Visibility of Delineators and Chevrons with Reflectorized Posts

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SPEED
LIMIT
60

Research Objectives

- How do combinations of vertical and horizontal delineation affect driving performance ?
- Focus on :
  - Traditional markings, markers, delineator posts, chevrons
  - Combinations of treatments, not in isolation
  - Nighttime
  - Two-lane Rural Roads

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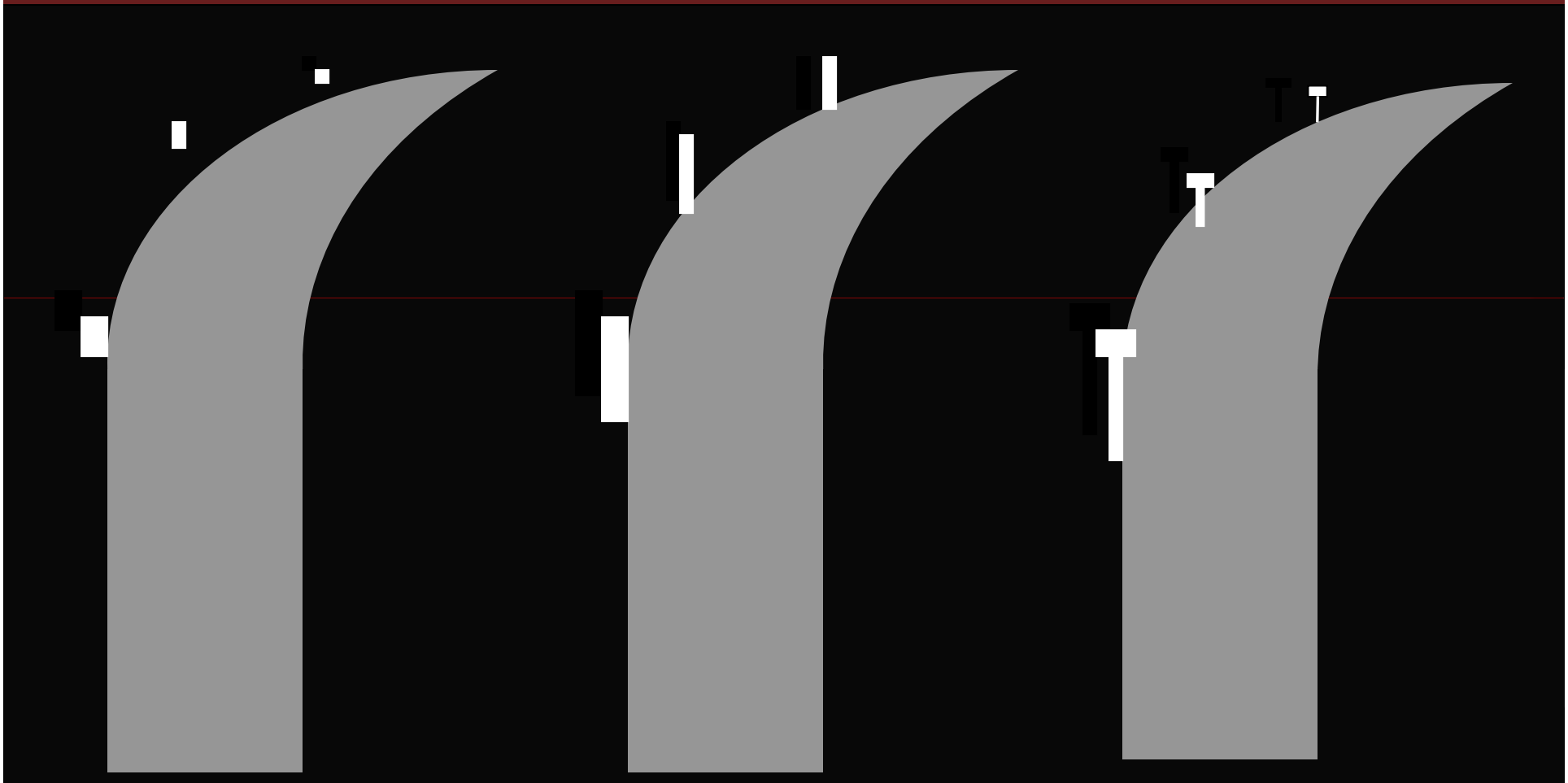
Examples of Nighttime Appearance of Post Styles Tested by Penn State

