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methods

Appendix 7 - Table of Contents

A7.1 Purpose of Methods 120

A7.2 Data Sources and Year Ranges 121

A7.3 GIS Environment and Base Mapping 121

A7.4 Crash Analysis Approach 122

A7.5 High Injury Network (HIN) Development 122

A7.6 Supplemental Spatial Analysis 122

A7.7 Prioritization and Interpretation Methods 123

A7.8 Assumptions, Limitations, and Context 123

A7.9 Quality Control and Review 124

A7.10 Relationship to Other Appendices 124

A7.1 Purpose of Methods

Data sources, analytical methods, GIS workflows, and assumptions used to support the Bridgeport SS4A Safety Action Plan are included in the following methods documentation and are intended as a technical reference for engineers, planners, and reviewers seeking transparency into how analyses were conducted and how findings were developed.

The methods described here support:

- Crash analysis and severity screening (**APPENDIX A2**)
- Mapping and spatial visualization (**APPENDICES A3** and **A6**)
- Findings and interpretation (**APPENDIX A4**)
- Project and countermeasure prioritization (**APPENDICES A8** and **A9**)

Methods were scaled appropriately for a rural community context and generally aligned with FHWA SS4A and Safe System guidance for systemic safety planning.

A7.2 Data Sources and Year Ranges

Crash Data

Source: Nebraska Department of Transportation (NDOT) crash records

Years Covered: 2014–2023

Geographic Extent:

- Bridgeport corporate limits
- City limits plus a 1-mile jurisdictional buffer

Severity Classification:

- Fatal
- Injury A (serious)
- Injury B (moderate)
- Injury C (minor)
- Property Damage Only (PDO)

Crash data were reviewed for completeness, consistency, and spatial accuracy prior to analysis. Records were screened for location accuracy, duplicate entries, and alignment with roadway centerlines.

As several crash record fields were incomplete or inconsistently populated within the statewide crash database, individual law enforcement crash reports were reviewed to supplement and verify key analytical information where available.

Additional review included:

- Driver age
- Crash type and manner of collision
- Contributing circumstances
- Lighting and weather conditions
- Roadway context and movement patterns

Manual review was particularly important given the low crash volumes typical of rural communities, where individual severe crashes can substantially influence interpretation of risk patterns.

This supplemental review improved consistency of crash interpretation and supported more detailed understanding of systemic risk factors within the study area.

Roadway and Boundary Data

- City of Bridgeport street centerlines
- NDOT state highway centerlines (US-26, US-385, NE-88)
- Corporate limits and extraterritorial jurisdiction boundaries
- Railroad centerlines and at-grade crossings

Supplemental Data

- Sidewalk and ADA inventory (where available)
- School locations and activity areas
- Parks, recreation areas, and community facilities
- Hospital, fire hall, and emergency service locations
- Public input locations from the online safety comment map and surveys

A7.3 GIS Environment and Base Mapping

All spatial analysis and mapping were completed using ArcGIS Pro and ArcGIS Online. Spatial datasets were maintained in a consistent projected coordinate system (Nebraska State Plane Coordinates, NAD83, USFeet) to support accurate measurement, buffering, spatial analysis and spatial alignment with existing city GIS data layers.

Additional tools used for documentation, visualization, and data management included:

- ArcGIS StoryMaps Online
- Microsoft Excel
- Microsoft PowerPoint

Base mapping and visualization included:

- Local and state roadway networks
- High-resolution aerial imagery for spatial context
- Parcel and land use references (where relevant)
- Standardized symbology for crashes, severity levels, and safety features

Spatial data layers were reviewed for topology issues, projection consistency, and attribute completeness prior to analysis.

A7.4 Crash Analysis Approach

Crash analysis emphasized severity, exposure, and systemic risk factors, rather than crash frequency alone, consistent with FHWA SS4A guidance for small and rural communities.

Key steps included:

- Filtering crashes by study year range and severity
- Separating corporate-limit and extended-area datasets
- Reviewing crash distributions by:
  - Severity
  - Corridor and roadway type
  - General context (downtown, highways, residential streets, school areas)
- Avoiding trend-line analysis where low annual counts would produce misleading results

Findings were interpreted using Safe System principles, emphasizing roadway characteristics, exposure conditions, and systemic risk factors associated with severe crash outcomes rather than relying solely on crash frequency.

Crash analysis outputs informed:

- High Injury Network (HIN) screening
- Identification of priority corridors and intersections
- Interpretation of systemic risk factors is discussed in **CHAPTER 3** and **APPENDIX A6**

A7.5 High Injury Network (HIN) Development

A High Injury Network screening was conducted to identify roadway locations associated with fatal and injury crashes using both intersection-based and corridor-based methods.

