Defining Near Crashes

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Block 2 Questions

- **What are the different techniques and equipments to measure near crashes?**
- **What are their (dis-)advantages, practically and technically?**
- **What kinds of near crashes can be detected (and how) and which ones go undetected?**

Near-Crash Qualitative Definition

- "Any circumstance that requires a rapid, evasive maneuver by the subject vehicle, or any other vehicle, pedestrian, cyclist, or animal to avoid a crash. A rapid, evasive maneuver is defined as a steering, braking, accelerating, or any combination of control inputs that approaches the limits of the vehicle capabilities." (Dingus et al., 2006)

Operational Definition

- Near crashes are typically defined in terms of data triggers
- Video analysis often used to qualitatively confirm that the trigger event conforms to qualitative definition
- Best definitions are specific to a given crash scenario (e.g., rear-end collisions)

Classes of Near-Crash Operational Definitions

- Environment-based
- Driver-based
- Device-based

Environment Triggers

- E.g.: Time-To-Collision, Required Deceleration
- Pros: Incorporates external circumstances in trigger definition, serves as operational definition of “danger”
- Cons: Based on assumptions about future behavior, rely on sensors that sometimes miss relevant hazards or misread irrelevant ones

Behavior Triggers

- E.g.: Hard braking, hard steering (swerving)
- Pros: More reliable measures than external sensors, reflects driver's sense of hazard level
- Cons: Likely to miss if near crash resolved by someone else (e.g., lead vehicle turns), hard braking occurs surprisingly often in normal driving (e.g., at stop signs and red lights), so it can be hard to distinguish a normal situation from a hazardous situation solely by looking at behavioral measures

Device triggers

- E.g., warning algorithm triggered, whether shadowed (i.e., during baseline) or alerts given, most relevant for FOTs
- Pros: Targets potential crash of interest
- Cons: Inflexible algorithm, subject to sensor errors (like environment triggers)

Challenges

- Continuous trigger definitions can have cutoff at any point along the way
- More liberal cutoff (e.g., higher time-to-collision) = more cases & more errors
- More conservative cutoff = fewer cases & fewer errors

Challenges

- Video confirmation of triggered events is ideal, but video coding must be done as rigorously as possible
- Different coders define “dangerous” differently, so even video coding requires an operational approach

Solutions

- Choose measures tuned to scenario of interest—avoid trying to be too general
- Explore range of cutoff values and look for potential sensor errors or common situations that produce triggers but are not qualitatively considered near crashes; video is quite useful in this process if it is available
- Accept presence of some spurious events

Many Thanks

David LeBlanc, UMTRI