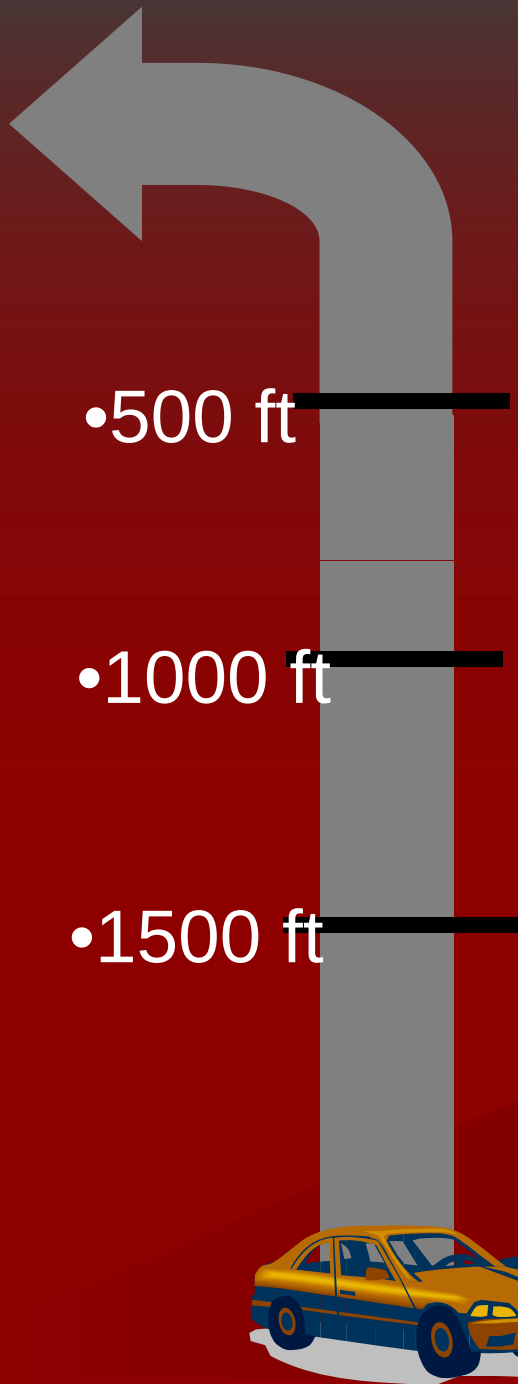


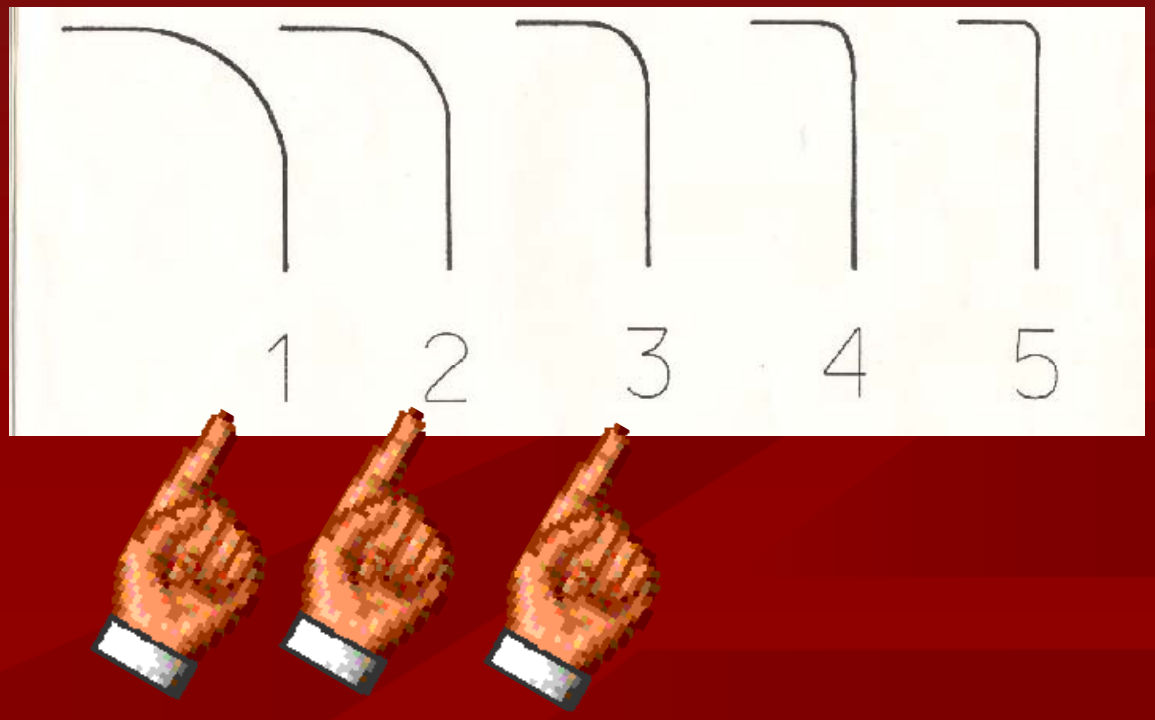
Standard
Reflector at Top

Fully
Reflectorized

T-posts

Previous TTI Research on Post Mounted Delineators: Static Rating Task





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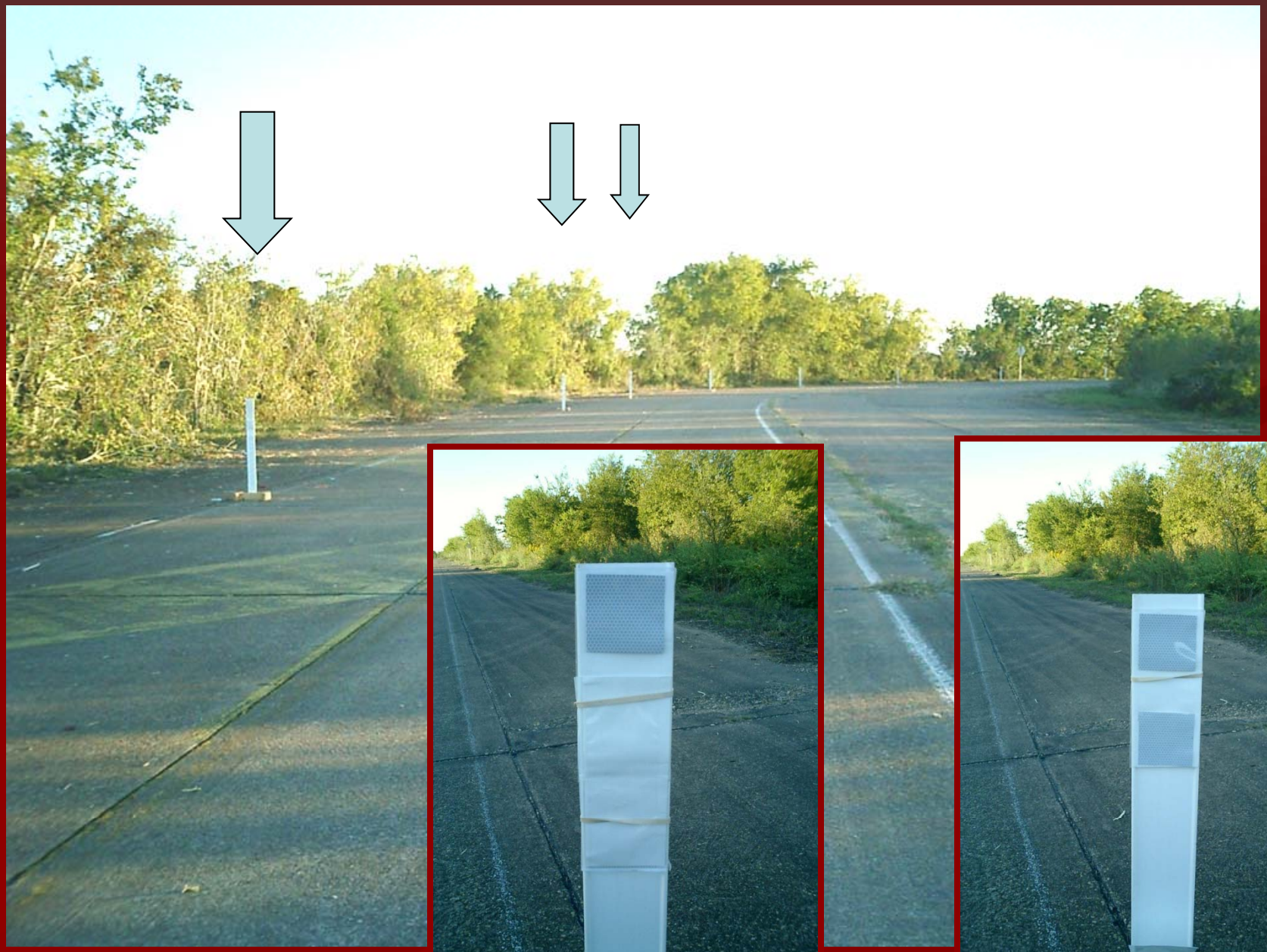
•Example of Delineator Post placement from TTI Project



Current Project: Experimental Conditions

- Closed-course study
- 4 curves
- Ten treatments (Five, with or without edgeline)
  - Pavement Markings only (double yellow centerline, RPMs)
  - Standard Post Mounted Delineators (PMD)
  - Fully Reflectorized PMDs
  - Standard Chevrons
  - Chevrons with fully reflectorized posts
- Edgeline started 300 feet upstream of PC
- No curve warning sign

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Baseline

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Standard Posts (Dot PMD)

