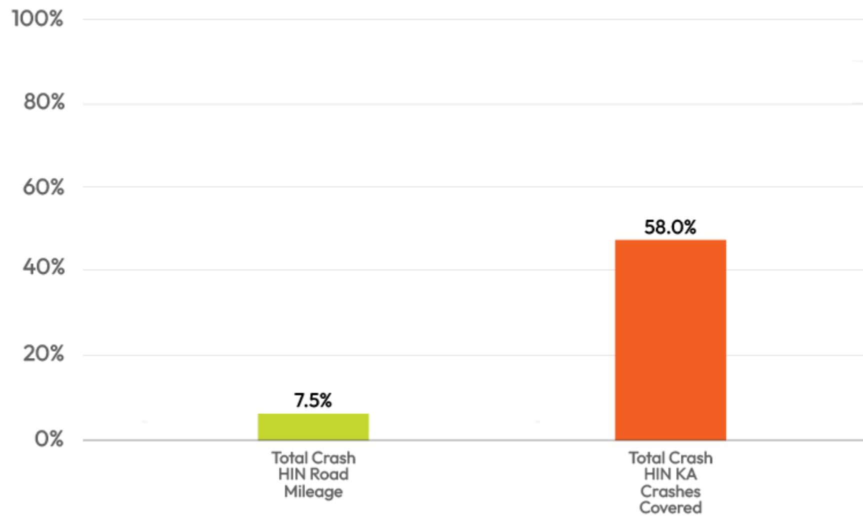

FIGURE 3 Regional HIN Coverage Statistics Excluding Interstate Highways.

Local HIN and HII

Figure 4 provides coverage statistics for local HINs in the Triangle West TPO region. Mileages for each HIN vary between 7.1% and 13.2% of the locality's roads, while fatal and serious injury crash coverage varies between 71.4% and 88.9%. These thresholds were used to capture the greatest share of historic fatal and serious injury crashes, while keeping the amount of road mileage around 10% for any single jurisdiction.

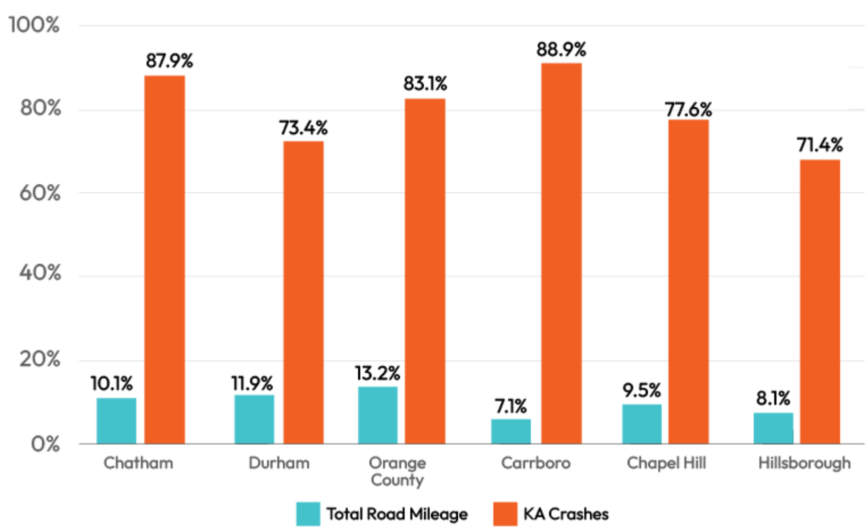

FIGURE 4 Local HIN Coverage Statistics

Figure 5 provides a summary of the fatal and serious crash coverage for the top 1% of intersections in each locality. There are roughly 11,600 intersections in the TPO boundary, and this threshold was set at 1% across the region to focus attention on the highest severe crash locations.

