

DRAFT Appendix F: Priority Emphasis Areas Analysis Methodology

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Overview

Development of the Priority Emphasis Areas required the completion of three primary processes. First, a kernel density analysis identified the concentration of bicyclist crashes across the region. Second, a contour analysis converted raster data from the kernel density output to contours, which are vector data that could be further analyzed and modified. Finally, a boundary adjustment process was performed on the contours so they better fit the real-world geography of the region.

Step 1: Kernel Density Analysis

The [*Kernel Density*](#) tool was used to identify areas where a high density of bicyclist crashes occurred in the region. The Kernel Density tool calculates the density of crashes occurring in “neighborhoods” around crash locations. Therefore, kernel density analysis can identify areas of high, moderate, and low bicyclist crash density and provide direction on where to prioritize the implementation of bicycle networks to improve safety.

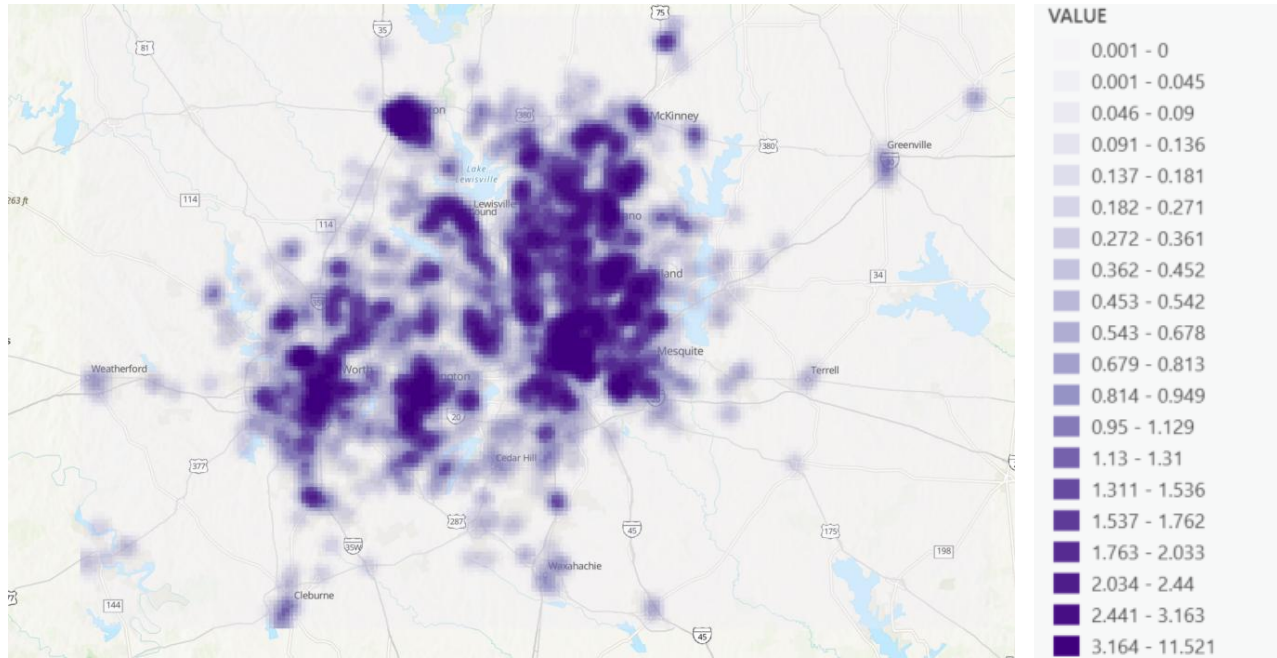
Kernel Density Parameters

Data for the kernel density analysis was filtered to only include crashes occurring within the TxDOT Urbanized Area GIS layer, as an overwhelming majority of crashes (99%) occurred within this area. This layer is comprised of polygons representing the adjusted 2020 Census Urbanized Areas with a population over 5,000. In addition, the TxDOT Urbanized Areas represent human development patterns more conducive to bicycle trips. Funding for active transportation infrastructure is limited, and the TxDOT Urbanized Areas serve as a starting point for NCTCOG’s prioritization.

