Synthesis of Operational Aspects and Safety Implications of Reduced Cross Sectional Elements

(Buffer Width vs. Shoulder Width vs. Lane Width)

PRESENTATION FOR:

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Previous Findings – Freeways

- Freeway crash prediction equations available in *Highway Safety Manual*
- Reduction in freeway shoulder width → increase crashes
- Reduction in freeway lane width → increase crashes
- Increase in crashes may be offset if reductions are done to increase number of freeway lanes

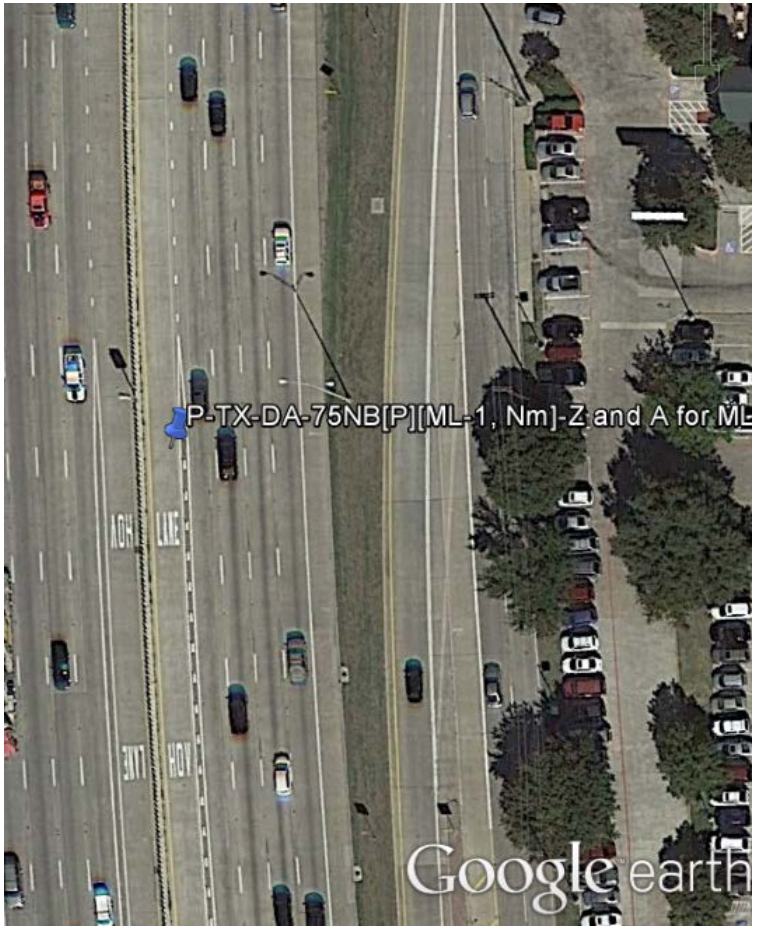
Previous Findings – Managed Lanes

- Florida study → crash prediction equations for HOV / HOT lanes
  - Significant variables – left shoulder width and 2-3 ft buffer (10 lane freeways)
- California study
  - Wider HOV lane width associated with fewer HOV crashes
  - Wider left shoulder width associated with fewer HOV crashes
- Texas study (narratives) identify following contributors
  - Reduced HOV cross section, location of GP ramps, speed differential

Site Selection

- Focus on sites with 1 managed lane (rather than 2 lanes)
- Eliminate sites w/ reversible ops or concrete barrier separation
- Prefer managed lanes that are operational 24/7
- Want range of buffer widths, shoulder widths, lane widths

