

Translating Teen Driver Research from the Simulator to the Road



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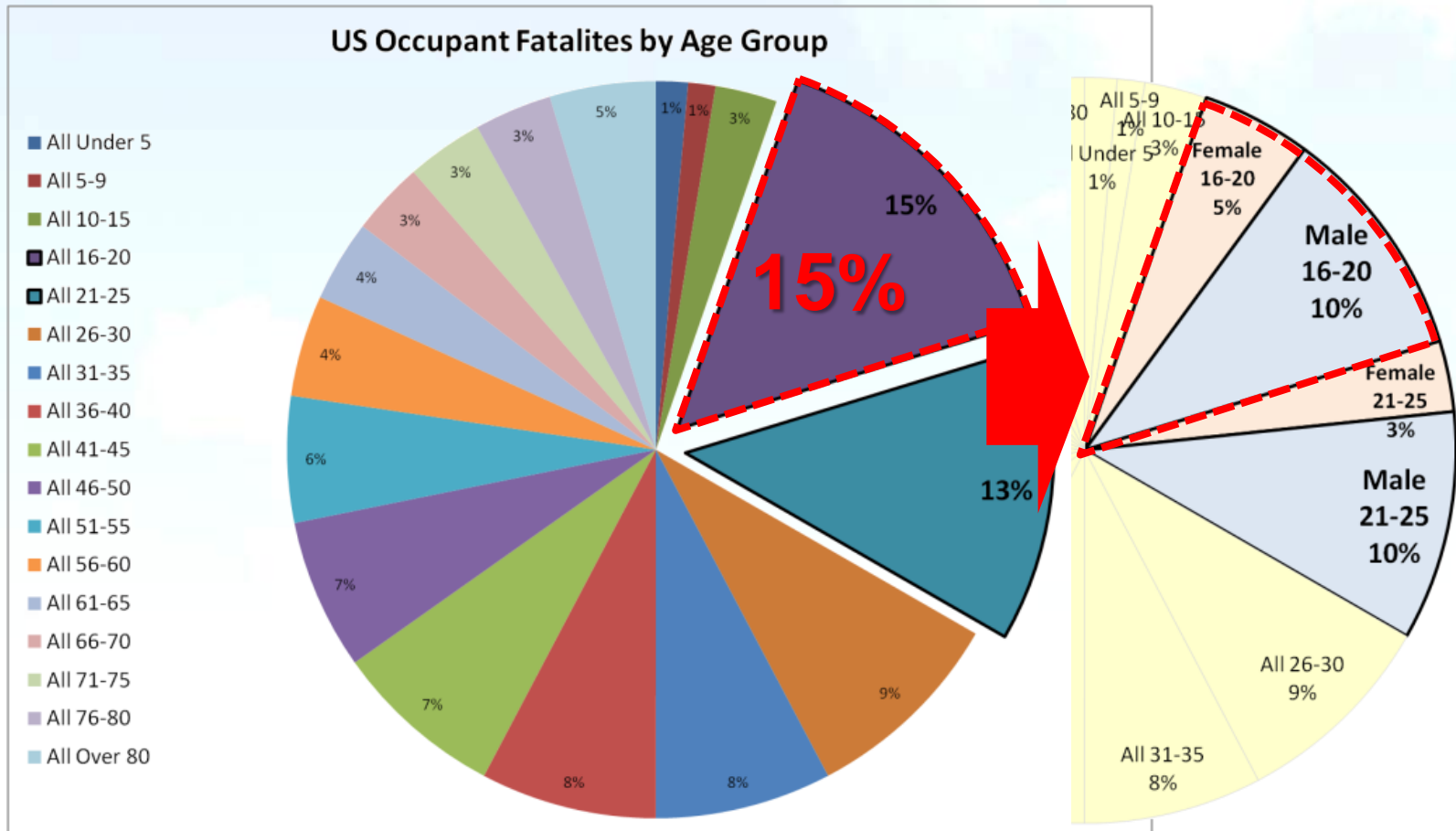


Outline

- **Introduction**
- **Teen ACAT Study (Simulator)**
 - **Study Overview**
 - **Simulator Response Measurements**
- **Teen IVBSS Study (IVBSS)**
 - **Study Overview**
- **Conclusions**

