Crash Rate Performance of Edge Lane Roads

MICHAEL WILLIAMS

2024 ITE Western Conference

Outline

- My Career
- Introduction to Edge Lane Roads
- Highway Safety Manual Project-Level EB Method

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My Career

- BS Computer Engineering, 1982…… 17 years
- MS Electrical Engineering, 1984
  - Embedded Systems Computing/Medical Devices
  - >10 Patents in Medical Devices
- Public Works General Contractor…… 15 years
  - Roads, Bridges, Buildings
- MS Civil Engineering, 2017 …… 7 years
  - Alta Planning+Design, Independent Consultant
  - North American Champion for Edge Lane Roads (ELRs)

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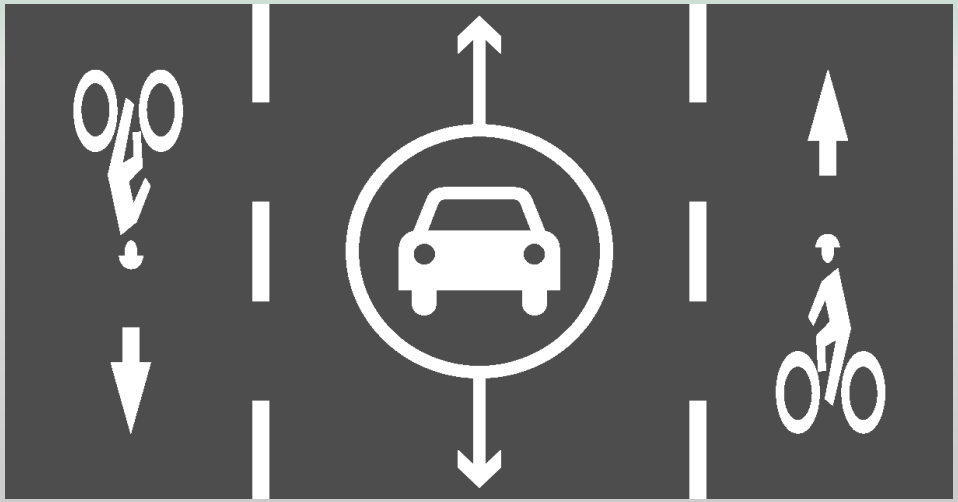
What is an Edge Lane Road?

An ELR is a roadway which supports two-way motor vehicle traffic within a single center lane and vulnerable road users such as bicyclists, pedestrians, etc in the edge lanes on either side. Motor vehicles are allowed to use the edge lanes, after yielding to any VRUs there, to pass approaching vehicles.

AKA Advisory Bike Lanes or Advisory Shoulders



Edge Lane | Center Lane | Edge Lane

ELR Design Guide, courtesy of www.edgelaneroads.com

How Safe are Edge Lane Roads?

While used for decades in other countries, ELRs are new to the US and safety data is scarce. Limited before/after analyses have been performed with good results but more rigorous studies did not exist.

Results from a more rigorous study spanning multiple ELRs was needed.

METHOD

Eleven U.S. installations were found to have at least 5 years of pre-install and 3 years of post-install crash data + traffic volume data.

Empirical Bayes analysis was used to estimate the expected post-install crash rates for each ELR. Site-specific CMFs and an aggregate CMF value for all sites were calculated. Crash Modification Factors (CMF) = actual crashes/predicted crashes.

This procedure used Safety Performance Functions (SPFs) and relevant CMFs for 2-lane roads in the project level approach described in the AASHTO Highway Safety Manual.

Edge Lane Roads are Safe!

RESULTS

Aggregate CMF of .56 for 11 sites and > 60 million vehicle trips.

Three ELRs had CMFs > 1.0 but these were artifacts of their low volumes and the crash types included in the analysis.

A 3 year post-install survey period reduces the chance that safety improvements are temporary.