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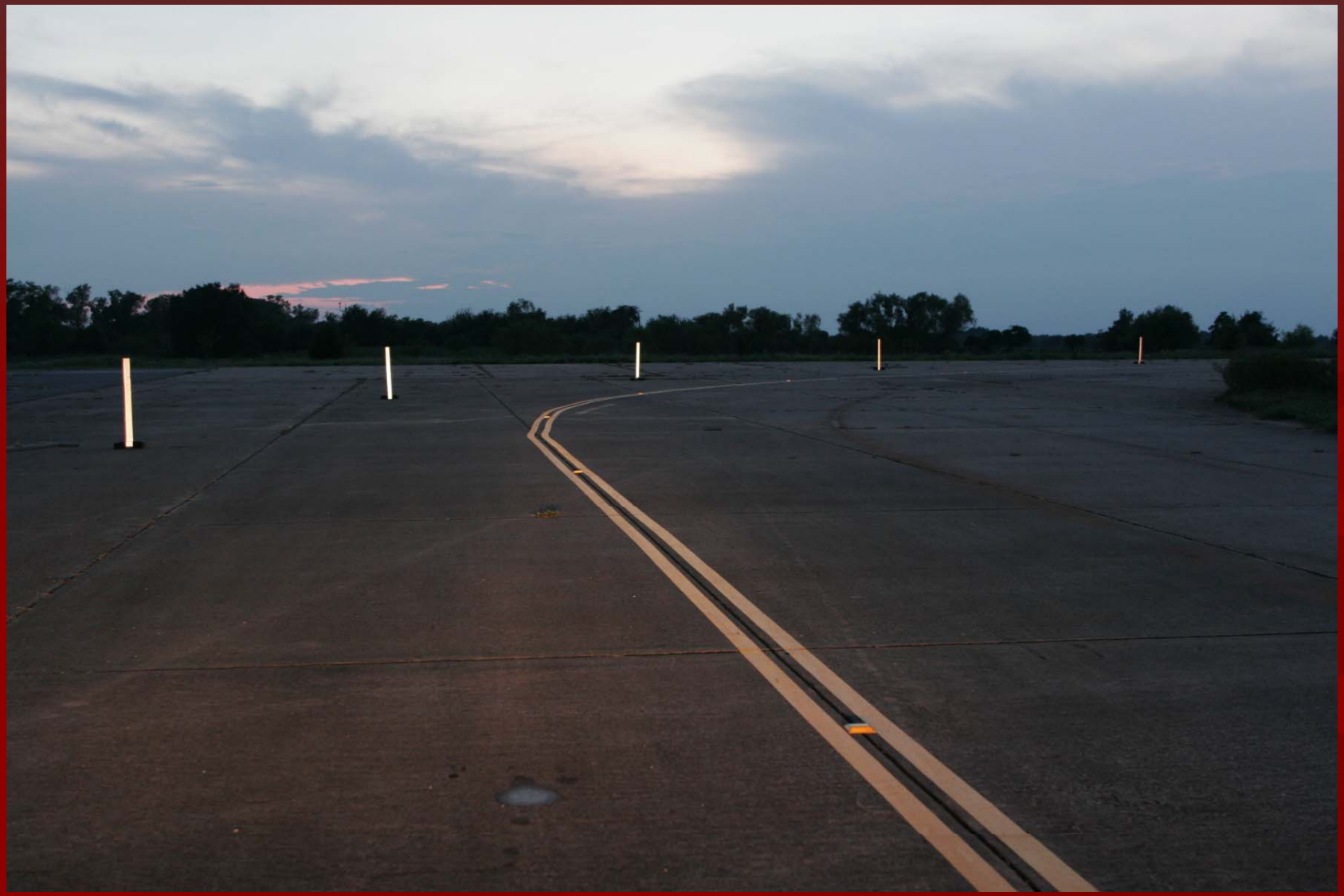
Full Posts (Full PMD)



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Standard Chevron

24 x 30 inch, Prismatic High Intensity

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Full Post Chevron (ChevFull)

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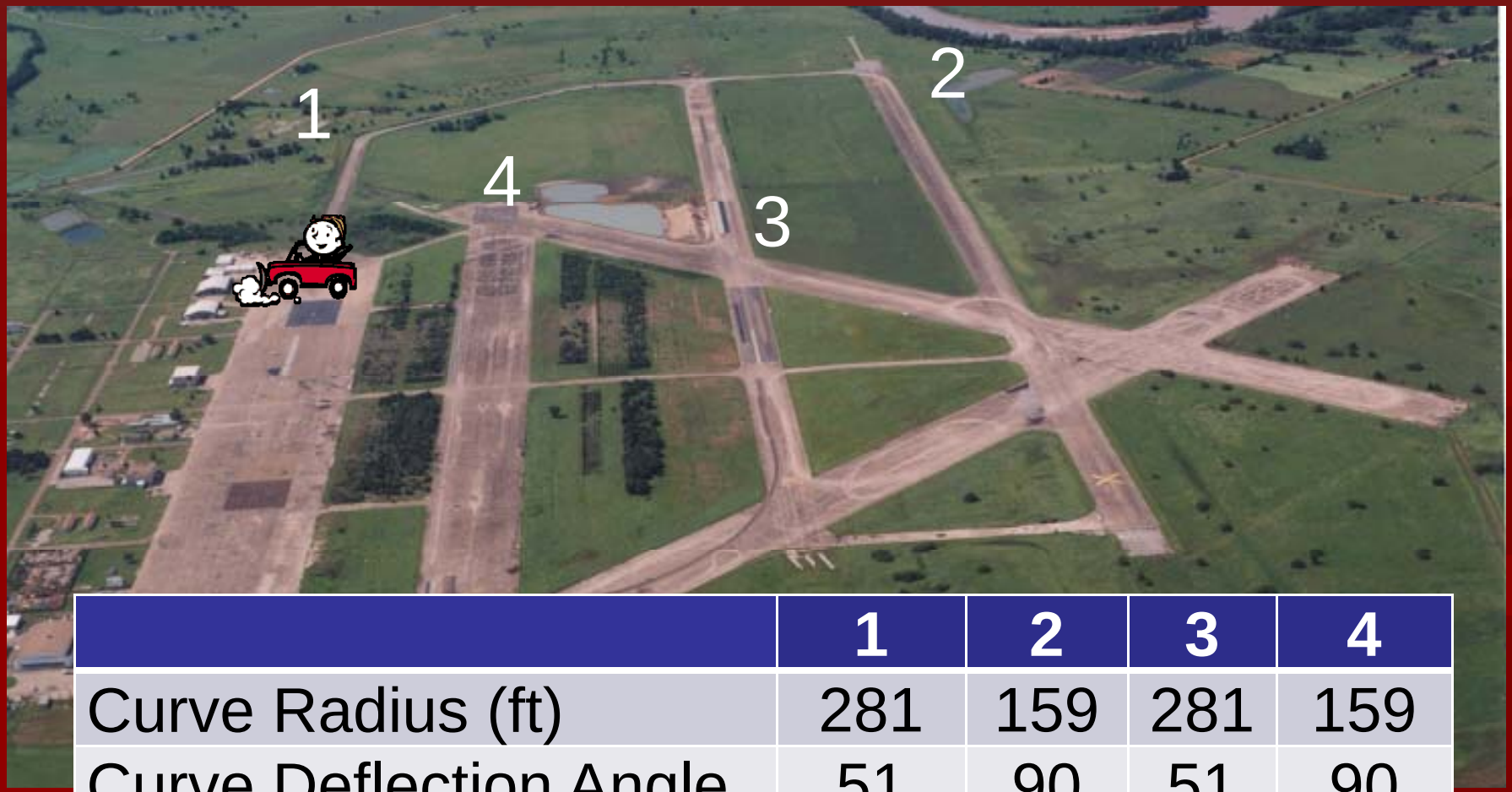
TTI Instrumented Vehicle