Introduction

Teen Drivers account for 15% of fatal crashes in the US

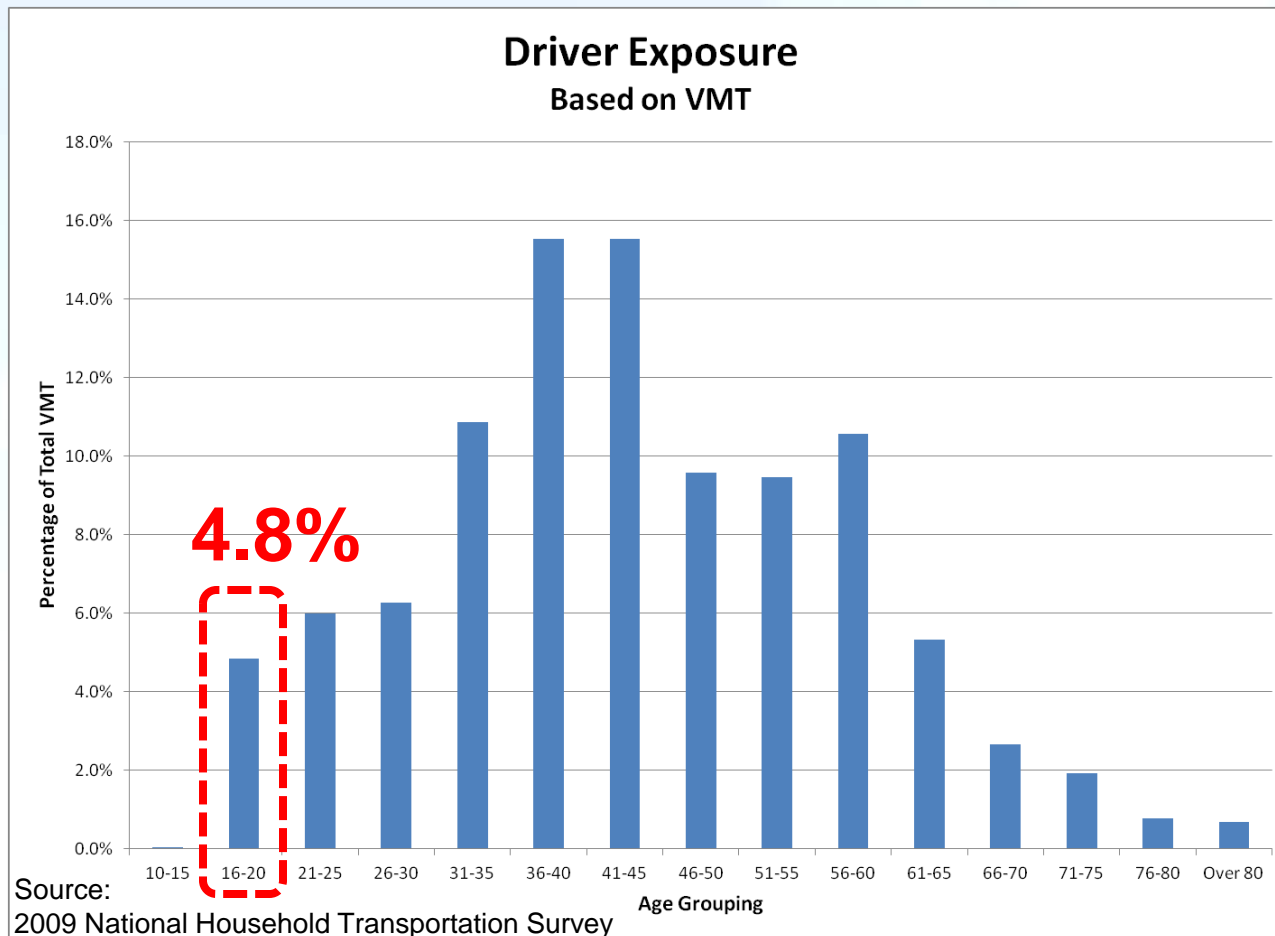


Source: NHTSA Fatal Accident Reporting System (FARS)