Aggregate CMF = 16/28.39 = .56

ELR	Urban or Rural	Length (feet)	Posted Speed (miles/hour)	ADT (vehicles/day)	N_{exp} (3 years)	N_{obs} (3 years)	Site CMF
Bridge Street	Urban	250	25	926	0.05	0.00	0.00
Flynn Avenue	Urban	1400	25	4349	1.87	0.00	0.00
Eastern Road	Rural	4766	25	1019	3.97	0.00	0.00
W 54th Street	Urban	1196	30	2400	1.00	0.00	0.00
Lakeview Ave	Urban	1600	25	1741	1.31	2.00	1.53
W 46th Street	Urban	1304	30	4280	4.97	1.00	0.20
Harvard Lane	Urban	1497	25	380	0.46	1.00	2.19
E. 54th Street	Urban	4250	30	4329	10.75	8.00	0.74
E. 7th Street	Urban	2507	25	200	1.55	2.00	1.29
Oak Street	Urban	913	25	810	2.30	2.00	0.87
Morton Road	Urban	2900	25	200	0.16	0.00	0.00
Totals				**20,634**	**28.39**	**16**	

A complete paper is available at www.advisorybikelanes.com/more-info.html.

Safety Performance of Edge Lane Roads

Michael Williams, Transportation Consultant; Marcial Lamera, M.S. Student Cal Poly SLO; Dr. Anurag Pande, Associate Professor of Civil & Environmental Engineering Cal Poly SLO

PROBLEM

An edge lane road (ELR) is a road which supports 2-way motor vehicle (MV) traffic within a single center lane and vulnerable road users (VRUs) in the edge lanes on either side. Motor vehicles may use the edge lanes, after yielding to any VRUs, to pass approaching vehicles. ELRs are also known as Advisory Bike Lanes or Advisory Shoulders.

Despite decades of use in other countries, ELRs are relatively new to the US and safety data is scarce. Limited before/after analyses existed for six North American installations but more rigorous studies did not exist until this work.

METHODS

Eleven American ELRs were found with the required MV volume data and at least five years of pre-installation and three years of post-installation crash data. Empirical Bayes (EB) analysis as described in Hauer* was used to estimate post-installation crash rates. The procedure uses Safety Performance Functions provided in Chapters 10 and 12 of the Highway Safety Manual (HSM). EB analysis was performed using the project-level approach described in section A.2.5 of the HSM.

A CMF for each ELR was calculated as the ratio of the actual 3-year post-installation crash count (N_{obs}) to the EB estimate (N_{exp}). Because site CMFs have limited applicability, an aggregate CMF was calculated as the ratio of the total actual crash counts to the total EB estimated crashes.

RESULTS

Aggregate CMF = 16/28.39 = .56

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CONCLUSIONS

An aggregate CMF of .56 was calculated over 11 sites and more than 60 million motor vehicle trips. A 3-year survey period indicates that this improvement is not a short-term phenomena.

This result shows that ELRs can be safer than a standard 2-lane road. This information, and decades of widespread international use, support the transition of this treatment from experimental status to interim approval by the FHWA.

Complete paper available at: www.advisorybikelanes.com/more-info.html.

*Hauer, E., D. W. Harwood, F. M. Council, and M. S. Griffith. Estimating Safety by the Empirical Bayes Method: A Tutorial. *Transportation Research Record: Journal of the Transportation Research Board*, Vol. 1784, 2002, pp. 126–131.

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Highway Safety Manual (HSM) Terminology

Safety Performance Function (SPF): a regression equation that estimates the average crash frequency of a given site with given base conditions.

Crash Modification Factor (CMF): a measure of the change in crash frequency for a well-defined change to a given road type in given conditions. Equals actual # crashes/predicted # crashes.

Facility: the entity being studied. It can consist of one or more sites. The HSM provides 3 facility types: rural 2-lane roads, rural multi-lane highways, & **urban-suburban arterials**.

