Safety Effects of Turning Movement Restrictions at Stop-controlled Intersections

Presented by

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Outline

- Background
- Objectives
- Methodology
- Data set
- Results
- Conclusions and Future research
- Q & A

Background

- Turning at stop-controlled intersections:
  - Full movement (no restrictions)
  - Left turn from mainline only
  - Right-in-right-out (RIRO)
- FHWA's Development of Crash Modification Factors (DCMF) program


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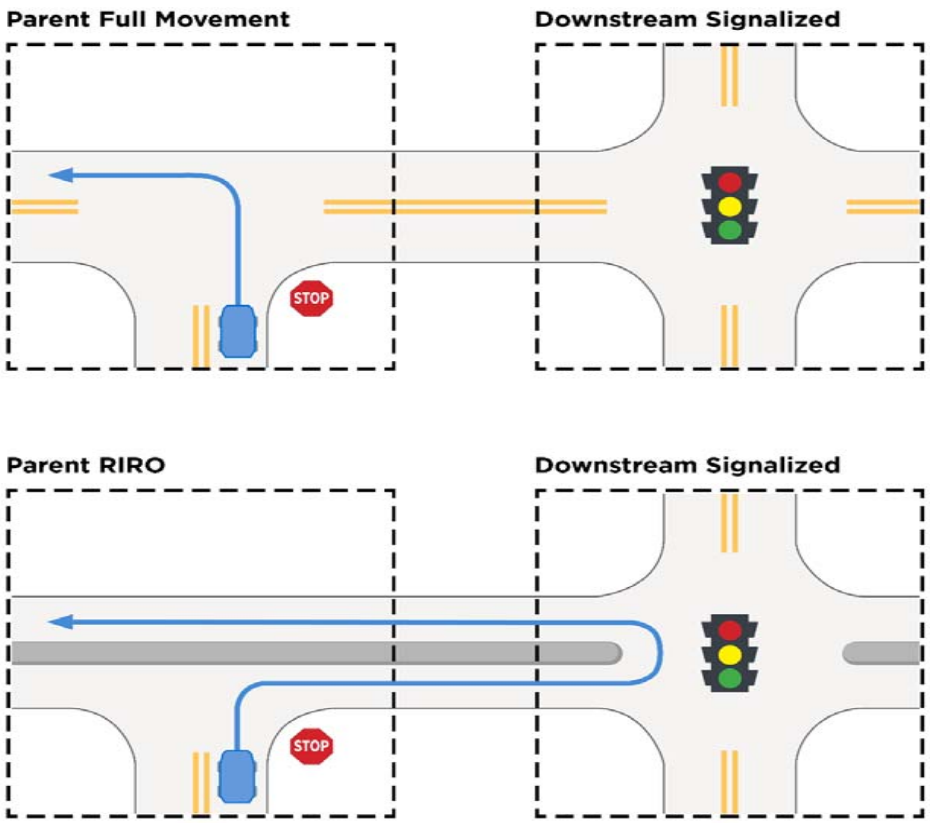

Parent Full Movement
Downstream Signalized
STOP
Parent RIRO
Downstream Signalized
STOP

Study objectives

- Quantify the effects on safety of RIRO restriction
  - Total crashes
  - All intersection-related crashes
  - Fatal & Injury crashes
  - Multi-vehicle crashes
- Examine possible crash migration
- Disaggregate analysis
- Estimate economic effectiveness