Introduction

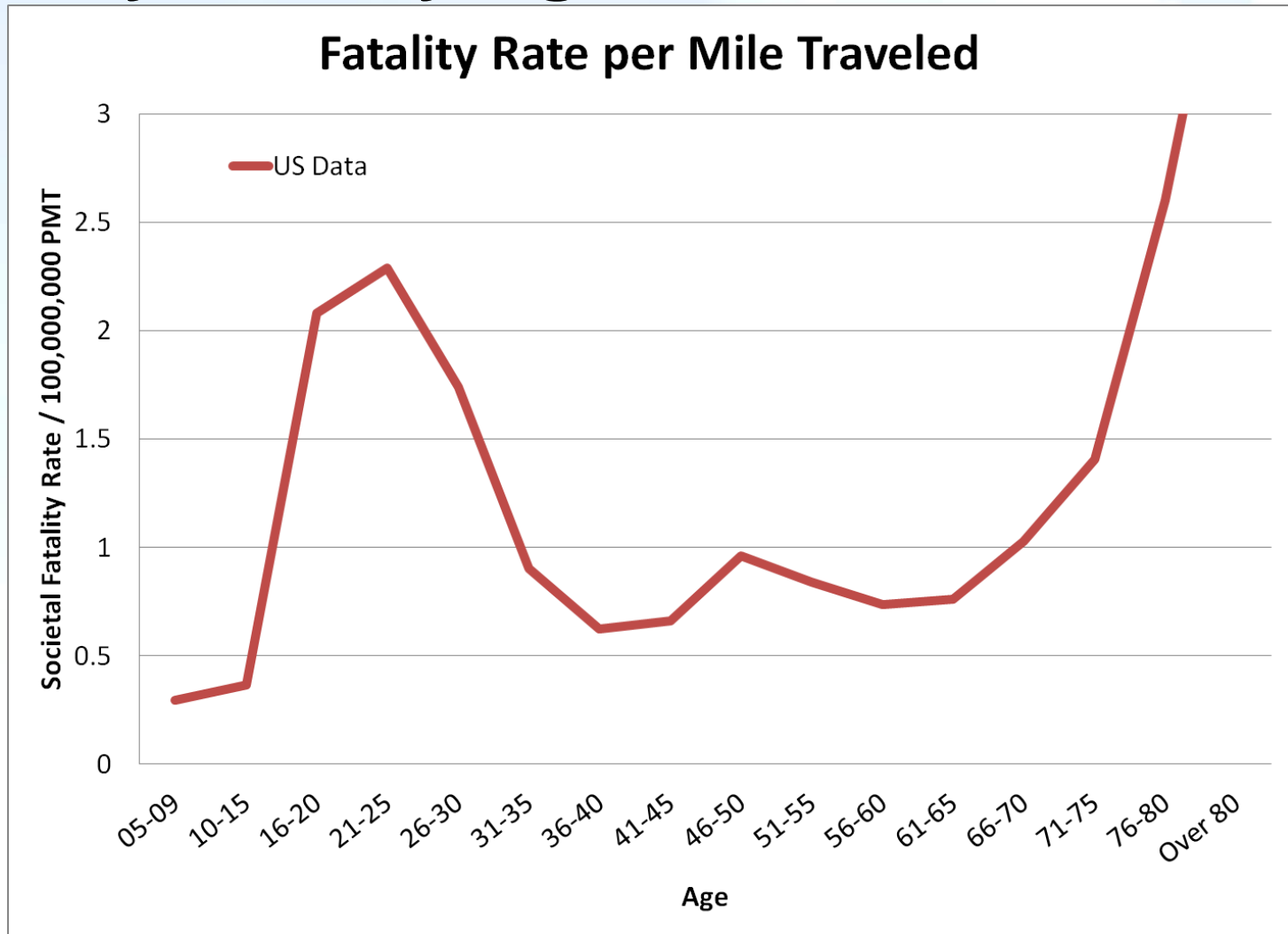
Exposure

Teen drivers account for < 5% of VMT



Introduction

Fatality Rate by Age & VMT



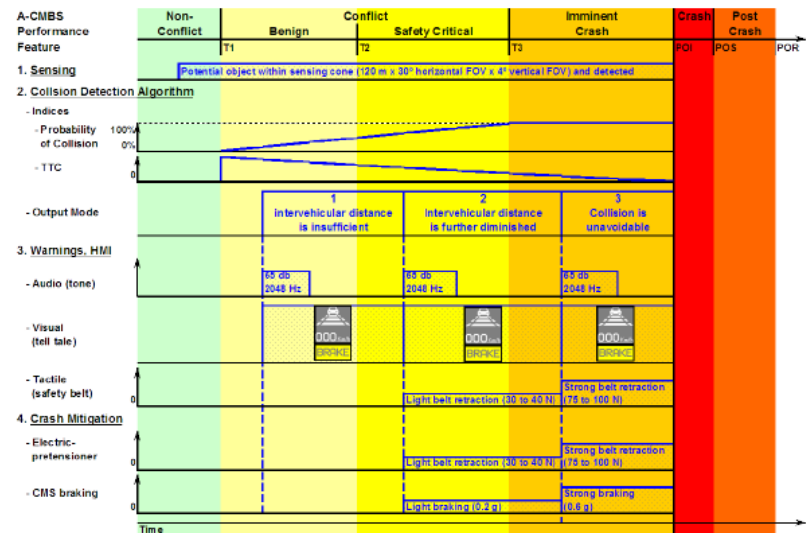
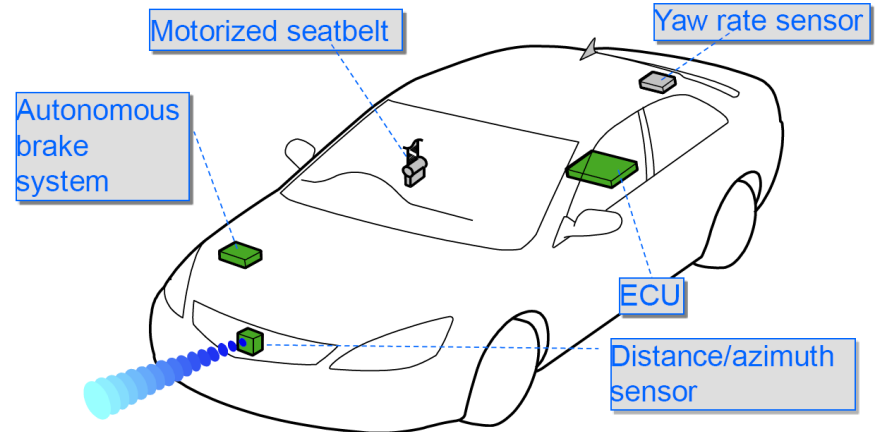
Teen ACAT Study