- Throttle, Brake, and Steering Sensors
- 10 Hz GPS
- Accelerometer
- DMI

- Cameras
- Lane Tracker
- Front Bumper Radar
- Head – Mounted Eye Tracker

Experimental Procedure

- All testing done at night
- Viewed 4 curves, 10 times each
- Experimenter in back seat
- Subjects drove 45 mph



	1	2	3	4
Curve Radius (ft)	281	159	281	159
Curve Deflection Angle	51	90	51	90
Edgeline	N	N	Y	Y

Experimental Procedure

- Twenty people tested
- Five laps of plain driving
- Five laps with verbal curve severity task
- Post-drive rank ordering of photos of treatments
- Measures of Effectiveness
  - Distance from curve when throttle was released and brakes applied
  - Velocity
  - Maximum lateral g-force in curve
  - Distance at which subjects indicated when they had judged the sharpness of the curve (Say "Now")

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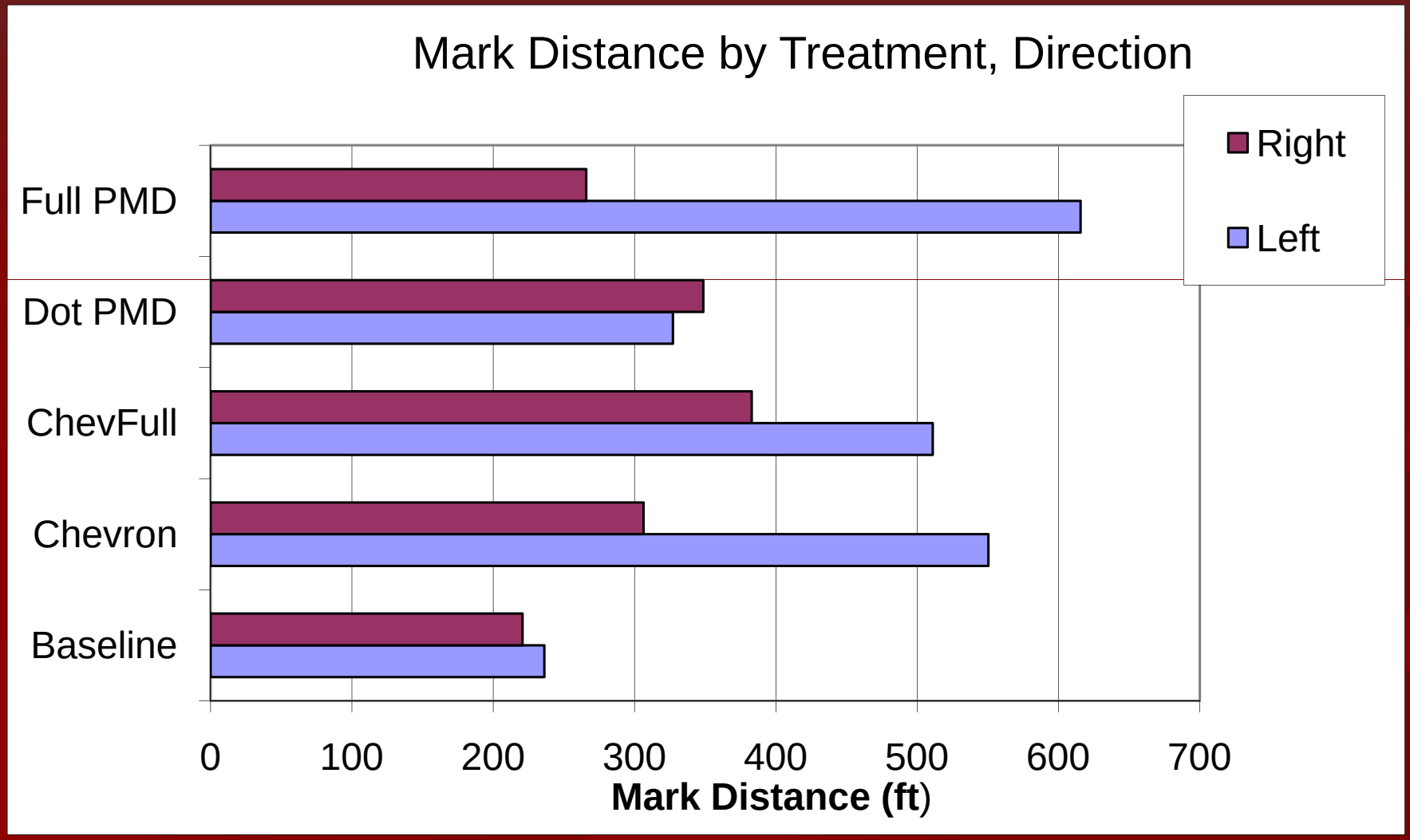
How far away did they note the curve severity?



Differences between left/right are greater for vertical treatments than for baseline

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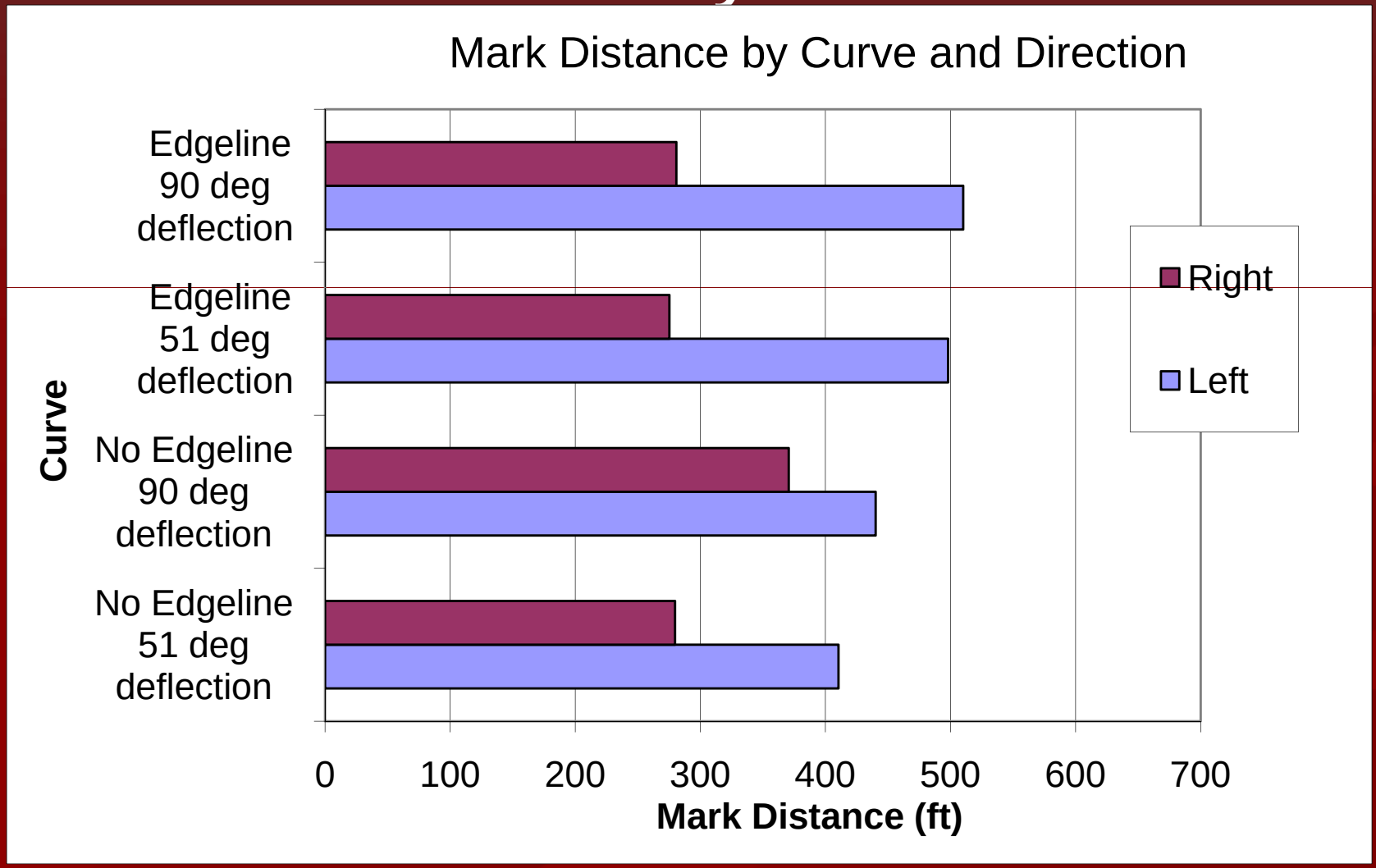
Did edgelines and deflection angle affect when they said “now”?