Mobility 2050, the Metropolitan Transportation Plan for the North Texas Region, places an emphasis on providing traveler choice. The Plan aims for “All trips less than two miles in length in the urbanized areas should have options available to be accomplished by nonmotorized, transit, or micromobility modes of travel.” A 2-mile search radius was selected for the kernel density analysis to reflect a typical bicycle trip. In this application, the Kernel Density tool represents a distance decay function, whereby bicyclist crashes in close proximity (a typical bicycle trip distance) are more similar than those further away.

A half mile was determined to be the appropriate output cell size to represent crash influence neighborhoods for a regional analysis. A half mile provides a degree of detailed representation of overlapping crash search radii values without being too granular. Therefore, half mile influence neighborhoods provide enough detail to identify differences in densities across the region without being too large that crash densities are generalized and not representative of the reality.

Figure F1: Density of Bicyclist Crashes in the North Texas Region's Urbanized Area



Step 2: Contour Analysis

Contour analysis converts crash data generated during the kernel density analysis into high-quality maps that support more detailed examinations necessary for planning purposes. Contours provide smooth, clearly defined boundaries that show where crashes are concentrated and allow for the overlay of thematic geographies that are required for further analysis. Through this process, crash densities are organized into high, medium, and low categories to further highlight safety trends across the region.

Defining High, Moderate, and Low Priority Emphasis Area Values

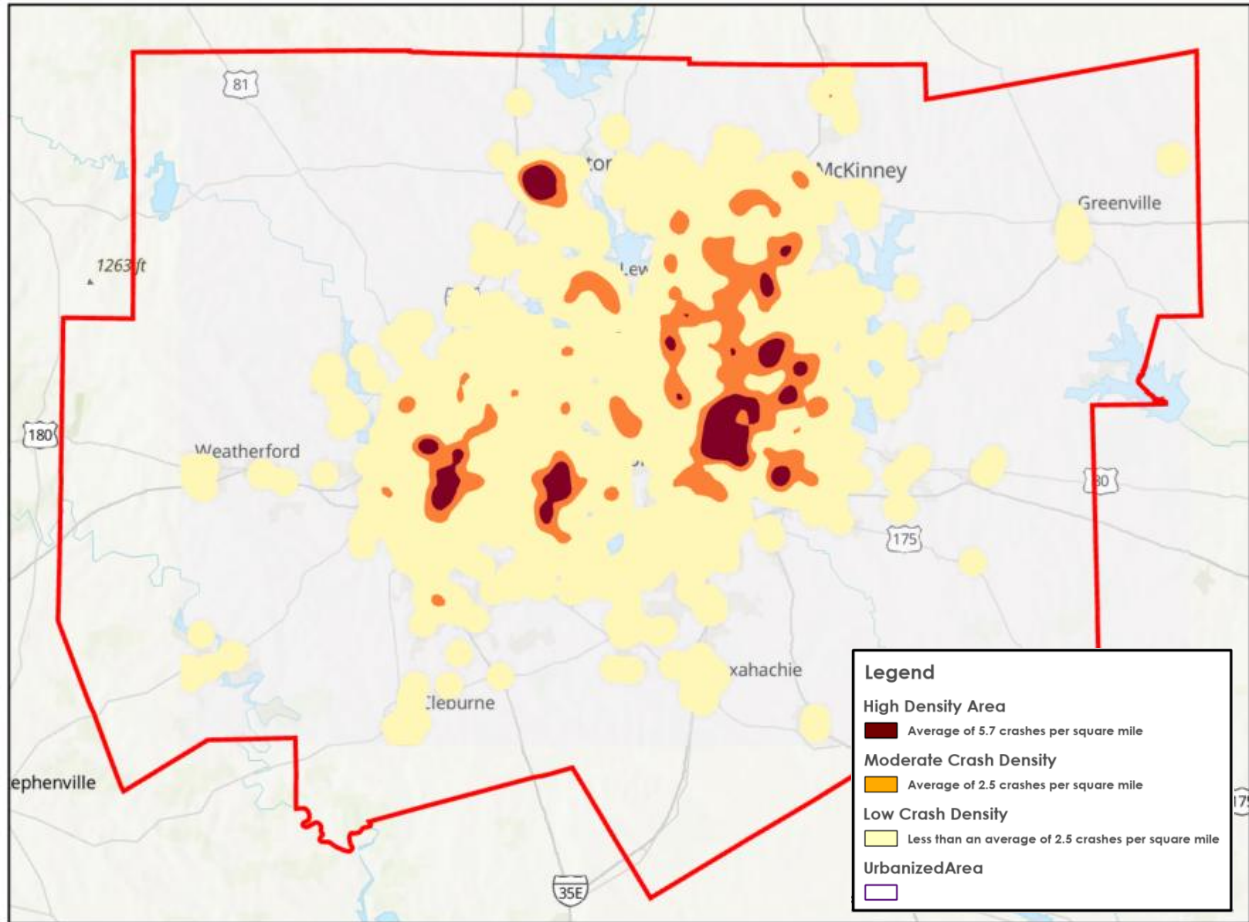
The highest quantile class, representing the top 5% of bicyclist crash density output cells, was designated as the threshold for identifying “High” crash density areas. This class has an upper density limit of 11.3 crashes per square mile and accounts for 21% of total bicyclist crashes, despite covering only 2.6% of the urbanized area. The mean crash density within this interval is 5.7 crashes per square mile.