Advanced Crash Avoidance Technologies

DRI Driving Simulator

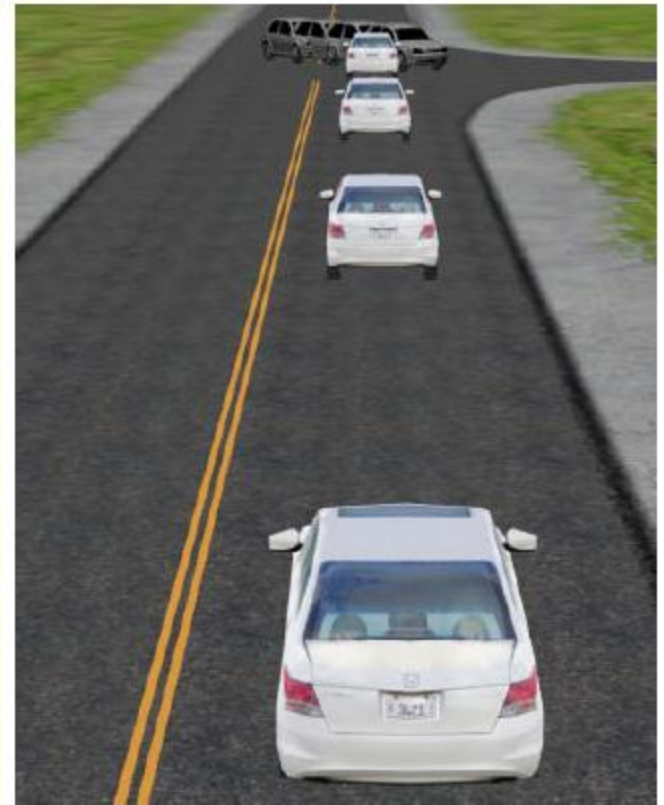
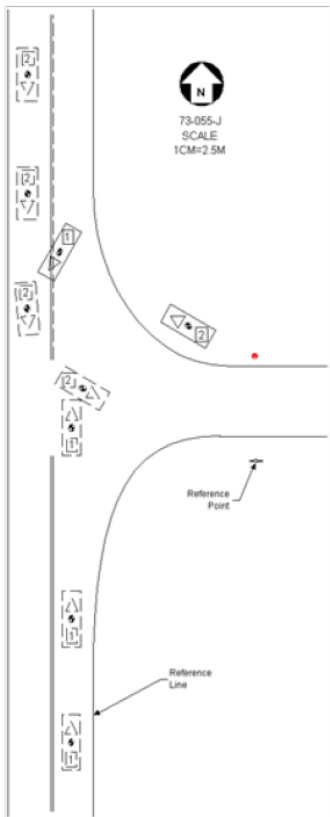
Honda-DRI ACAT Methodology

Crash Imminent Braking (Honda aCMBS)