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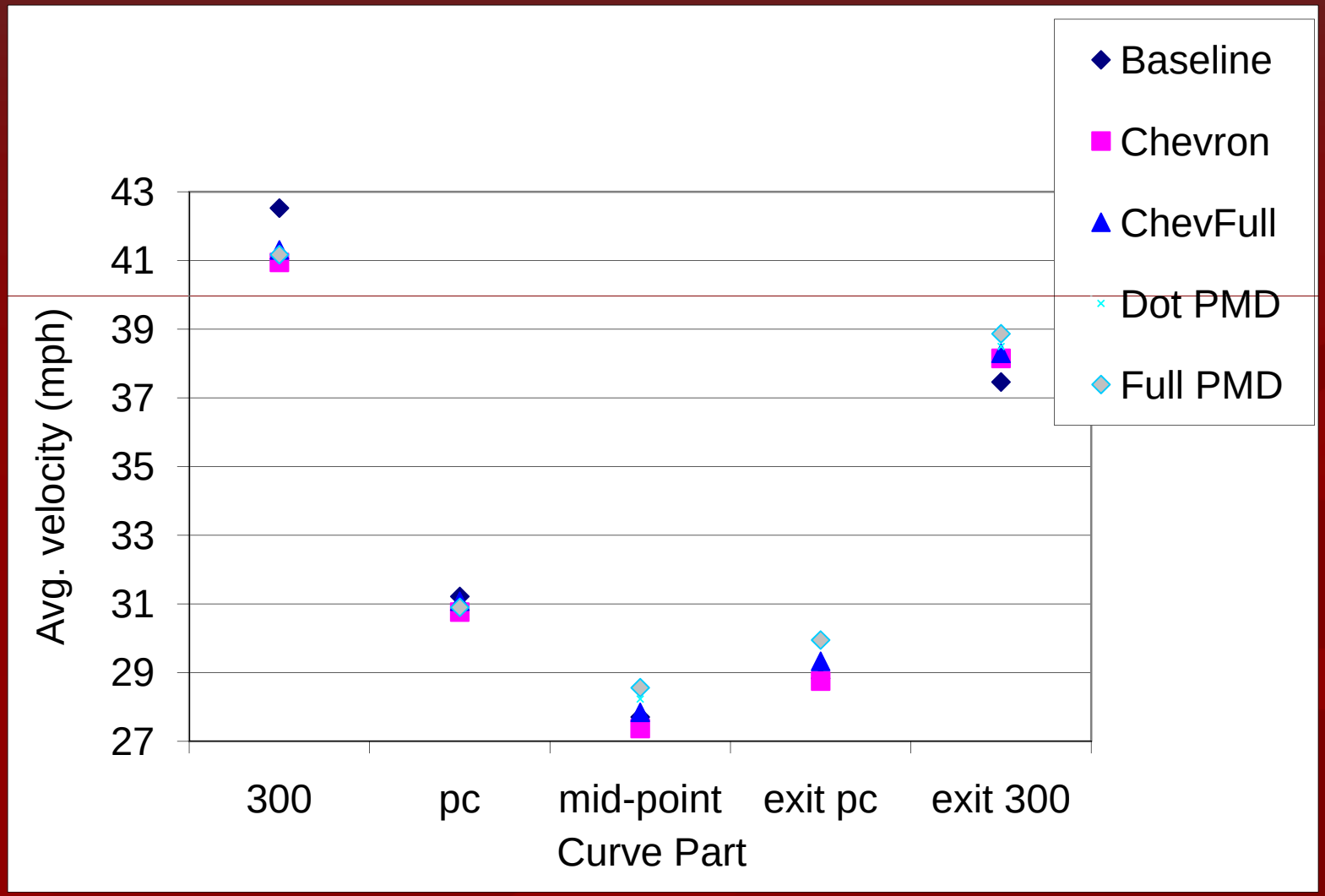
How fast did they drive while approaching and going through the curve?