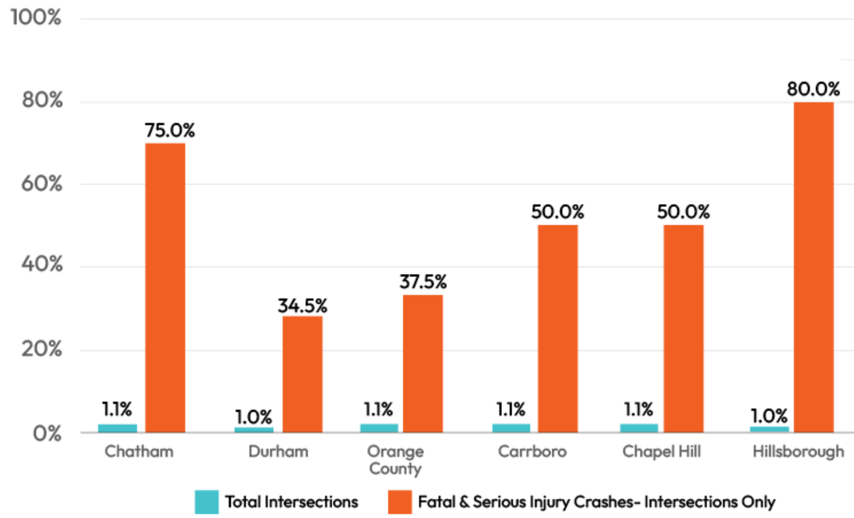

FIGURE 5 Local HII Coverage Statistics

Risk-Based Networks

Analysis

The objective of the risk-based analysis is to enhance road safety through the identification of specific roadway characteristics where fatal (K), suspected serious injury (A), and suspected minor injury (B) crashes are most likely to occur. This analysis identifies common roadway characteristics at high severity crash locations and identifies a network of road segments and intersections with those same characteristics. This approach identifies segment- and intersection-level risk factors and is a tool used to inform transportation policies and infrastructure improvements that can proactively target these specific high injury crash types.

The following crash types represent a greater share of KA injury crashes than total crashes. Focusing on these crash types as the highest priority for treatment – due to their comparative higher severity than other crashes – supports the Vision Zero goals of this action plan.

- **Lane Departure:** Crash/Collision type recorded as running off the road, rollover/overturn, striking fixed object, sideswipe in opposite directions, or head on.
- **Speed-Related:** Contributing circumstances related to the driver are recorded as exceeding the posted speed limit or driving too fast for conditions.
- **Bike:** Crash/Collision type, "vehicle" type, or person type recorded as a bicycle.
- **Pedestrian:** Crash/Collision type, "vehicle" type, or person type recorded as a pedestrian.
- **Motorcycle:** Vehicle type involved in crash is recorded as a motorcycle.
- **Intersection-Related:** Roadway feature at the crash location is an at-grade intersection.
    - All crash modes
    - Bicycle/Pedestrian crashes

Methodology

Risk network identification starts by identifying the roadways and intersections where more severe KAB focus crashes (i.e., the seven identified above) have occurred during the study period. This framework then assesses common characteristics among these roadways using a binary logistic model for each of the seven crash types. This model produces a probability that a crash will occur at a segment or intersection based on the associated characteristics of each site. This produces a set of risk factors – characteristics that are correlated with KAB crashes. The characteristics are then used to generate a "probability" or score for each segment and intersection in the inventory that indicates the likelihood that a KAB crash will occur based on the characteristics of that location.

This "probability" is not associated with a site's specific crash history, but rather an indication of crash likelihood based on the known characteristics. Furthermore, there may be site-specific characteristics that are not captured as part of the model that can influence safety. For instance, although the presence of a traffic signal, approach AADT, and intersection skew angle are all risk factors for intersections, sites that have these similar characteristics might be differentiated by sight distance limitations associated with vegetation or other obstructions or driveway curb cuts near the intersection that may impact safety at the individual site-level. This reflects the importance of site-level diagnosis and review before implementing countermeasures.

Results

Figure 6 provides the coverage statistics for the seven high risk networks developed for the Triangle West TPO area. This includes five segment-based networks and two intersection networks. The following notes provide more context for the high-risk network:

- Whether or not a crash has occurred at a segment or intersection does not factor into whether the location is "high risk" or not; only the probability produced by the model indicates high risk.
- The risk networks in Figure 6 reflect the highest probability locations for each crash type; each risk network is distinct and may include overlapping or unique segments to the other risk networks. These networks are distinct from the HINs and may include overlapping or unique segments to those.

- The coverage statistics in Figure 6 reflect crashes that have an NCDOT flag associated with that crash type; there are a different number of crashes in each crash type across the Triangle West TPO region; some individual crashes may be identified in multiple crash types.
- All road segments and intersections in the region have a risk probability, or score, associated with them. The road mileage or number of intersections included in Figure 5 are not necessarily meant to be used as clear cutoff points for a standalone high-risk network(s). Rather, this is a comparable amount of road mileage to the HIN statistics in Figure 4.