Methodology

Simulator Reconstruction of NASS-CDS collision events

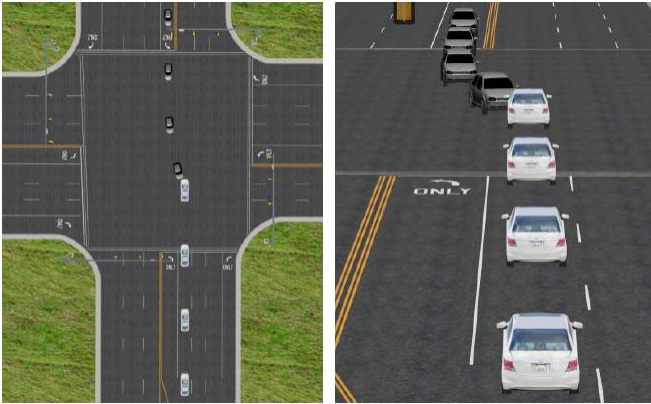


Scene Diagram

Methodology

4 Scenario Types x 3 Variations = 12 Cases

Intersecting Path



Rear End



Head On



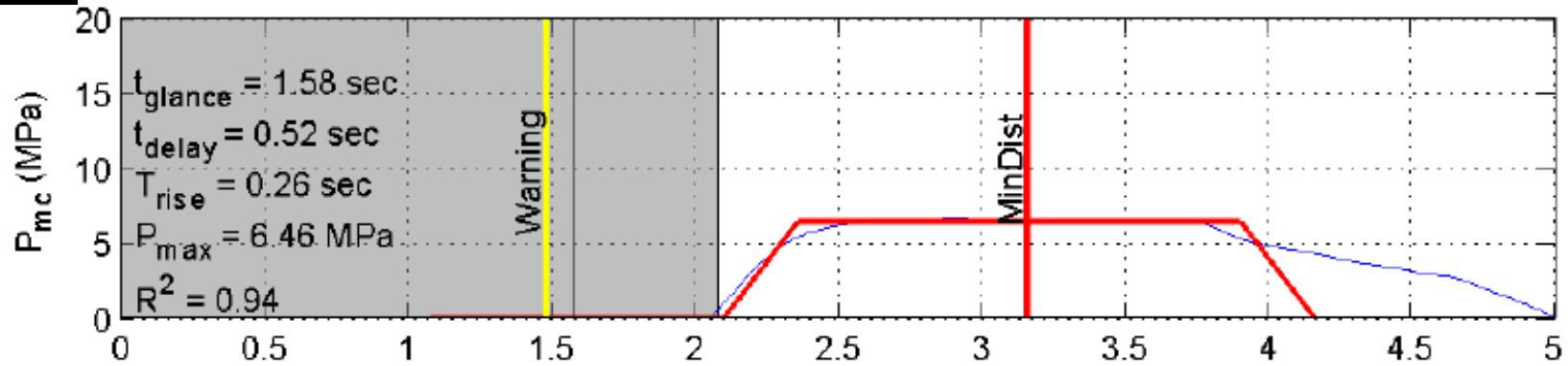
Pedestrian



