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Analysis of Run-Out-Of-Lane Crashes Using Real-Word Data

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Outline

- Target Population
- Current Crash Avoidance Technologies
- Clinical Real-World Analysis Method
- Fatal NMVCCS Summary
- Exemplar Cases
- Preliminary Findings
- Summary

Target Population

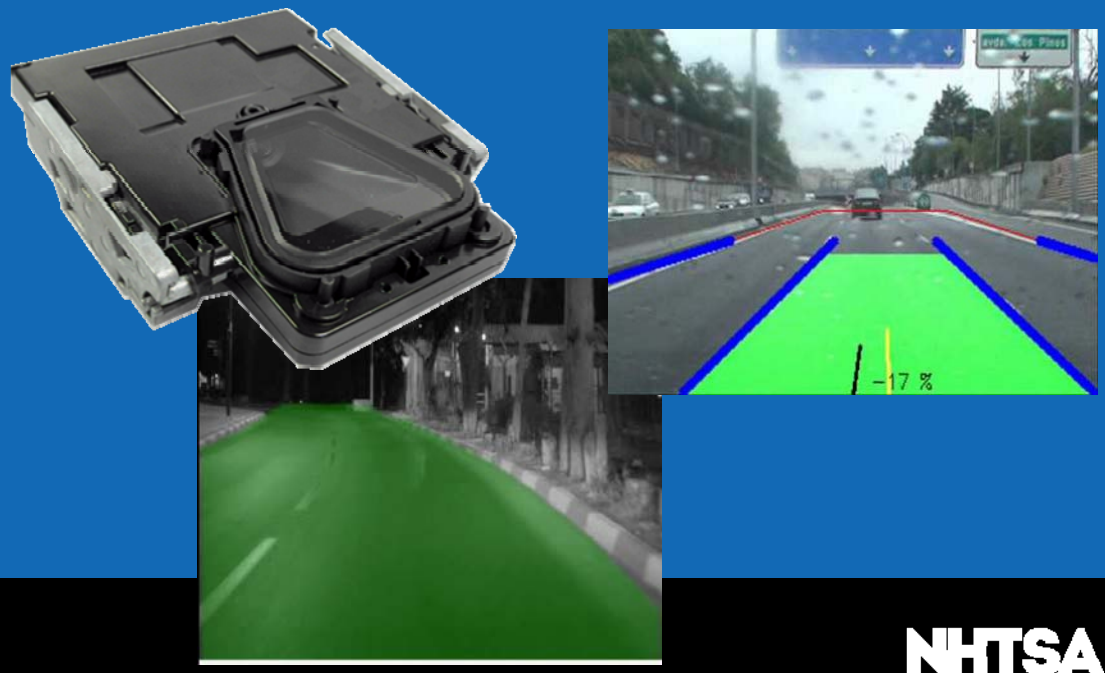
2011 – 2015 FARS and GES Run-Out-Of-Lane
Light Vehicle Target Population

Scenario	Avg. FARS	Avg. GES
Road Edge Departure/No Maneuver	6,284	472,182
Opposite Direction/No Maneuver	2,983	96,095
Drifting/Same Direction	196	120,223
Object/No Maneuver	151	80,088
Target Population	9,615	768,588

Current Crash Avoidance Technologies

- Lane Departure Warning (LDW) – Provides warning only when driver may be departing lane.
- Lane Keeping Support (LKS) – Actively adjust position of the vehicle to prevent driving from leaving the lane.
- Lane Centering Control (LCC) – Actively maintains the position of the vehicle

- Vision systems
  - Monitor lane markings
  - Driving Surface
  - Road edge detection
  - Path projection



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Clinical Real-World Analysis Method

- A detailed review of real-world run-out-of-lane crashes was conducted where an occupant sustained fatal injuries in an involved vehicle using the NMVCCS dataset.
- The review focused on coded and non-coded data (photographs, crash summaries, scene diagrams, etc.), and resulted in the identification of critical characteristics contributing to the fatal injuries in run-out-of-lane crashes.
- The intent was to capture those crashes where the vehicle left the original travel lane and resulted in a fatal crash. The broad selection criteria included 72 fatal cases in the dataset.