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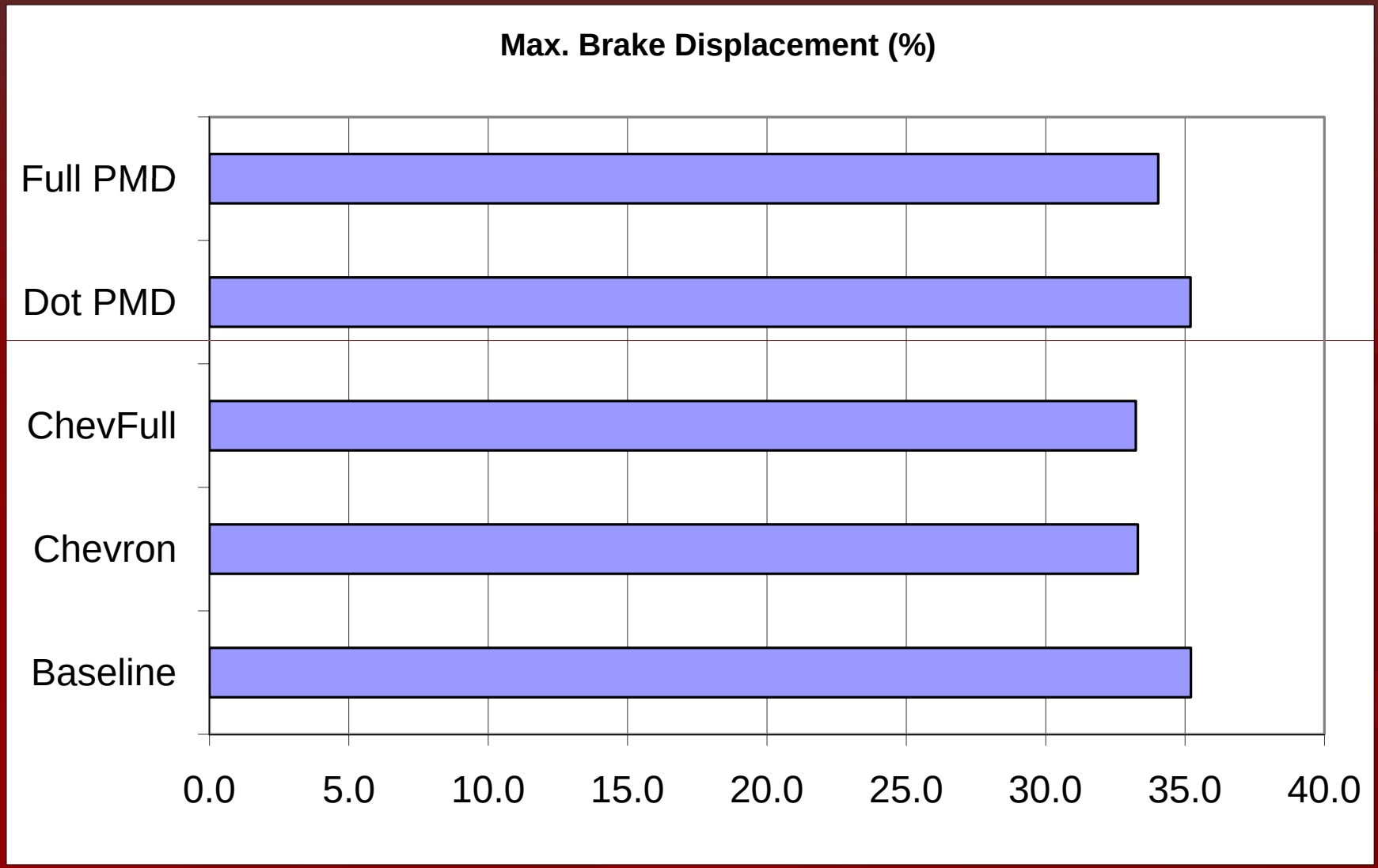
How hard did they hit the brakes?



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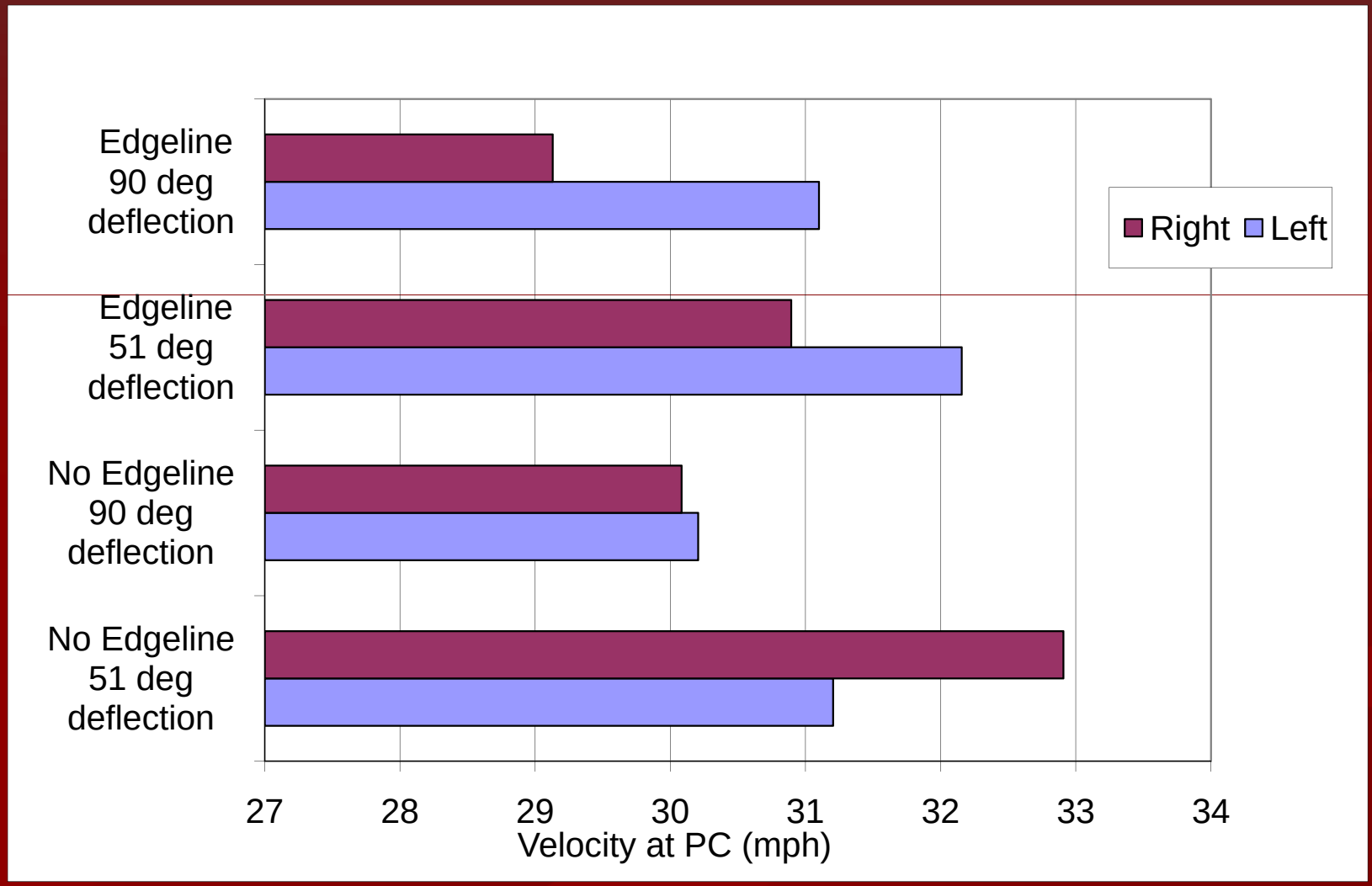
Did edgelines and deflection angle affect speed?