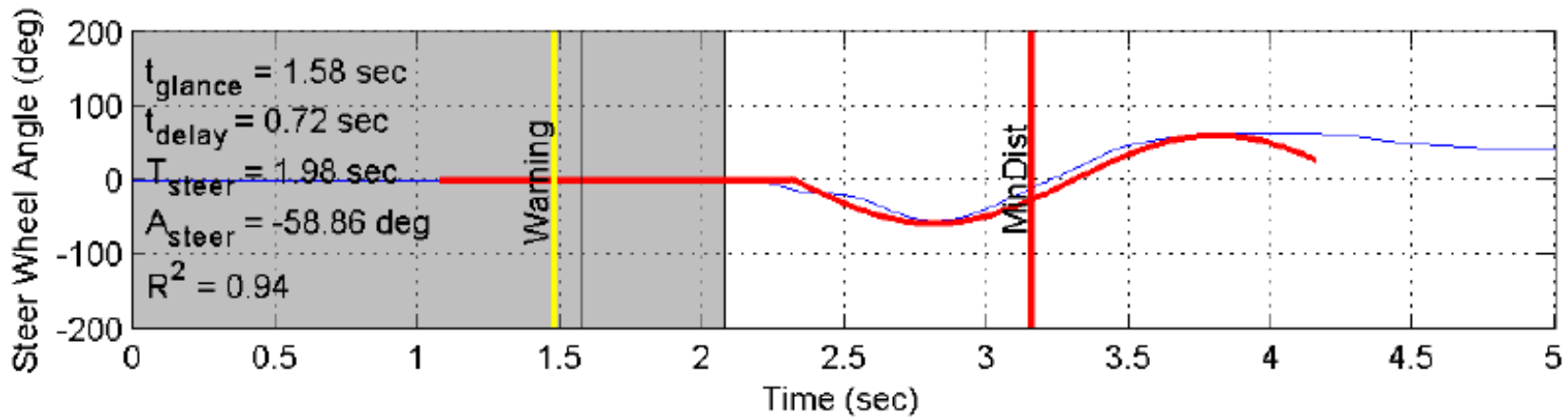
Methodology

Key Response Variables

Brake



Steer

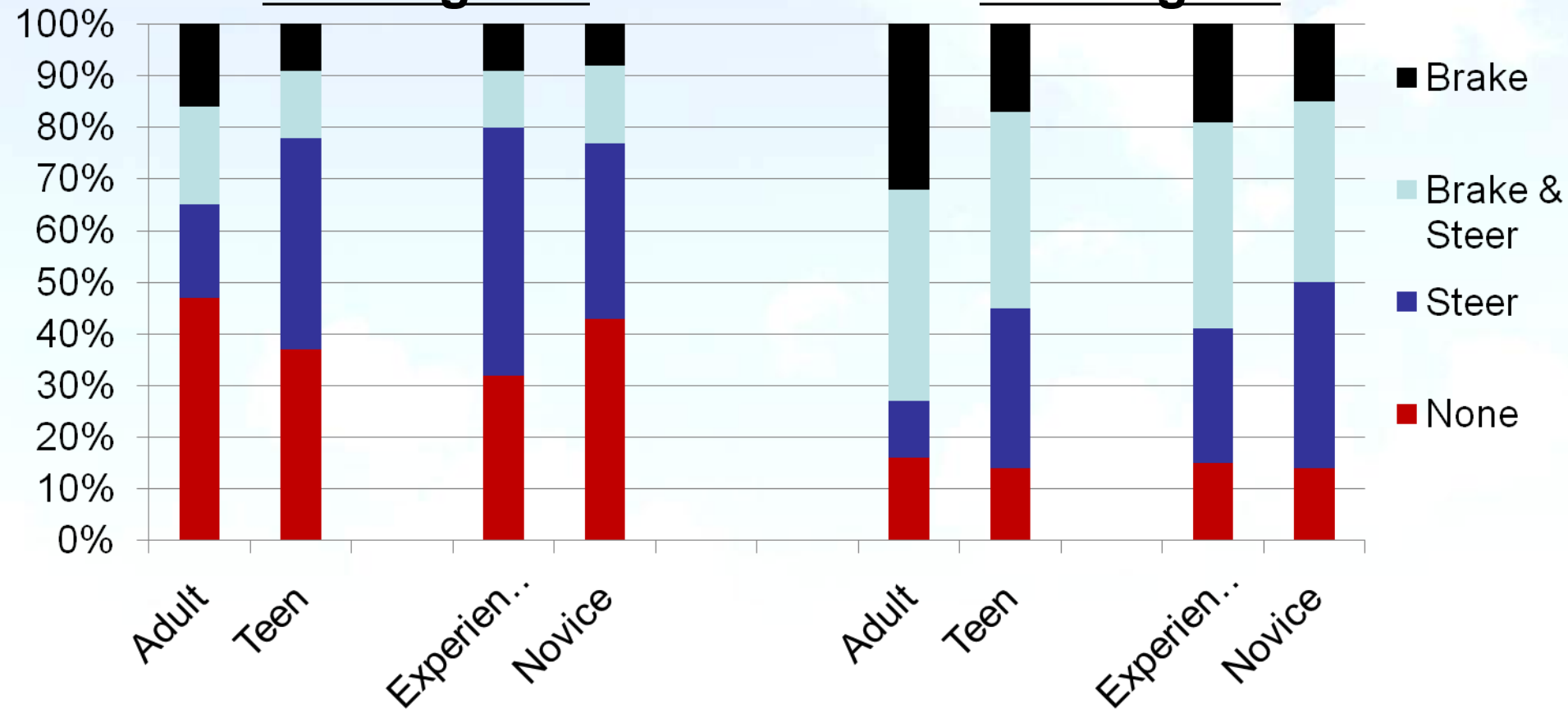


Results

Response Type

Warning OFF

Warning ON



37% Did Nothing – Teens
(47% Did Nothing – Adults)

14% Did Nothing – Teens
(16% Did Nothing – Adults)