Site: A facility is composed of a contiguous chain of sites where each site is either a roadway segment or an intersection. The HSM provides 4 site types: signalized intersections, unsignalized intersections, divided road segments, & undivided road segments.

Segment: A segment is a portion of road with consistent cross-section and defined by two endpoints. These endpoints can be intersections, on- or off-ramps, a change in cross-section, or a change in roadway characteristics (eg AADT).

Intersection: an area where two or more roadways meet, including the roadway, and roadside facilities for pedestrian and bicycle movements within the area.

ELR Safety Study

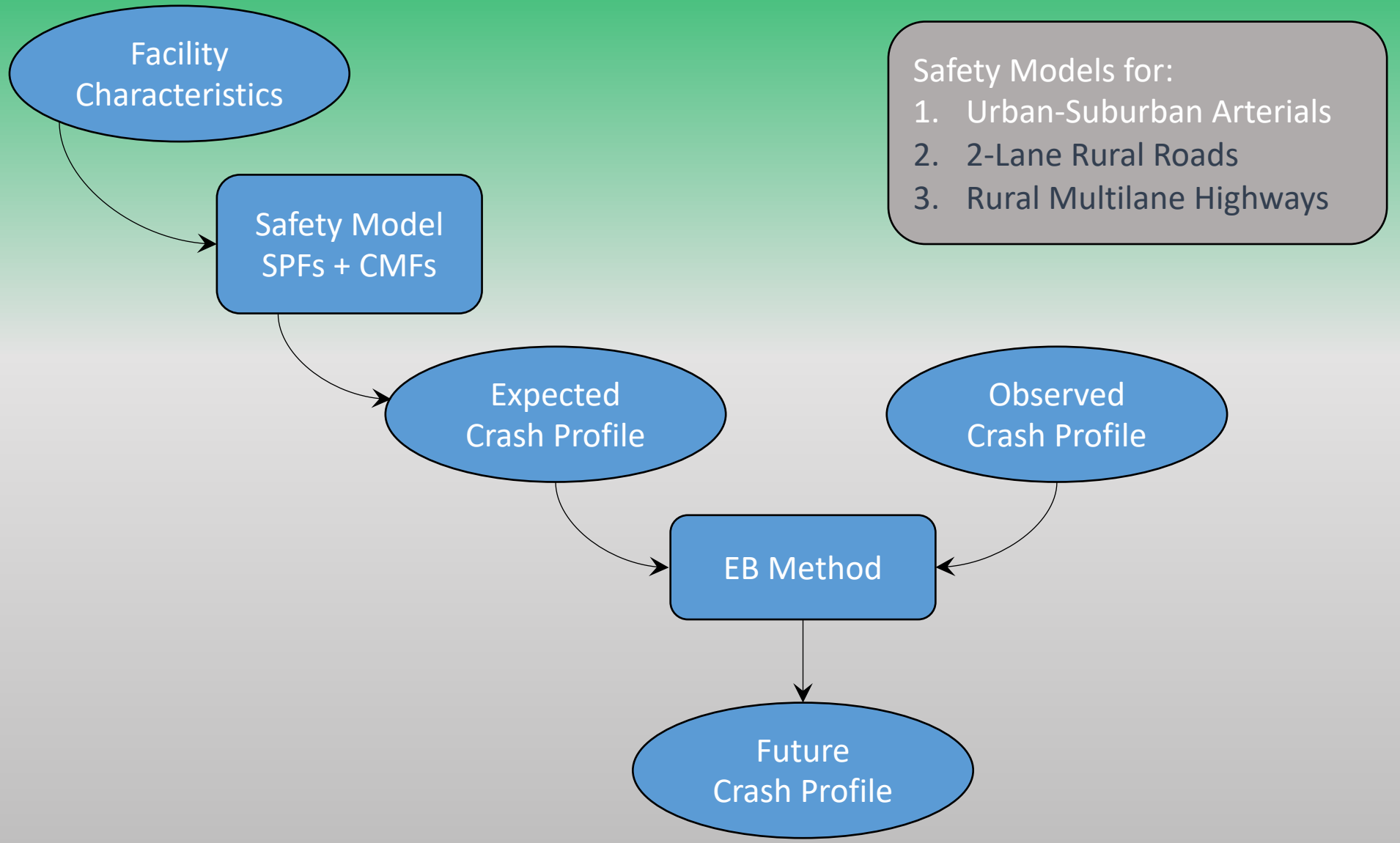
The purpose of our study was to use information on roadway characteristics, 5 years of pre-ELR-installation crash data and 3 years of post-ELR-installation crash data to determine what safety impact ELR installation had on a roadway.