The subsequent three quantile intervals, encompassing the top 6th to 20th percentile of crash density cells, were classified as “Moderate” crash density areas. These cells have an upper density threshold of 3 crashes per square mile, capture 34% of crashes, and occupy 9% of the urbanized area. The mean density within this range is 2.5 crashes per square mile.

The remaining 16 lower quantile intervals, representing the bottom 80% of crash density cells, define the “Low” crash density areas. This classification includes cells with density values up to

1.7 crashes per square mile and captures the remaining 45% of crashes across 88.4% of the urbanized area. The average density in this category is approximately 0.4 crashes per square mile (equivalent to 1 crash per 2.5 square miles).

Figure F2: Contour Analysis Output for High, Moderate, and Low Priority Emphasis Areas



Step 3: Boundary Adjustment Process

Contour analysis provides valuable insight into where bicyclist crashes are most concentrated across the region. However, the contour polygons generated through this method produce boundaries that overlay the built environment rather than conforming to it. As a result, these boundaries are not well-suited as a planning tool, since they fail to reflect the real-world conditions bicyclists encounter on the region's roadway and trail networks. To address these limitations, a boundary adjustment process was undertaken using professional judgement to realign areas of high and moderate bicycle crash density with local geographies, ensuring the results are more meaningful and practical for planning applications.

The Systemic Approach

Relying on crash history alone to inform policy decisions and determine the implementation of safety countermeasures is a reactive approach that leaves road users vulnerable to safety gaps within the transportation network. Crash density areas were adjusted using a systemic approach, which requires proactive tools to be used to identify and address safety issues before crashes occur. Six factors were analyzed to identify patterns corresponding with previous bicyclist crash incidents to predict where future crashes may occur. Boundaries for Priority Emphasis Areas were adjusted using professional judgment to account for the factors identified in Table F1.

Table F1: Criteria Considered during the Boundary Adjustment Process

Criteria	Description
Bicyclist Crash Locations	Documented history of nearby bicyclist crashes.
Priority Bicycle Safety Corridors and Intersections	Identified prioritized roadways and intersections with a documented history of bicyclist crashes.
Points of Interest	Specific destinations anticipated to generate future bicycle trips.
Natural and Manmade Barriers	Crossings with no dedicated bicycle facilities.
Existing or Planned Bikeway Facilities	Opportunities to expand the bikeway network.
Mobility 2050 Demand Zones for Walking and Bicycling Travel	General areas anticipated to generate future bicycle trips (see Figure F3).

Figure F3: Demand Zones for Walking and Bicycling Travel