Results

Response Type

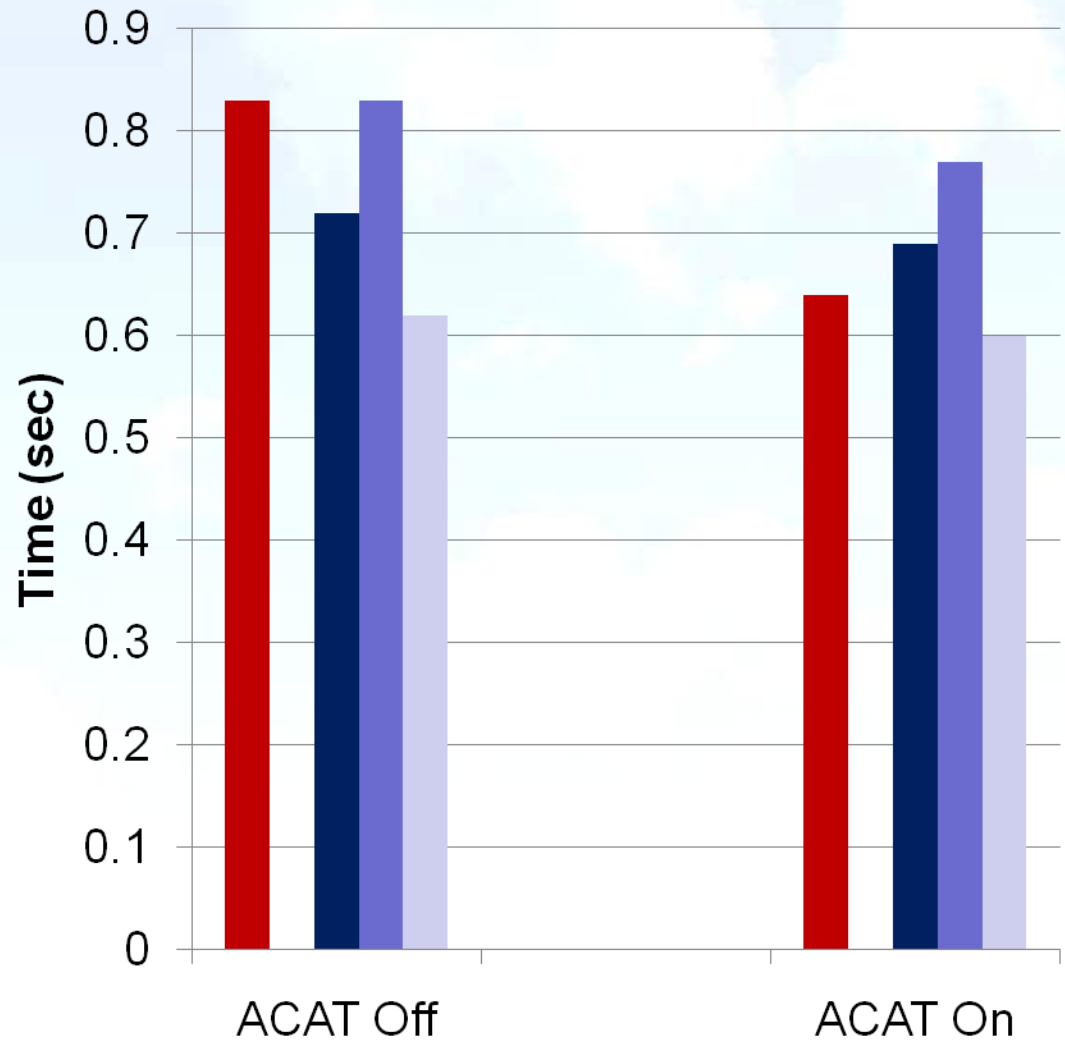
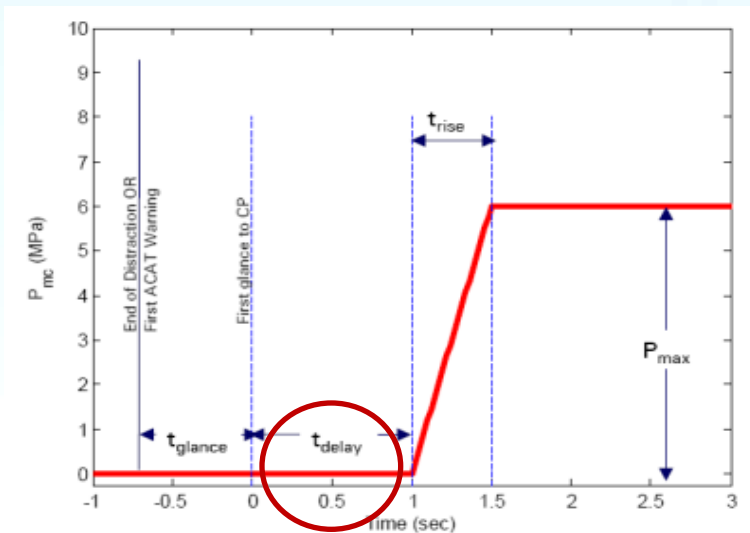
- Teens more likely to respond than adults without a warning
- Teens twice as likely to steer than adults
- Experienced teens are more likely to steer than novices

- ACAT more than doubles the brake and brake + steer response rates for all groups