We examined 11 facilities over 8 years, >60 million motor vehicle trips

This presentation reviews one of those facilities

– East 54th Street in Minneapolis, MN

Highway Safety Manual (HSM) Predictive Method



Highway Safety Manual (HSM) Predictive Method

The HSM contains 2 procedures for predicting facility crash rates using the Empirical Bayes (EB) method. The EB method can only be used when reliable, observed crash data is available for the facility.

1. Site-Specific EB Method
   Used when crash data provides good information on location

2. **Project Level EB Method**
   Used when crash data may not provide good location information

Highway Safety Manual (HSM) Worksheets

The HSM includes worksheets for different facility types that implement these procedures.

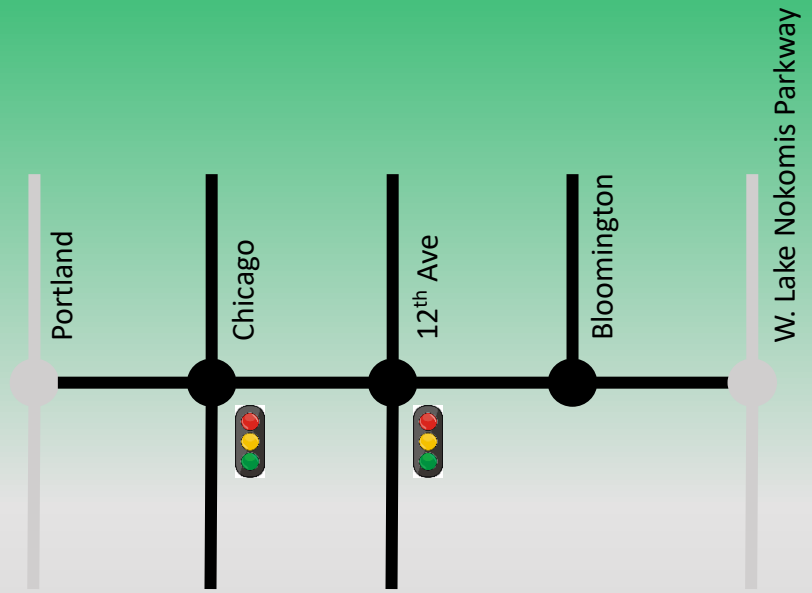
Dr. Karen Dixon created spreadsheets to automate use of the HSM worksheets.

These spreadsheets take facility characteristics (road user volumes, road type, intersection type, presence of signals, etc) and past crash profile data and return a crash profile prediction.

Lessons on Crash Data

- Good crash data processing is time intensive.
- Crash data forms are defined by each state. Policies on data availability differ on a state-by-state and agency-by-agency basis.
- Crash records often contain errors and incomplete data.
- You must create a consistent story from a crash record to understand what data is missing, in error, needed, etc.
- Assume you will never have all the (correct) info you need

FACILITY: EAST 54TH STREET



|----------East 54th Street ELR ----------|

Minor streets crossing E. 54th were treated as significant driveways due to missing data.

East 54th Street Spreadsheet


Thank You
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www.edgelaneroads.com

TRB Poster Presentation Video

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