HIN Parameters

- **Intersection Buffers:**
  - 40-meter radius around intersections
- **Roadway Segments:**
  - 100-meter segment lengths along roadway centerlines

HIN Methodology

- All fatal and injury crashes (Fatal, Injury A, Injury B, Injury C) were included
- Crash points were spatially joined to intersection buffers and roadway segments
- Segments and buffers containing one or more injury crashes were flagged
- PDO crashes were reviewed for contextual understanding but not used as primary screening criteria

The HIN was used as a screening and visualization tool, not as a prescriptive ranking mechanism, recognizing the limitations of low crash counts and high variability in rural settings.

A7.6 Supplemental Spatial Analysis

Additional spatial analysis techniques were used to understand crash dispersion and exposure-based risk, including:

- Hexagon grid mapping to visualize crash distribution and persistence
- Corridor-based review of state highways including Main Street and 5th Street
- Overlay of crash locations with:
  - School areas
  - Parks and community facilities
  - Railroad crossings
  - Pedestrian infrastructure gaps

These analyses supported identification of recurring, network-level risk conditions beyond isolated crash locations.

Field review observations and windshield assessments were conducted to verify roadway context, visibility conditions, pedestrian exposure, parking interactions, and operational characteristics at key corridors and intersections.

Public comments, survey responses, stakeholder input, and near-miss locations collected through the online mapping platform and engagement activities were geospatially reviewed

alongside crash data and roadway conditions.

Reported concerns were evaluated for recurring patterns related to:

- Visibility limitations
- Speed concerns
- Crossing difficulty
- School access
- Sidewalk and ADA gaps
- Winter walking conditions

Near-miss clustering was compared with High Injury Network corridors and key destinations to identify locations where exposure and perceived risk may not yet be fully reflected in reported crash history.

This approach supports FHWA SS4A guidance encouraging proactive identification of systemic risk conditions in rural and small-community environments.

A7.7 Prioritization and Interpretation Methods

Rather than relying on a single numeric scoring formula, the plan uses a multi-factor prioritization framework that considers:

- Crash severity and injury risk
- Exposure (pedestrian activity, school routes, traffic volumes where available)
- Systemic roadway risk factors (speed, visibility, geometry, access constraints)
- Community input and near-miss concerns
- Implementation feasibility and jurisdictional authority
- Alignment with SS4A eligibility and Safe System principles

In locations with limited crash history, prioritization emphasized exposure-based risk, recognizing that vulnerable users may experience elevated risk even where severe crashes have not yet occurred.

Prioritization also considered implementation readiness factors such as jurisdictional coordination requirements, compatibility with planned NDOT projects, feasibility within existing right-of-way, and ability to advance as phased or quick-build improvements.

Opportunities for phased implementation and quick-build demonstration treatments were also considered to support near-term deployment of lower-cost safety improvements.

Engineering and planning judgment were applied throughout interpretation and prioritization to account for local roadway context, operational characteristics, and practical implementation considerations.

This approach ensures that locations with high potential consequence, even where crash history is limited, are appropriately prioritized.

A7.8 Assumptions, Limitations, and Context

The following assumptions and limitations apply to the analyses documented in this plan:

- Crash data reflect reported crashes only and do not capture near-miss events
- Low crash counts limit statistical trend and predictive modeling
- Year-to-year variability is high in small communities
- Pedestrian and bicycle exposure data are limited or unavailable
- Some infrastructure datasets are incomplete or generalized

These conditions reinforce the plan's emphasis on proactive, systemic safety strategies rather than reactive, crash-driven approaches.

Due to low crash volumes and limited exposure data typical of small rural communities, advanced predictive safety modeling was not utilized. Emphasis was instead placed on systemic risk identification, roadway context, and proactive safety assessment.

A7.9 Quality Control and Review

Quality assurance and quality control (QA/QC) steps included:

- Review of crash point accuracy and alignment with roadway centerlines
- Cross-checking severity classifications
- Consistency checks across maps, tables, and narrative summaries
- Validation of HIN parameters and buffer distances
- Internal review of analytical outputs prior to interpretation and publication

A7.10 Relationship to Other Appendices

Supports and complements:

- **APPENDIX A2 – COLLISIONS**
- **APPENDIX A3 – CRASH MAPS**
- **APPENDIX A5 – MAPS**
- **APPENDIX A6 – FINDINGS**
- **APPENDIX A8 – PROJECTS**
- **APPENDIX A9 – COUNTERMEASURES**

Together, these appendices provide a transparent, reproducible foundation for the Bridgeport SS4A Safety Action Plan.