Methodology

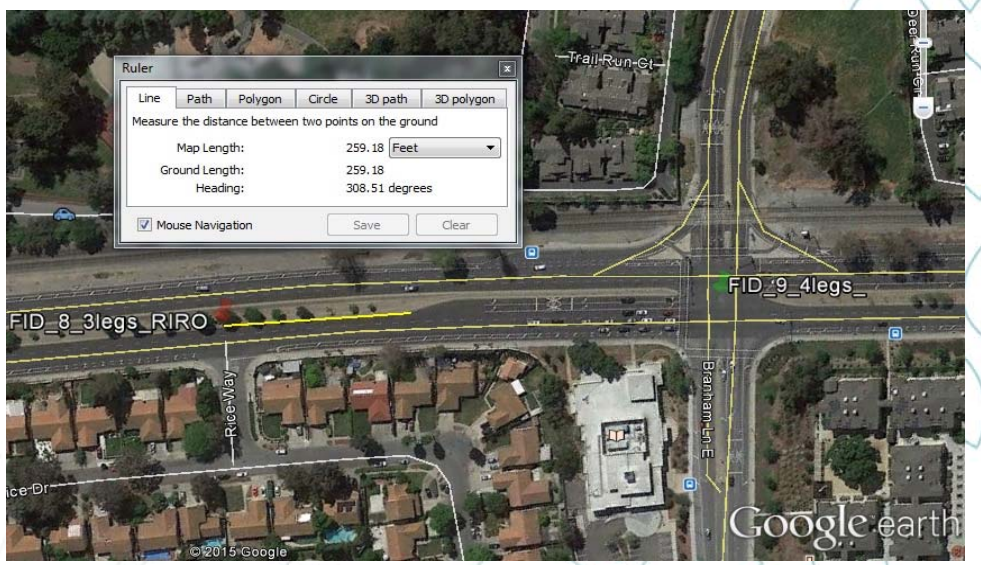
- Cross-sectional analysis: Negative-Binomial models
  - Locations with and without restriction
  - Account for contributing factors
- Adopt Propensity Score Matching

Data Collection

- Data collected for a previous FHWA project: *Safety Evaluation of Access Management Policies and Techniques*
- Data in GIS format:
  - Location
  - Turning restriction type
- Supplemented with HSIS data:
  - Traffic data: AADT
  - Geometric data: number of lanes, lane width, design speed, turn lanes
  - Crash data
- Enriched and verified using Google Earth

Data Enrichment and Verification

- Transfer intersections from GIS to Google Earth
- Identify and match street name with intersection description in HSIS (also street name)
  - Only available for California HSIS data
- Use upstream and downstream intersections for verification
- Use “ruler” tool for distance measurement



int_desc	FID	trf_cntl	milepost	int_prf	county	xstaadt	cntyrte	inty_rte	int_rte	rte_nbr
GAZANIA DR	6	B	1.16		43	101	04082 43 D		.	082
BOUGAINVILLEA DR	7	B	1.32		43	301	04082 43 D		.	082
RICE WAY	8	B	1.481		43	101	04082 43 D		.	082
BRANHAM LN		B	1.631		43	600	04082 43 D		.	082
VALLEY HAVEN WAY	10	B	2.03		43	400	04082 43 D		.	082
SKYWAY DR (SNELL RD)		M	2.133		43	8200	04082 43 D		.	082
SENTER RD		M	2.662		43	2600	04082 43 D		.	082