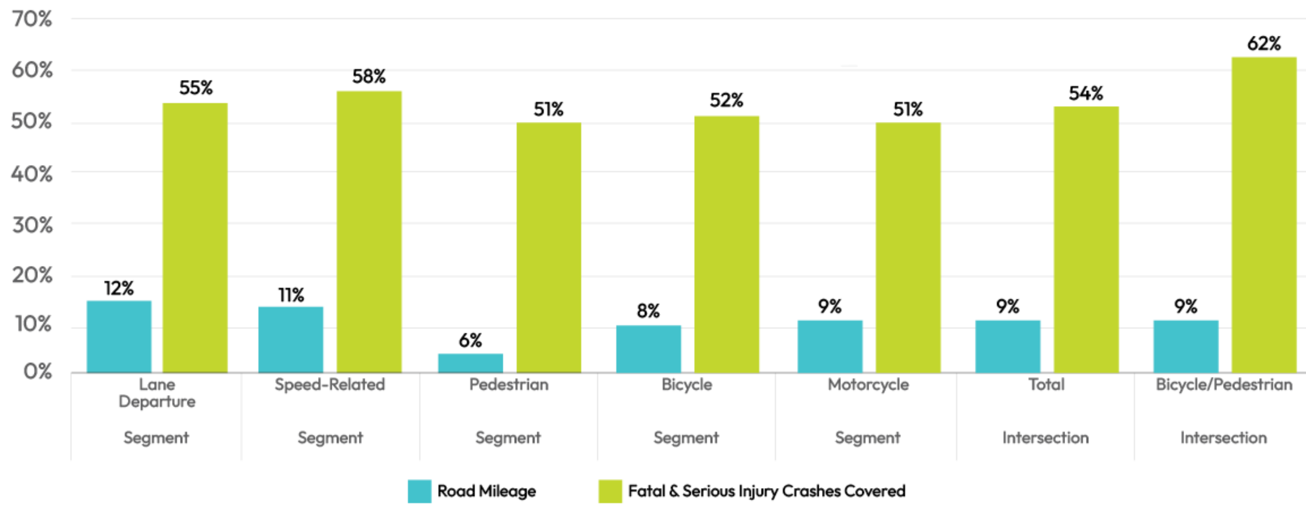

FIGURE 6 Risk Network Coverage Statistics

Risk-Factors

The logistic model considered many potential factors that could contribute to a higher likelihood of a certain crash type. Table 2 provides an overview of risk factors by crash type. This does not reflect any specific statistical significance threshold – the results are meant to only be used as a general guide for illustrating contributing factors correlated with increased risk.

A green cell indicates a risk factor is correlated with higher risk for that crash type. A black cell indicates a potential risk factor that was not considered; this can be because the factor is not necessarily appliable to a crash type (i.e., transit stops and lane departure). A blank square indicates a potential risk factor that was not significantly correlated with risk for that crash type.

TABLE 2 Risk-Factors by Crash Type

Risk Factors	Lane Departure	Speed-Related	Pedestrian	Bicycle	Motorcycle	Total Intersection	Bike/Ped Intersection
School or University Nearby							
Transit Stop Present							
Fewer Travel Lanes							
More Travel Lanes							
Higher AADT							
US Route							
NC Route							
SR Route							
Rural Context Classification							
Suburban Context Classification							
Urban Context Classification							
Higher CDC Social Vulnerability Index							
Higher Proportion of Zero Vehicle Households							
Higher Population and Employment Density							
Four Legs							
Signalized							
Greater Intersection Skew							

Comparison of 2023 Bike/Ped Crashes

NCDOT produces a curated dataset of bicycle and pedestrian crashes separate from the primary NC crash database.[3] Due to the timing of the analysis for this plan, crashes for the 2023 calendar year were not available for the HIN/HII or high-risk analysis. This provided an opportunity to test the HIN and high-risk networks to see how networks developed using 2013-2022 data compare to the crash locations in 2023.

Table 3 shows that both networks do a relatively good job of capturing 2023 crashes. However, the high-risk network appears to slightly outperform the crash frequency-based HIN analysis. This underscores the importance of considering risk in the Triangle West region along with locations that have experienced severe crashes recently.

TABLE 3 Comparison of the DCHC Bike/Ped HIN and Pedestrian High-Risk Network

	DCHC Regional Bike/Ped High Injury Network		DCHC High Risk Network (Top 500 Segments)	
	Total	Percent	Total	Percent
Total Mileage	119.18	3.8%	127.23	4.1%
Total KA Crashes	11	44.0%	13	52.0%
Total KAB Crashes	35	30.2%	47	40.5%
Total Crashes (All Severities)	62	29.8%	86	41.3%

3 NCDOT Non-Motorist Crash Map: https://www.arcgis.com/home/item.html?id=b4fcdc266d054a1ca075b60715f88aef

Prioritization Framework

Understanding and Assumptions

- The purpose of this analysis is to identify locations that could be suitable for project development by Triangle West and its member jurisdictions.
- This is not meant to scope or review project feasibility; however, the data analysis can help suggest to Triangle West the type of safety issues they might want to address.
- We can provide CMFs and countermeasures for the region to consider, but we will not attempt to do any specific project scoping or diagnosis.
- This framework will not consider access-controlled roads/highways in the screening.
- The output of this work will be lists of priority areas (corridors and intersections) for each part of the network:
  - A regional list that includes DOT-maintained roads
  - Agency-specific lists that will focus on areas where local agencies can affect change
- Next step may be to screen priority lists for locations that have already received a project or treatment in recent years.