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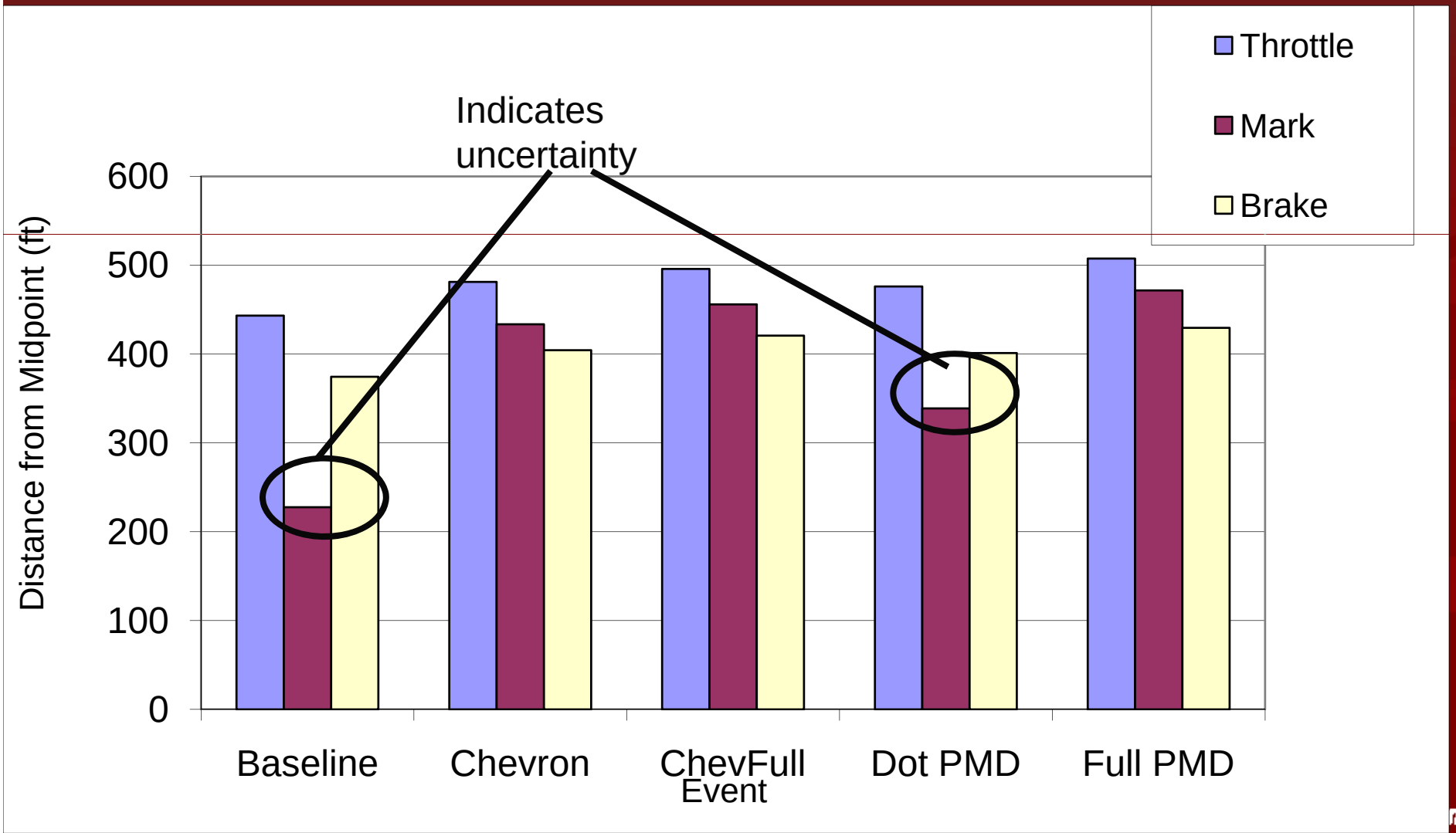
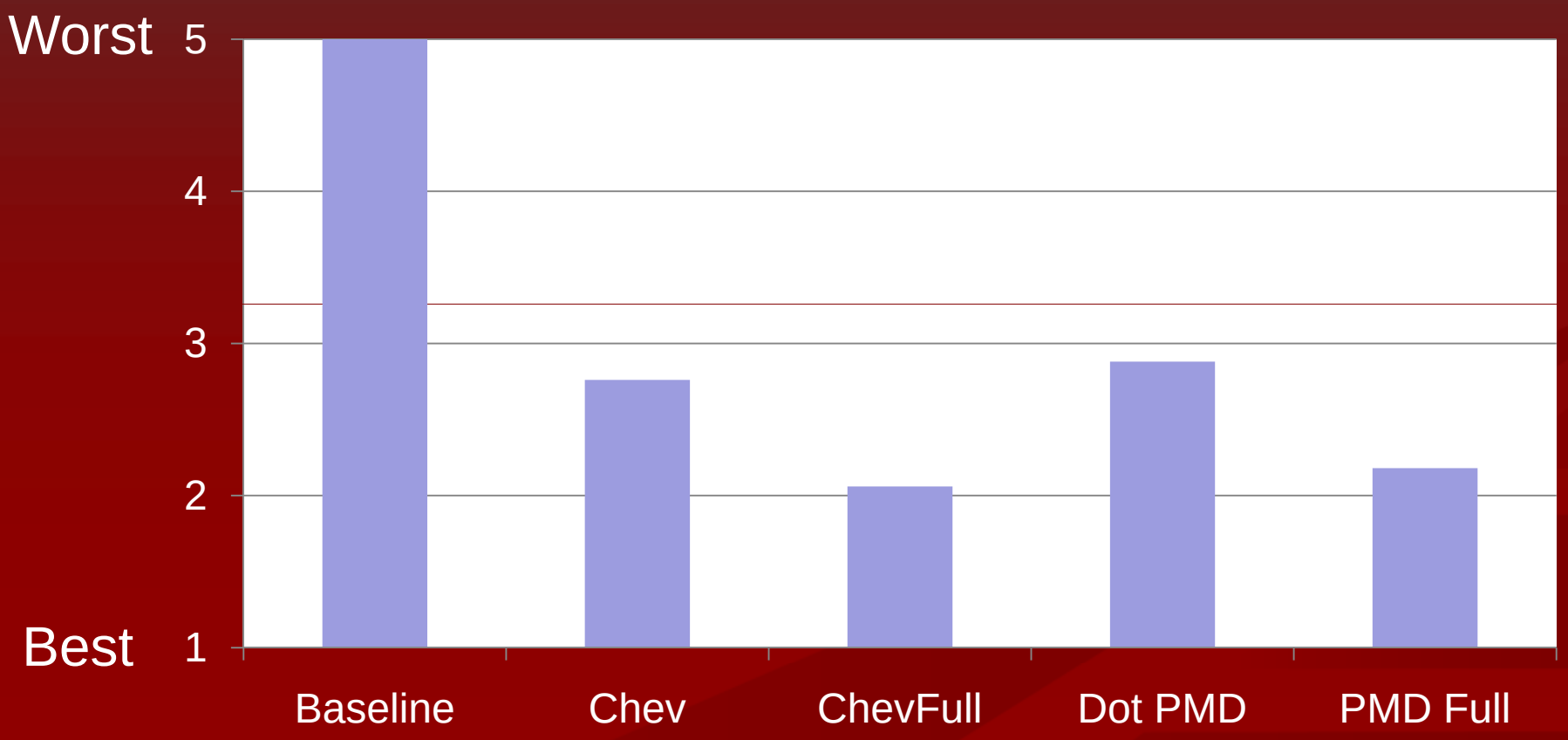
How far away did they let off the gas, say “now” and hit the brakes?



Ranking of Photos



Best

Best

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Conclusions

- Fully reflectorized post-mounted delineators showed great promise as an effective delineation treatment.
- Reflectorizing the chevron posts also provides a slight advantage over the standard chevrons, though the effect is not as strong as for the PMDs.
- The closed course showed consistent differences between inside (right-hand) and outside (left-hand) curves in terms of speed and curvature detection.