Managed Lane Sections



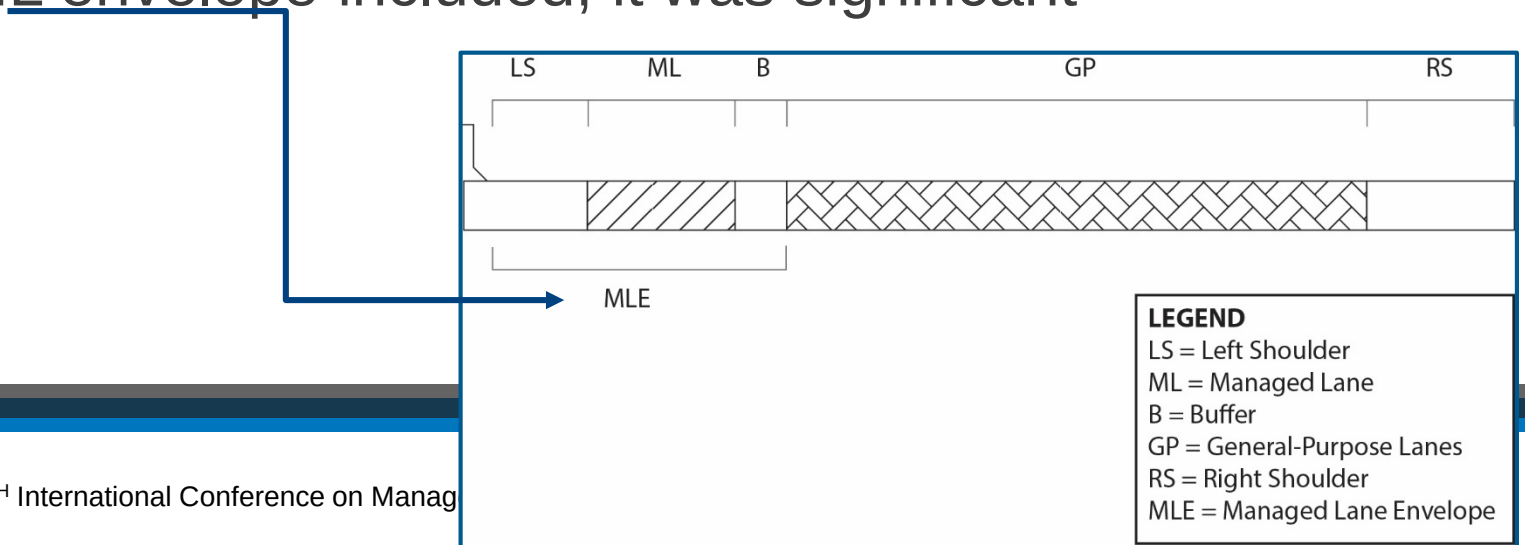
- Identify locations where the buffer (markings) change
- Classify as non-weaving or “weaving” sections
- Weaving =
  - Ramps
  - Opening in pavement markings
- Only considered non-weaving sections

