A More Standardized Approach to Identify and Understand the High-Injury Network

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Research Needs

Many cities have developed their own version of a high-injury network analysis. The resulting analyses characteristically show that 50% of their road fatalities take place on only 5% of streets. Or that 60% of fatalities take place on 6% of lane miles. Whatever the specifics, the underlying thinking has proven to be beneficial for cities trying to identify their high-risk road segments in order to reduce or eliminate traffic fatalities and severe injuries.

Unfortunately, the ad-hoc and individualized nature of the underlying high-injury network processes lacks consistency. This lack of a standardized approach hinders comparative analysis, systematic evaluations, as well as our ability to share successful strategies. More specifically, current practice prevents us from systematically examining the defining characteristics of our most dangerous streets. Without a more cohesive understanding of the problems that plague road safety, the impact of our interventions remains siloed, as insights and strategies cannot be easily shared or scaled. This reduces their potential effectiveness at the regional and national level.

Establishing a standardized, replicable approach for high-injury network analysis will provide cities with a tool to better understand and address dangerous roads. This standardization is essential for the preservation of our existing transportation infrastructure by helping ensure that both our designs and interventions can be systematically evaluated in a way that the resulting insights can be compared and shared across different contexts.

Research Objectives

The key steps for this project are the following:

1. Conduct literature review
2. Identify existing data sources
3. Develop a generalizable and replicable approach for defining high-injury networks
4. Apply this standardized approach to the primary city of each of the 100 largest metropolitan areas in the United States
5. Create a comprehensive dataset of high-injury networks
6. Analyze the defining characteristics of these dangerous streets, including street and network design features, to identify common patterns and factors
7. Advance knowledge by carrying out the above analyses and facilitating better-informed, evidence-based decision-making in road safety strategies
8. Advance policy and practice with respect to building safer cities by providing a comparative analysis framework
9. Advance education through the hands-on training of students
10. Build an evidence base by disseminating findings through publications and presentation

Research Methods

The overarching intent of the following is to build a comprehensive, replicable approach for high-injury network analysis that can be used across multiple cities:

Literature Review and Analysis of Existing High-Injury Network Methodologies

The intent of Phase 1 is to review the existing literature on high-injury network analyses as well as gather information on current methods used by different cities This will include a systematic review of academic papers, city reports, and transportation studies.

Data Collection and Standardization
In Phase 2, we plan to collect and work to standardize the various data sources needed to support the development of a high-injury network analysis. This will likely involve normalizing data formats, resolving discrepancies in data collection methods, and ensuring compatibility across different data systems and cities.

Development of Standardized Approach for Identifying the High-Injury Network
In order to develop our approach for identifying a high-injury network, we intend to use GIS and spatial statistical tools to first identify patterns and commonalities across different cities. We will then work to statistically test what data inputs are important or not. This will allow us to develop and refine algorithms that can automatically identify high-injury networks based on a standard set of data inputs.

High-Injury Network Model Testing and Assessment
After piloting the approach in a select number of cities to test its applicability, we will conduct sensitivity analyses to determine how changes in data inputs or model parameters affect the outcomes. We will also compare the results with existing high-injury network analyses to assess the effectiveness of our methodology.

High-Injury Network Model Application
We will then test our approach to the identification of the high-injury network for the primary city in the largest 100 U.S. metropolitan areas. Part of this process will be to detect recurrent design features of the high-injury network streets and street networks.

Relevance to Strategic Goals

This project directly supports the USDOT's strategic goal of enhancing safety. By creating a common data-driven methodology to help cities identify and compare their high-injury networks, the project offers a scalable and replicable approach that can be adopted both regional and nationally. This will facilitate data informed decision-making, comparative analysis, as well as benchmarking. But still, the bottom line is that this project will help cities share best practices and improve safety outcomes.

Educational Benefits

This study will provide opportunity for student research in terms of data collection, analysis, and paper writing. It will also be integrated into a graduate-level Transportation System Safety course being offered in Fall 2024. The resulting data will be made available to students for use in term projects, master's reports, and PhD dissertations.

Outputs through Technology Transfer

The overarching goal is to disseminate the findings in a fashion that helps cities improve their road safety outcomes. So, in addition to publishing papers in peer-reviewed journals and presenting at major transportation and urban planning conferences, we intend to share our methods and findings in less academic venues via op-eds, online videos, and workshops. We will also be sure to collect and organize our data and results in a non-proprietary format so that other researchers can contribute to the work.

Expected Outcomes and Impacts

The anticipated outcomes of this research include:

- Development of a standardized approach to high-injury network analysis
- Understanding into common conditions of high-injury networks across different cities
- Identification of street and network design issues that may be contributing to high injury and fatality rates
- Fostering of a more unified approach across cities when it comes to identifying road safety issues and improving road safety outcomes
- Supporting the broader goal of preserving existing transportation infrastructure by arming cities with the information needed to target their road safety interventions

Work Plan

The proposed scope of work is scheduled for one-year and will adhere to the following timeframe:

Task	Timeline
Literature review	Months 1 – 2
Identify data sources	Months 1 – 3
Develop methodology	Months 3 – 5
Test and validate methodology in real cities	Months 5 – 7
Apply methodology to larger set of cities	Months 7 – 9
Analyze results	Months 9 – 10
Incorporate lessons into classes	Months 9 – 10
Draft paper and presentation materials	Months 10 – 12

Project Cost

Total Project Costs:	$251,330
CTIPS Funds Requested:	$125,665
Matching Funds:	$125,665
Source of Matching Funds:	University of Colorado Denver

References

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