Clinical Real-World Analysis Method

- For each of the cases, the following characteristics of the crash were noted:
  - Environment (weather/lighting)
  - Presence and condition of lane markings and rumble strips
  - Road curvature
  - Type of crash (head on, rollover, single vehicle, etc.)
  - Vehicle defects
  - Physical and cognitive state of the driver

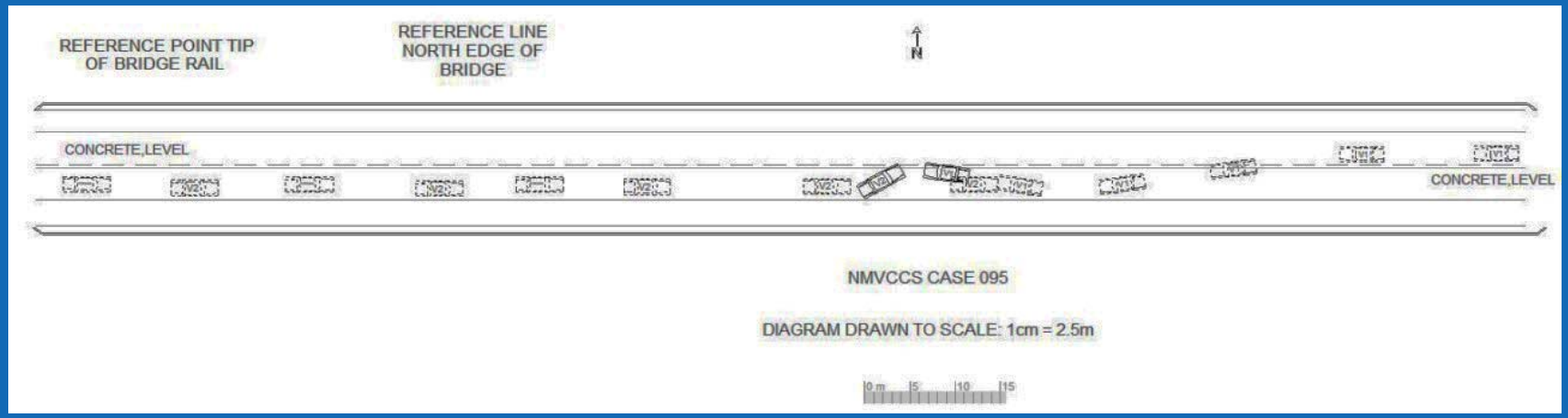
Fatal NMVCCS Summary

- 43 out of the 72 cases are driver *drifted out* of lane resulting in a crash
  - LDW/LKS/LCC applicable crash prevention technologies
  - Remaining cases are loss of control prior to lane departure where Electronic Stability Control was more applicable
- Curvature of the road considered important with respect to steering authority
  - Straight roads require minor correction
  - Curved roads require more steering authority
  - 17 cases occurred on straight roads
  - 26 cases on roads with curvature

Exemplar Case 1 – Straight Road

- Case No. 2007-74-95
- A 2000 Ford Taurus was traveling west and a 2000 Buick Park Avenue was traveling east.
- Ford driver crossed centerline, head-on with the Buick
- Clear day, no precipitation
- Level roadway and with posted speed of 60 mph
- Lane markings were in good condition
- Ford driver was not under the influence

Exemplar Case 1 – Straight Road



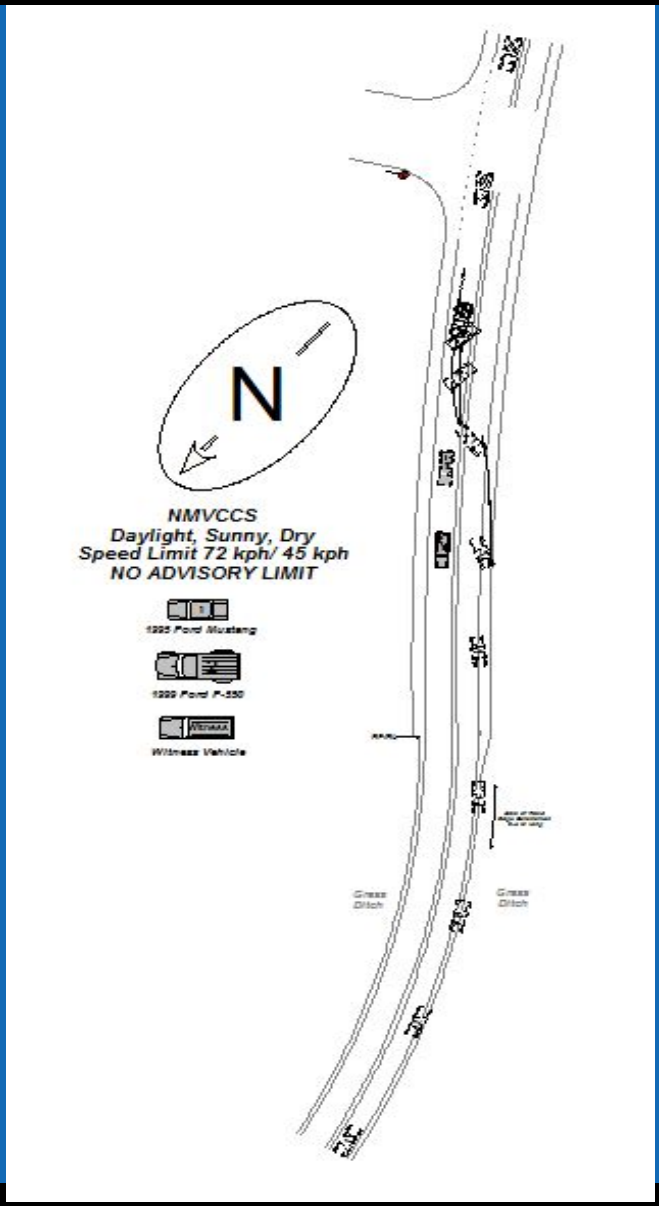
- Assessment: a vision system could potentially detect the free space of the roadway and the clearly defined lane markings, and with a minor steering correction to maintain its forward heading, the crash may have been avoided