Framework

Prioritize locations that have the potential to affect one or more of the following dimensions of safety:

- **Severity – Reduce the kinetic energy associated with collisions:** Projects that reduce the kinetic energy of collisions will be prioritized. Crashes that occur at higher speeds and at more severe angles are more likely to result in a fatality or serious injury. The most effective proven safety countermeasures, such as roundabouts and all-way stops, are effective because they can either 1) reduce the speed at which a potential collision occurs or, 2) reduce the angle (i.e., sideswipes instead of head on or angle crashes) at which crashes occur.
- **Likelihood – Reduce the likelihood of a collision occurring:** Proactive projects that prevent a collision from occurring will be prioritized. The Action Plan may include projects that remove or reduce potential conflicts that tend to result in more severe outcomes. Example strategies include intersection designs that reduce conflicts points between left-turning vehicles and on-coming traffic and median barriers that reduce or prevent cross-centerline collisions.
- **Exposure – Reduce the exposure to potential collisions:** Reducing exposure to collisions is another method of reducing severe crashes. This can take many forms, but a simple example may be the presence of bicycle and pedestrian traffic generators near major traffic thoroughfares. For example, this could be applicable to reviewing existing transit stops that may be incurring unsafe and unexpected crossings or reviewing planned development for proximity to high-speed, high-volume crossings. Projects that provide refuge and visible crossings in the former example and reconsideration of traffic patterns in the latter example are examples of projects that should be prioritized.

Practical Application

- Separate paths for corridors and intersections
- **Corridor path**
  - Severity: Flag segments that are above the average 50th percentile speed. If no reliable speed data are available, severity will be assumed to be low, and likelihood and exposure will be used to rank
  - Likelihood: Flag segments that are in the top 20% of bike or ped risk or on the bike/ped HIN, as well as a separate flag for being in the top 20% of lane departure or speed risk or on the "all mode" HIN

- Exposure: Flag segments above 9,000 and 15,000 AADT[4], as well as segments in suburban, urban, urban core, and rural town contexts. Below is the order of priority in terms of highest to lowest priority

AADT	Context
1. >15,000 2. 9 ,000 – 15,000 3. <9,000	1. URBAN CORE 2. URBAN 3. RURAL TOWN 4. SUBURBAN

- According to this framework, priority will be given to corridors that:
  - Are an above average speed for the functional class
  - Have a high likelihood of either a VRU or motor vehicle collision
  - Are in neighborhoods where multiple modes are more likely to be present
- Separate lists will be developed for vehicular and VRU priority
- Example:
  - Road One is identified as a high priority location because it exhibits high speeds (85th percentile +), high Bicycle Risk, Moderate High Lane Departure Risk, Moderate Volumes, is in an Urban area, and is on the Bike/Ped HIN,
  - Road Two is not identified as a high priority location because it has the same indicators, except speeds are more moderate, and it is Moderate Bicycle Risk and is not on the Bike/Ped HIN.

- **Intersection path**
  - Severity: Flag Intersections that are on corridors that have above average 50th percentile speeds on an approach (corridor analysis). If no reliable speed data are available for any approach, severity will be assumed to be low, and likelihood and exposure will be used to rank
    - Roundabouts and all way stops receive lowest "Severity" priority by default
  - Likelihood: Flag intersections that are in the top 20% of bike or ped risk or on the bike/ped HII, as well as a separate flag for being in the top 20% of total crash risk or on the "all mode" HII.
  - Exposure: Flag intersections with approaches above 9,000 and 15,000 AADT, as well as intersections in suburban, urban, urban core, and rural town contexts. For AADT, all approaches will be considered so intersections with multiple approaches >15k will be highest priority. Below is the order of priority in terms of highest to lowest priority:

AADT	Context
1. >15,000 2. 9 ,000 – 15,000 3. <9,000	1. URBAN CORE 2. URBAN 3. RURAL TOWN 4. SUBURBAN

  - According to this framework, priority will be given to intersections that:
    - Have an approach that has an above average speed for the functional class
    - Have a high likelihood of either a VRU or motor vehicle collision
    - Are in neighborhoods where multiple modes are more likely to be present
  - Separate lists will be developed for vehicular and VRU priority

4 Thresholds noted in FHWA's Unsignalized crossing guidance: https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/docs/STEP-guide-improving-ped-safety.pdf

Tiers for Prioritization

- High priority locations will be those that meet the highest criteria in each category, Severity, Likelihood, and Exposure
- Based on the top tier of locations, those that meet all the criteria, we will find top locations for the region and each agency (Orange County, Durham County, Chatham County, Chapel Hill, Hillsborough, City of Durham, and Carrboro) for inclusion in the final action plan

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