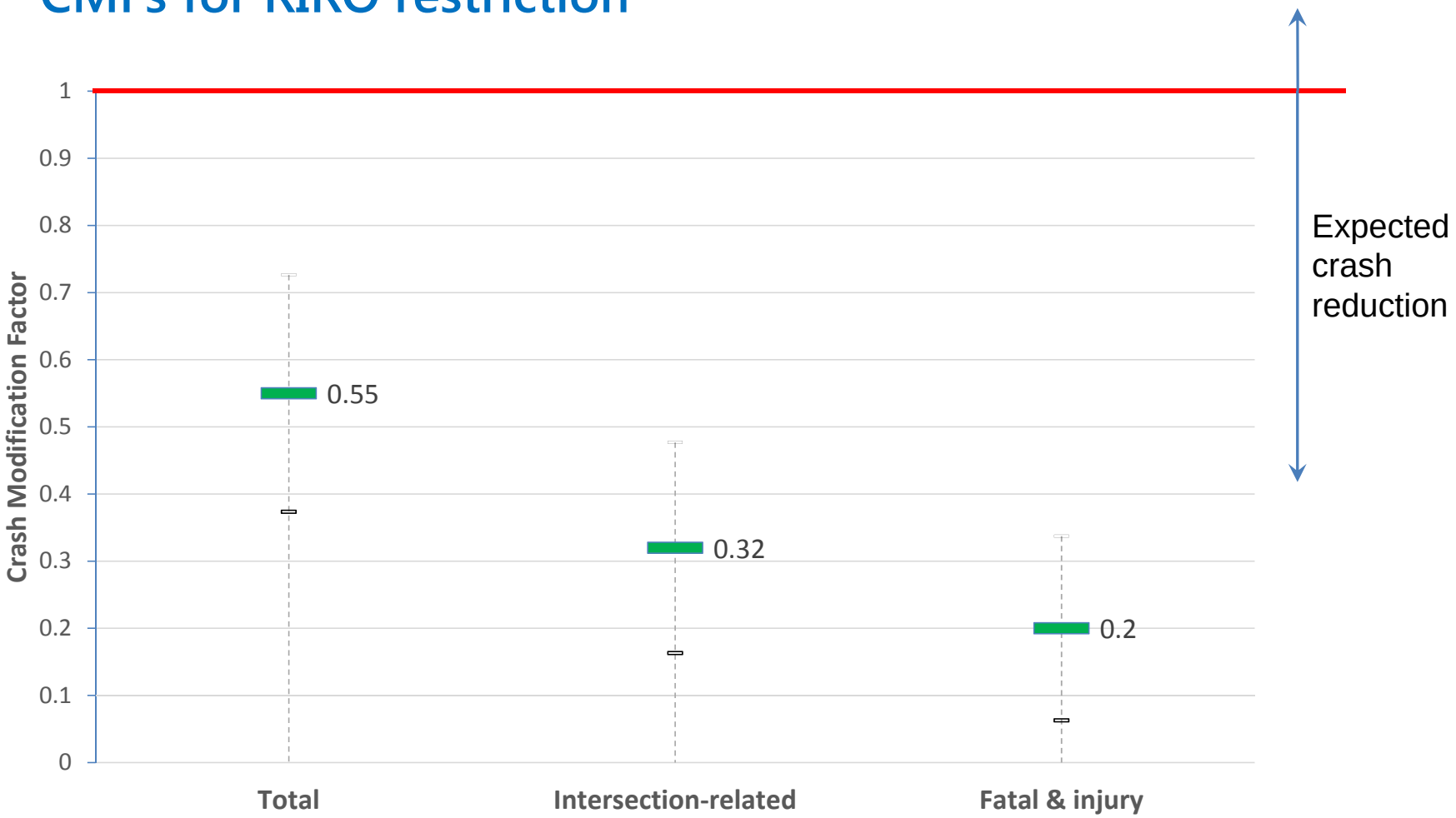
Final Dataset

- RIRO restriction: 58 intersections
  - 48 nearest downstream U-turn locations
- Full movement: 80 intersections
  - 61 nearest downstream U-turn locations