Exemplar Case 2 – Curved Road

- Case No. 2007-43-88
- Two-vehicle fatal crash that occurred along an undivided two-lane, north/south S-curved road
- The Ford Mustang departed the road, re-entered the road, departed travel lane, and collided with an F-550
- Posted speed limit was 45 mph
- Daylight, sunny, and dry
- No rumble strips

Exemplar Case 2 - Curve

- Assessment: Given that the roadway had lane markings on both sides that were in good condition and the driver was not speeding a vision system should have been able to detect the lane markings a minor correction of the vehicle's path may have prevented the crash.



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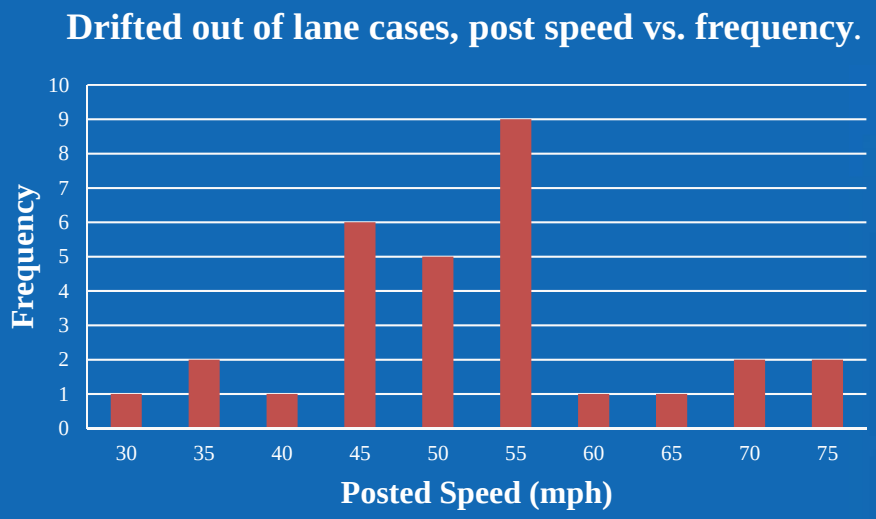
Preliminary Findings



Drifted Out of Lane Cases Side of Lane Departure

Curve	Left	Right	Total
No	12	5	17
Yes	12	14	26
	24	19	43

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Preliminary Findings

Drifted Out of Lane Cases Lane Markings

Curve	Lane Markings Both Sides	Lane Markings One Side Only	No Lane Markings	Total
No	15	0	2	17
Yes	23	3	0	26
	38	3	2	43

Drifted Out of Lane Cases Driver factors Alcohol

Curve	Alcohol
No	4
Yes	7

Crash Type Post Run-Out-Of-Lane

Curve	Rollover	Frontal Head On	Frontal w/ Tree or Pole	Frontal w/ Barrier	Totals
No	8	6	3	0	17
Yes	10	10	4	2	26
	18	16	7	2	43

Drifted Out of Lane Cases Lighting Conditions

Curve	Light	Dark	Total
No	12	5	17
Yes	19	7	26
	31	12	43

Summary

- 43 cases were identified where the driver drifted out of the lane resulting in a fatal crash.
- 38 cases identified lane markings on both sides.
  - Only one crash where the vehicle left the lane on the side where there were no lane markings.
  - There were six cases where rumble strips were present on the side where the vehicle left the lane.
- 31 out of the 43 crashes occurred when it was light out.
- For the 17 cases where the road was straight, the median posted speed was 55 mph.
- For the 26 cases where there was roadway curvature the median posted speed was 45 mph.

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QUESTIONS?