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Additional Tasks in Project

- Survey drivers throughout the state by showing videos of curves and asking participants to estimate (or match) radius of curvature and estimate their speed.
- Field Evaluation of speed and lane placement using traffic counters

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C3-L-C
Curve 3, left, chevron

1. Press “now”
2. I would drive faster/slower than movie

Results of Video Survey

- No significant treatment effects for dependent variable of response
- No difference for speed judgment
- Videos did not work well to convey depth for a nighttime scene

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Field Study

- Field study consisted of 4 sites in East Texas
- Rural two-lane roads

Site	Before	After	After - After
Site 1	Baseline	ChevFull	Chevrons
Site 2	Baseline	Chevrons	ChevFull
Site 3	Baseline	PMD Dot	N/A
Site 4	Baseline	PMD Full	N/A

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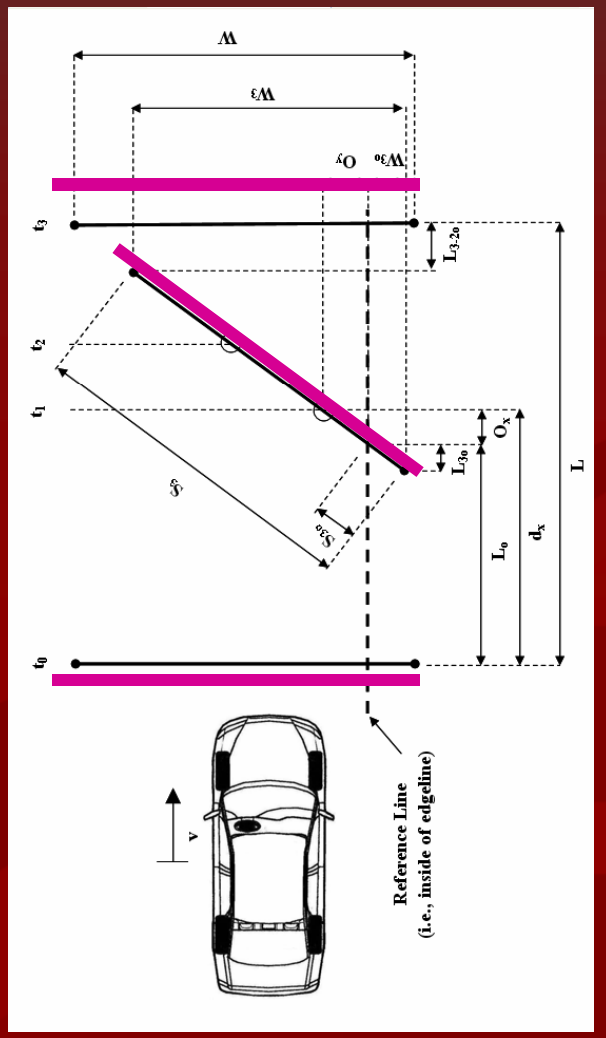
Data Collection



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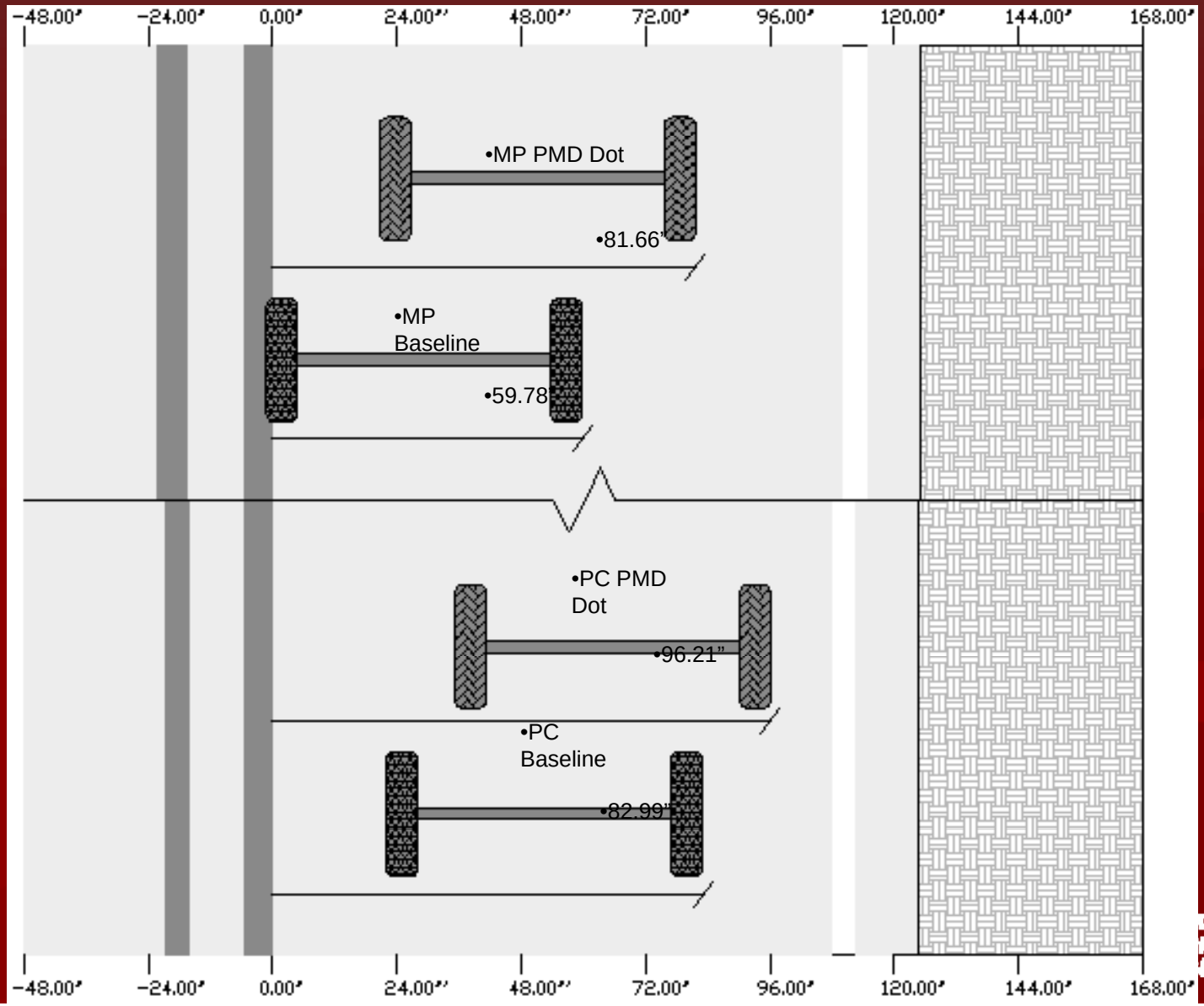
Example Lateral Placement
for Standard PMD Treatment



Chevron Findings

- Results were similar for all vehicle types and during both day and night periods.
- Both standard and full-post chevrons produced a shift away from the centerline by about 10 – 20 inches.
- Lateral position standard deviations were reduced by approximately 40%.
- Estimated centerline encroachments decreased by approximately 88% to 93%.
- Mean speed was significantly lowered by 1.4 mph for Chevrons and 2.2 mph for the ChevFull treatment.

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PMD Findings

- Again results were similar for all vehicle types.
- Both PMD treatments shifted vehicles away from the centerline by about 7” to 20”.
- Lateral position standard deviations were decreased by approximately 38%.
- Estimated centerline encroachments were reduced by about 78%.
- Both PMD treatments did not achieve a significantly difference in mean vehicle speed.

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Look for a paper by Re and Chrysler at TRB 2010 to learn more about the field study

Full report: Search TTI Website for Report Number 5772-1

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