DRISI

Caltrans Division of Research, Innovation and System Information

Research Results

Prioritizing HCCLs Identified using Pedestrian Safety Monitoring Report Tool

Develop methods to identify and address pedestrian safety problems in California, with the goal of reducing pedestrian fatalities and injuries.

Transportation Safety and Mobility

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Project Title:
Prioritizing HCCLs Identified using Pedestrian Safety Monitoring Report Tool

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WHAT WAS THE NEED?

In the absence of pedestrian-specific safety performance functions for the entire state highway system, pedestrian-specific high collision concentration locations (HCCLs) are currently being identified by prioritizing based on the total number of observed collisions. However, given collisions are subject to random fluctuations and may suffer from regression-to-the-means phenomena. In addition, site investigators are likely to identify patterns in the crash characteristics, which in turn may inform recommendations. However, the site selection process does not account for this pattern recognition approach.

WHAT WAS OUR GOAL?

The objective of this research was to identify metrics to prioritize crash frequency-based pedestrian high collision concentration locations that went beyond prioritizing sites based on total number of fatal and injury collisions.

WHAT DID WE DO?

Caltrans, in partnership with the University of California, Berkeley Safe Transportation Research and Education Center identified a set tasks and activities to accomplish this research. We analyzed methods that controlled for the regression-to-the-mean phenomenon in the total number of crashes in the absence of safety performance functions (Method of Moments approach). We also evaluated methods that used information present within the coded, party-level crash data to identify recurring crash patterns further upstream in the decision-making process (Direct Diagnostics and Probability of specific crash types exceeding

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threshold proportion (HSM 4.4.2.9)).

In order to implement the pattern recognition-based methodologies, we also proposed two alternative pedestrian crash typologies. Once the crash typologies were defined, based on the methods described above, we considered different potential prioritization metrics. We assessed the quality of the aforementioned metrics with regards to (i) mimicking the pattern identification process of traffic safety investigators and (ii) minimizing cases where an HCCL investigation yields no action.

For an empirical assessment, we used the investigation results of round 1 of the pedestrian safety monitoring report (PSMR) which analyzed 129 pedestrian HCCLs. We analyzed these HCCLs to assess if the any recommendations were made, and if so whether the recommendations were in alignment of either the fixed of the dominant crash typology. Thereafter, we sorted 129 HCCLs using each metric and evaluated whether the investigations with no actions showed an monotonically increasing trend (fewer at the top, more at the bottom), and if the investigations with patterns yielded a monotonically decreasing trend (more at the top, fewer at the bottom). We also conducted some simulations to check if there can be other factors that may affect the accuracy of reliably detecting crash patterns.

WHAT WAS THE OUTCOME?

Based on the findings from this research, we recommend the following:

- Metrics derived from significance of pattern recognition may potentially mimic pattern identification process of investigators. Thus, incorporating pattern recognition-based metrics further upstream in the decision-making process can potentially help increase the likelihood ensuring that the investigators can find a recurring safety concern at a location.
- Fixed crash typologies provide more consistent results along with the added the advantage of being easy to interpret.
- Since the round 1 of PSMR did not contain many false positives, we encourage continuing further research into the methods and metrics analyzed in this project to assess if they are prone to predicting presence of recurring pattern in response to outliers.
- The results of the investigations also contain multiple cases of sites where countermeasures were implemented prior to the investigations as part of other capital projects. Thus, we recommend identifying sites that have undergone relevant design/operational changes prior to the HCCL list generation, so as to consider excluding them from the final list of recommended sites for investigations.
- We also recommend revising the existing network screening process to adopt a segmentation-based approach so as to make it easier to implement methodologies that require well-defined site characteristics (e.g., SPFs and method of moments). We also recommend considering model-based alternatives to method of moments as defining the reference populations for the latter approach is not straightforward.
- Using simulation, we show that that depending on the presence or absence of overdispersion, the performance of the direct diagnostic test may differ from the beta-binomial test. While the performance of both tests in the empirical dataset was similar, further research is warranted using simulation to develop more insights for formulating a more robust pattern recognition framework.

WHAT IS THE BENEFIT?

The results of the empirical analysis reveals that crash patterns can be captured further upstream in the HCCL prioritization process which can assist Caltrans in identifying sites that may be more likely to yield a countermeasure implementation. But since the identification of a pattern based on observed crashes may also be due to random fluctuations in crashes, future research in complementary projects can investigate how to

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reliably detect the presence of a high propensity of a site to observe recurring collisions of a given crash type.

IMAGE

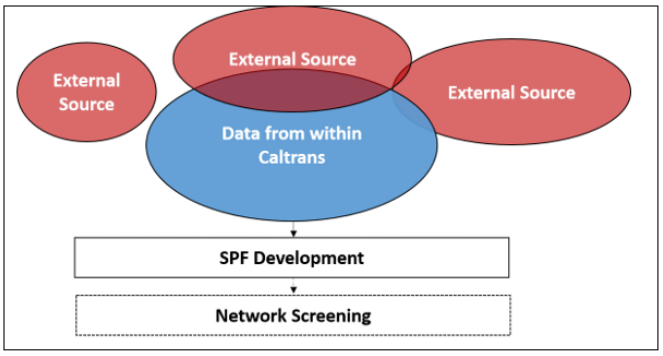

Image 1: Visualization of the scope of the project. This project seeks to develop a roadmap for integrating data sources within as well as outside of Caltrans and improving the overall quality of available data for SPF development, which will eventually improve the effectiveness of network screening employed for identifying high collision concentration locations.

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