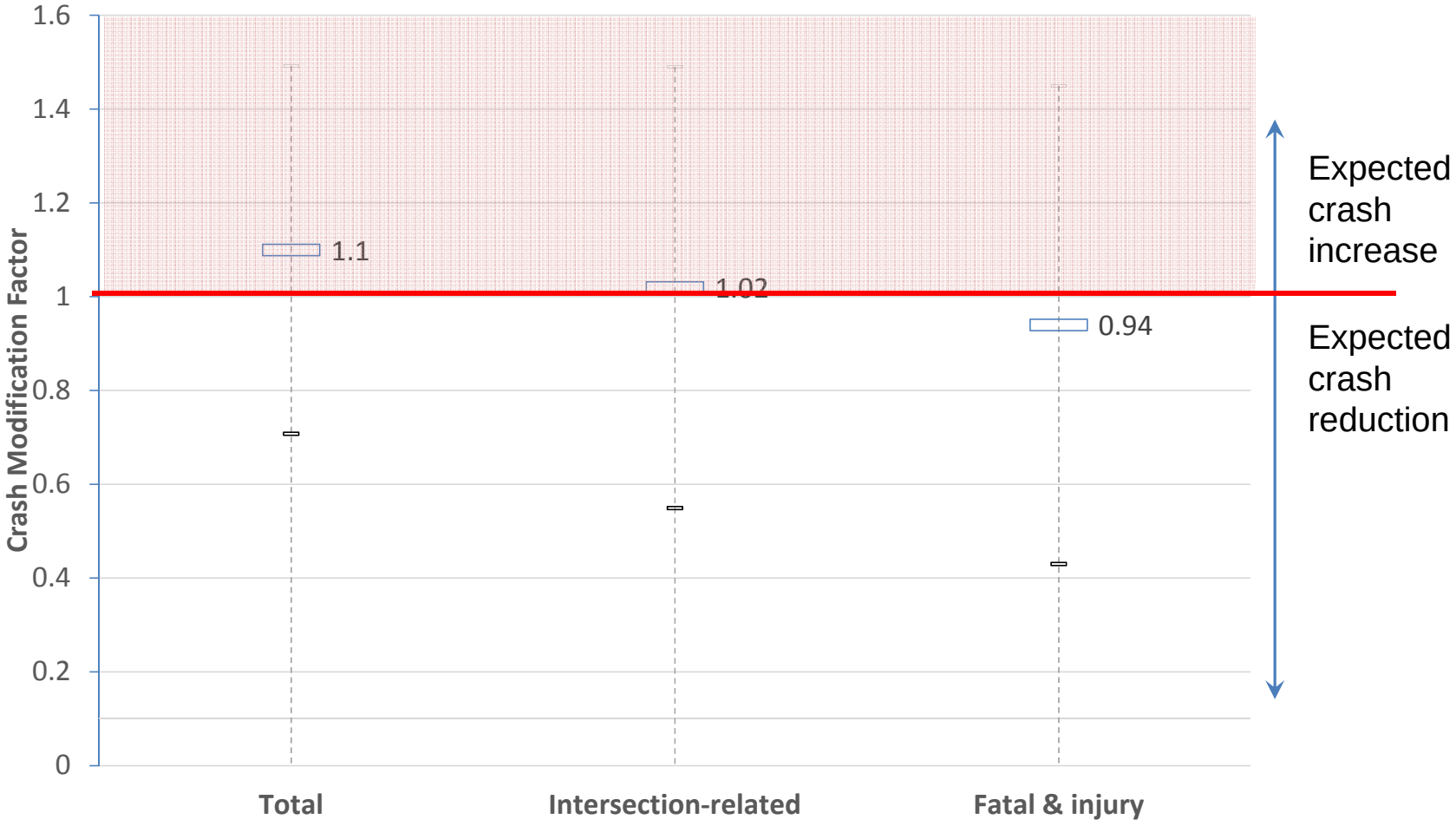
Results

- CMFs for RIRO restrictions
- CMFs for downstream intersections
  - Signalized
  - Stop-controlled
- Disaggregate analysis

