U.S. Department of Transportation
Federal Highway Administration

Systemic Noteworthy Practice

Boone County's Local Road Safety Plan

Introduction

The systemic approach to safety is a risk-based approach to safety in which the system is screened for systemic risk and sites are prioritized based on the risk of a high-severity collision, as opposed to a history of crashes. The systemic approach is especially useful for low-volume local roads where little or no data may be readily available, and the risk of a severe crash is ever present despite the lack of crash history. Because of those situations where the systemic approach can be useful, Boone County, Kentucky used it to prioritize roadway safety improvements.

Boone County's Systemic Approach

The systemic approach is particularly apt for specific crash types that occur less regularly or in areas where crashes are more widespread, as opposed to clustered. The systemic approach uses site characteristics to evaluate risk despite limited crash numbers. This is especially applicable for Kentucky's Local Road Safety Plan (LRSP) program due to the lack of sites with a history of severe crashes. As one example, Boone County's LRSP sought to reduce deaths and serious injuries within the county by recognizing and prioritizing roadway safety improvements through the systemic approach.

Data Collection and Analysis

The first step was identifying focus crash types, facility types, and risk factors. Due to the low frequency for any single crash type, Boone County elected to focus on all deaths and serious injuries rather than limiting their systemic safety analysis to a singular focus crash type. The County elected to focus on all deaths and serious injuries on the "County Collector" system - a network of local roads that are important to the County, serving large populations or connecting to significant roads. The County ultimately focused on a system of 15 roadways that accounted for 35 miles, 65 percent of all crashes, and 75 percent of injury crashes.

In the absence of complete roadway data, the County chose to use a panel of County officials to assign a "Qualitative Hazard Score" for each collector road. The qualitative hazard score was based on six features:

1. Horizontal curves.
2. Operating speed.
3. Traffic volume.
4. Vertical curvature.
5. Clear zone.
6. Roadway width.

Each item was rated minimal hazard (1), moderate hazard (2), or high hazard (3). The County summed the scores for each risk factor across the segment for a total roadway qualitative hazard score along each corridor.

Table 1. Prioritized roadway rankings for the County Collector System. Source: Boone County.

Road Name	Horizontal Curvature	Speed	ADT	Vertical Curvature	Clear Zone	Road Width	Qualitative Hazard Score	Hazard Rank
Camp Ernst	3	3	3	3	3	3	18	1
Limaburg	3	3	3	3	3	3	18	1
Longbranch	3	3	3	3	3	3	18	1
Litton	3	3	3	3	3	3	18	1
Hicks	3	3	3	3	2	3	17	5

The second step was screening and prioritizing candidate locations. To do so, the County sorted the roads by qualitative hazard rank, in order from highest total hazard score to lowest. Table 1 is an excerpt from the Boone County LRSP showing the ranked order of the roadways and the individual and total hazard scores for each site.

The County then paired the hazard ranking with a ranking using Equivalent Property Damage Only (EPDO) scoring. The EPDO method assigns a score of 1 to property damage crashes, a score of 5 to injury crashes, and a score of 10 to fatal crashes. Again, the County ranked the "County Collector" roadways from highest to lowest using the EPDO score.

Outcomes

Boone County combined both analyses in a final ranking to prioritize roadways for further safety investigation. Table 2 shows the EPDO rank, hazard rank, final rating, and final ranking for the top 15 roadways. As shown, the EPDO and hazard rankings were summed for a final rating, which was used to create a final ranking.

Conclusion

The first key takeaway is systemic safety analysis can be performed despite limited data. Second, local knowledge is useful for assessing safety risk. The LRSP chose individuals that were qualified and familiar with the County roads in a variety of circumstances, allowing for a more robust and reliable hazard rating. Lastly, agencies can combine risk data and crash data to prioritize system elements for potential safety improvements. Boone County developed a range of recommended improvements in the LRSP to address the highest ranked roadways, as well as a recommendation to provide systemwide improvements to horizontal alignment signs and object markers.

Contact

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Table 2. Boone County LRSP Final Ranking (table 3; Boone County, LRSP 2022).

Street Name	EPDO Rank	Hazard Rank	Final Rating	Final Rank
LITTON	1	1	2	1
CAMP ERNST	2	1	3	2
LIMABURG	3	1	4	3
LONGBRANCH	6	1	7	4
HICKS	9	5	14	5
OAKBROOK	5	10	15	6
ROGERS	8	10	18	7
BULLITSVILLE	10	10	20	8
CONRAD	7	14	21	9
POINT PLEASANT	12	9	21	9
WILLIAMS	16	5	21	9
CAYTON	4	22	26	12
WOOLPER	20	7	27	13
SALEM CREEK	14	14	28	14
STEPHENSON MILL	15	14	29	15

References

Gooch, J., Gross, F., Dunn, M., Kersavage, K., Sanders, R., Schoner, J., Himes, S., Albee, M., & Boller, N. (2024, August). Systemic Safety User Guide. Federal Highway Administration, Washington, D.C. FHWA-SA-23-008. https://highways.dot.gov/safety/data-analysis-tools/systemic/systemic-safety-user-guide

Boone County Local Road Safety Plan (2021) available at (Boone County, Updated 2022): https://cms7files.revize.com/boonecountyky/document_center/PublicWorks/Boone%20County_KY_Local%20Road%20Safety%20Plan.pdf

The Kentucky LTAP Technology & Transfer Program Presentation available at (Kirk, 2021): https://www.youtube.com/watch?v=iAE9LlQc4yQ&t=1079s