Evaluations

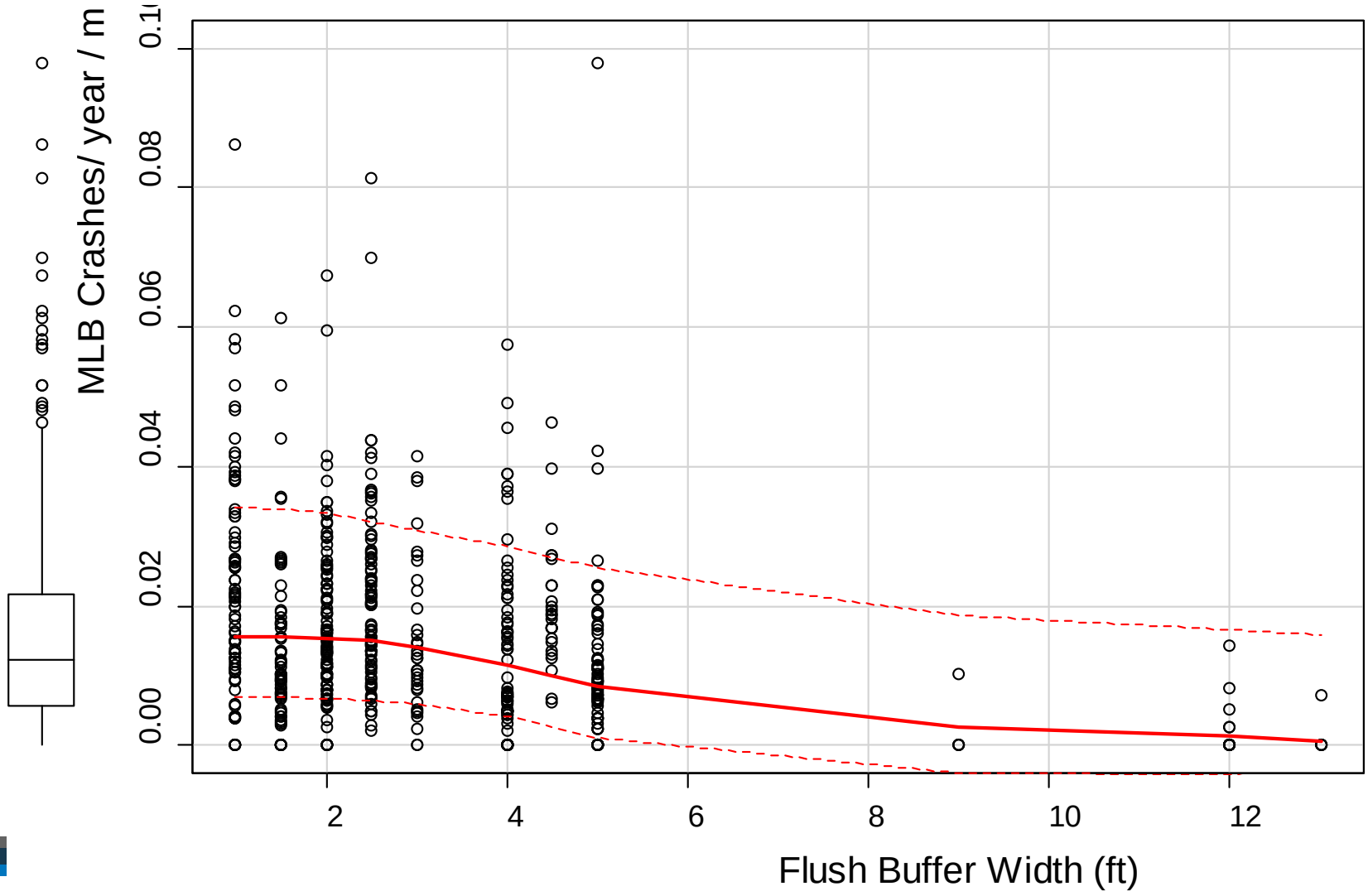
- Managed-lane related crashes → California only
  - All severity levels
  - Fatal and injury severity levels
  - AADT = volume on managed lane
- Freeway crashes → both California and Texas
  - All severity levels
  - Fatal and injury severity levels
  - AADT = volume on freeway

Findings – California, Managed-Lane Crashes, Fatal & Injury Severity

- Several models considered
- In most cases, only a few of the variables were significant
- When managed lane elements are included (shoulder, lane, buffer), only left shoulder width significant
- When ML envelope included, it was significant



Buffers in California



Summary of Key Findings

State or HSM	Severity	Location of Crash	Reduction per Additional Foot of Managed Lane Envelope	Highway Safety Manual: Reduction per Additional Foot of…	
				Lane	Inside Shoulder
California	Fatal & Injury	Managed-Lane or Buffer	4.5%	Not available	Not available
HSM	Fatal & Injury	Freeway	Not available	About 3.9%	About 1.7%
California	All	Freeway	2.0%	Not available	About 1.5%
Texas	All	Freeway	2.8%		

Summary of Key Findings

- Managed lane or flush buffer crashes (CA)
  - 4.5% reduction in KAB crashes for each additional foot of ML envelope
- No ML crash reduction in the *Highway Safety Manual*, however, relevant freeway data:
  - 3.9% crash reduction for each additional foot of freeway lane
  - 1.7% reduction per each additional foot of inside shoulder
- All freeway and all severity crashes: similar reductions in crashes for each additional foot of ML envelope:
  - California: 2.0%
  - Texas: 2.8%