Center for Transportation Research and Education

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RESEARCH PROJECT TITLE

A Transportation Safety Planning Tool for the City of Ames

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The mission of the Center for Transportation Research and Education (CTRE) at Iowa State University is to develop and implement innovative methods, materials, and technologies for improving transportation efficiency, safety, and reliability while improving the learning environment of students, faculty, and staff in transportation-related fields.

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A Transportation Safety Planning Tool for the City of Ames

tech transfer summary

Incorporating new safety analysis methods into the long-range transportation planning process can assist city decision-makers in setting and monitoring progress toward transportation safety goals.

Objectives

The main objective of this research was to examine the applicability of existing models/tools for forecasting in small and medium-sized communities given changes in socio-demographics, traffic demand, road network, and countermeasures. City planners and engineers are seeking additional ways to consider safety explicitly in the transportation planning process. This research investigated the applicability of three safety analysis methodologies for small-area planning agencies, where the lack of guidance is particularly challenging.

Problem Statement

Safety-related legislation (e.g., the Safe, Accountable, Flexible, Efficient Transportation Equity Act/SAFETEA-LU) mandates planning by state departments of transportation (DOTs) that "considers the results of state, regional, or local transportation and highway safety planning processes." Although there is an increasing interest in developing safety performance measures and incorporating safety into the transportation planning process, few tools are available that planning agencies can use.

Moreover, there is no national guidance on how to measure and incorporate safety into the transportation planning process for small and medium-sized communities. The City of Ames is representative of hundreds of small and medium-sized communities across the US.

During the period from 2002 through 2008, on average, 1,000 traffic crashes (of property damage more than $1,000) occurred per year in the Ames (Iowa) Area Metropolitan Planning Organization (AAMPO). For communities like Ames, safety has traditionally been considered separately from the regional transportation planning process, and has typically been incorporated only at the project design level or addressed by enforcement agencies.

The historically-reactive approach to identifying safety problems and mitigating them involves selecting black spots or hot spots by ranking locations based on crash frequency and severity. The approach focuses mainly on the corridor level without taking the exposure rate (vehicle miles traveled) and socio-demographics information of the study area (which are very important in the transportation planning process) into consideration.

Research Description and Methods

This study included a state-of-the practice literature review and data collection and descriptive data analysis for the City of Ames.

Existing planning tools (such as the PLANSAFE models presented in NCHRP Report 546) were examined for forecasting safety in small and medium-sized communities, particularly as related to changes in socio-demographic characteristics, traffic demand, road network, and countermeasures.

The research also evaluated the applicability of the Empirical Bayes (EB) method to network-level analysis. In addition, application of US Road Assessment Program (usRAP) protocols at the local urban road network level was investigated.

Summary of Key Findings

Although the three safety analysis techniques studied in this work have potential for application in planning, all have limitations.

The calibrated PLANSAFE-like SPF models provide predicted crash frequency based on historical crash data, road network data, and socio-demographics data at the planning level. The PLANSAFE software uses the same theory as the models but provides a more user-friendly interface for planners who do not have backgrounds in statistics. Both approaches can be policy-sensitive, by including variables within the control of decision makers, such as planning and zoning restrictions, utility provisions, or road plans.

However, for cities the size of Ames, small crash datasets and short road segments limit the calibration of policy-sensitive models. In fact, only two, limited variable PLANSAFE-like SPFs could be developed for Ames. In addition, the PLANSAFE software was not applicable given the available data, necessitating the development of customized models.

The EB crash analysis methodology is useful for problem site identification. EB is useful for small, lower crash density locations, as it combines the limited information available from site-specific crash histories with information from similar locations (SPFs). The EB method gives more-precise and less-biased crash prediction than traditional crash frequency/rate methods. The method is particularly useful when long crash histories (more than, say, four years) are not available.

usRAP-style risk mapping can be used to incorporate risk into decision making. Each of the four usRAP-style maps clearly present area-wide crash risk information of interest to various user groups (road authorities, drivers, etc.), demonstrating that no single map can provide all of the information needed to make effective safety planning decisions. The maps can be used to identify higher-risk roads that could be useful as agencies comply with Federal SAFETEA-LU requirements.

Finally, all of the studied methodologies require significant amounts of detailed data, including located crash data and road attribute data. For planning agencies with limited access to such data, approximations may be possible using appropriate statewide databases.

Recommendations

1. As set forth in legislation, safety should be an integral part of the agency's planning objectives and goals and it should be emphasized throughout the life cycle of transportation planning.

2. Data-driven safety planning requires the collection and maintenance of quality data including geocoded crash and road network data.

3. Due to the clarity and effective graphical presentation of usRAP-style risk maps, they may be more useful in early stages of the transportation planning and public involvement process.

4. More detailed evaluation of high-risk locations should be conducted with the EB methodology.

5. The PLANSAFE models or software are most useful in "big picture" planning and policy analysis. Even if models cannot be developed to be sensitive to policies within the control of metro planners, the models can be used to forecast the impacts of changes in socio-economics and demographics so that cities may be more prepared for long-run changes in safety.

6. Following this process, quantitative safety may be incorporated into the planning process, through effective visualization and increased awareness of safety issues (usRAP), the identification of high-risk locations with potential for improvement (usRAP maps and EB), countermeasures for high-risk locations (EB before and after study and PLANSAFE), and socio-economic and demographic-induced changes at the planning level (PLANSAFE).

Finally, while the applicability of these tools was examined for the City of Ames, it is recommended that additional case studies be performed as the tools may be more or less applicable in other locations. It is also recommended that the additional protocols of usRAP be examined for applicability to the small, urbanized area.