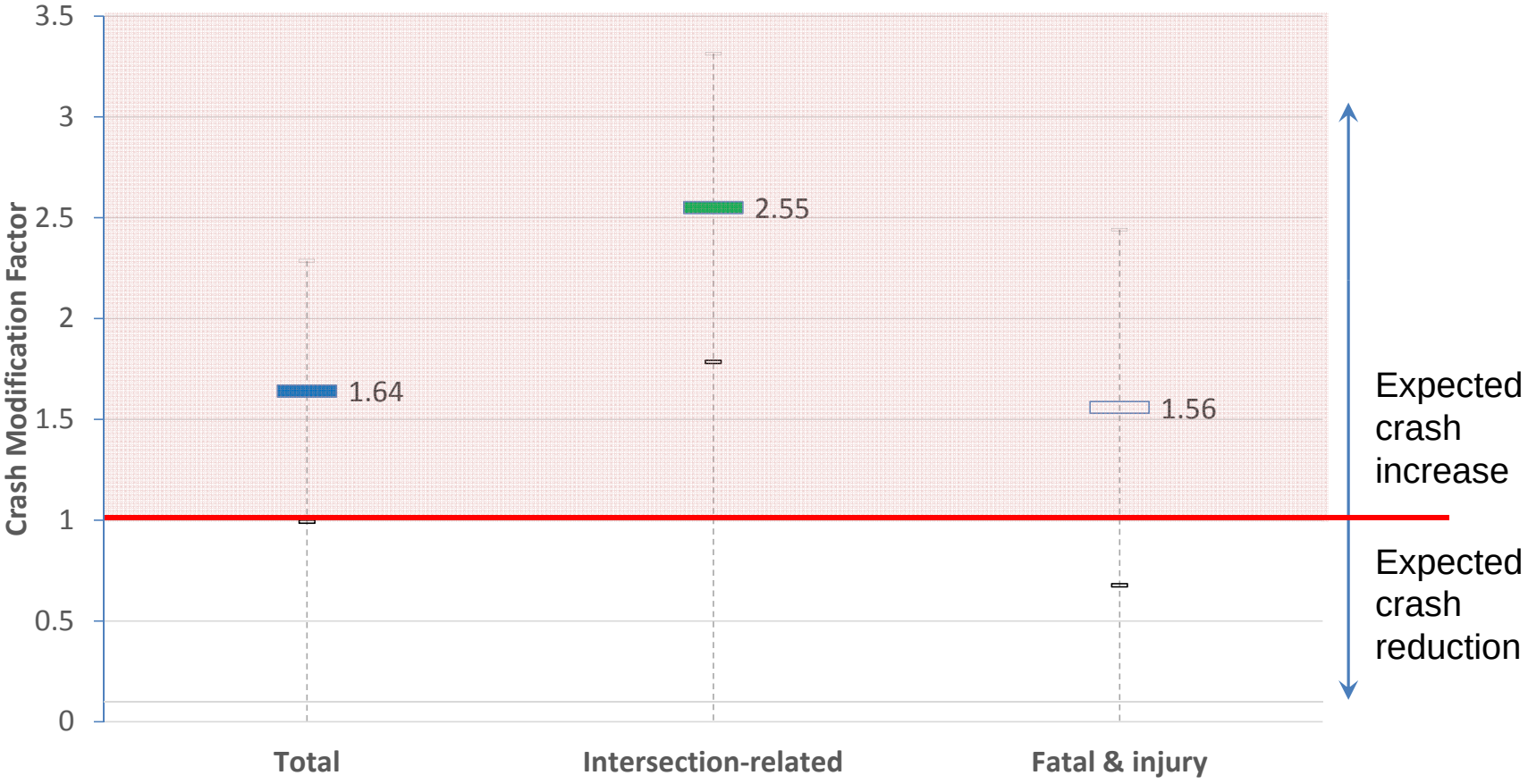
CMFs for RIRO restriction



CMFs for Downstream Intersections (Signalized)



CMFs for Downstream Intersections (Stop-controlled)



Disaggregate Analysis

- Disaggregated by:
  - Traffic volumes
  - Number of mainline lanes
  - Design speed on mainline
- No differences detected

Economic Analysis

- Hypothetical scenario based on assumptions
  - Crash cost saved: based on Fatal & Injury crashes
  - Construction and maintenance cost: median barrier
- Consider: Crash reduction vs. potential crash migration
- The analysis demonstrated potential economic benefits
- Recommendation: perform similar analysis with site-specific information

Conclusions

- RIRO benefit: Potential crash reduction
- Potential crash migration: Crash increases at downstream intersections
- Type of traffic control downstream
  - Signalized: smaller percent increase, not statistically significant
  - Stop-controlled: larger percent increase, more statistically significant
- Disaggregate analysis: No differences detected
- Economic analysis
  - Example: cost effective
  - Perform similar analysis on case-by-case basis

Opportunities for future research

- Similar analysis with data from other states
- Examine other crash types (e.g., pedestrian)
- Expand to include other facility types (e.g., two-lane)

Questions?

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