Results

Brake Response - Delay

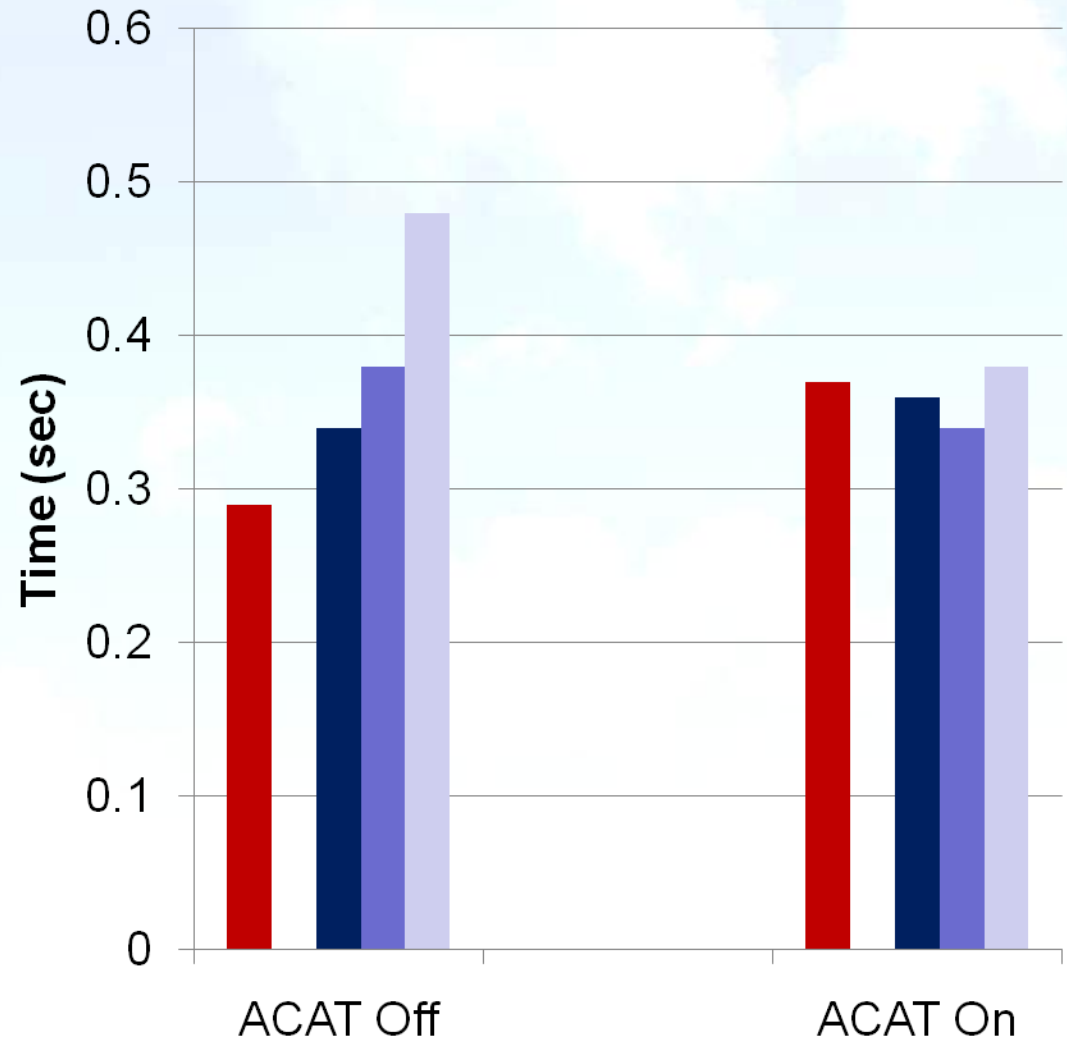
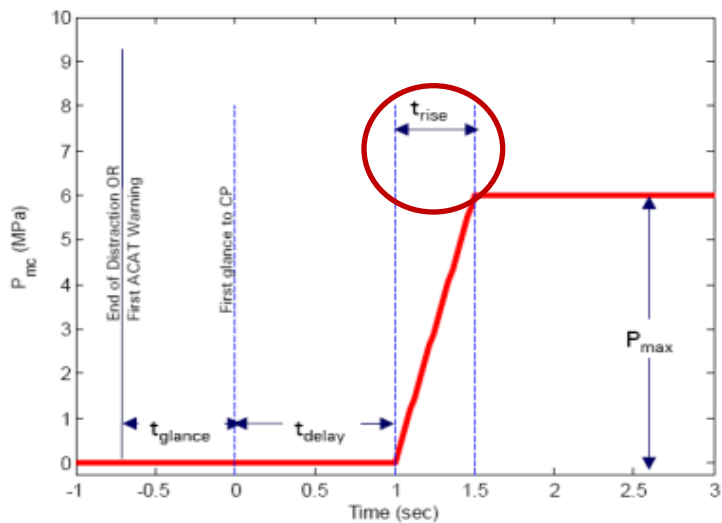
■ Adult ■ Teen
■ Experienced ■ Novice



Results

Brake Response – Rise Time

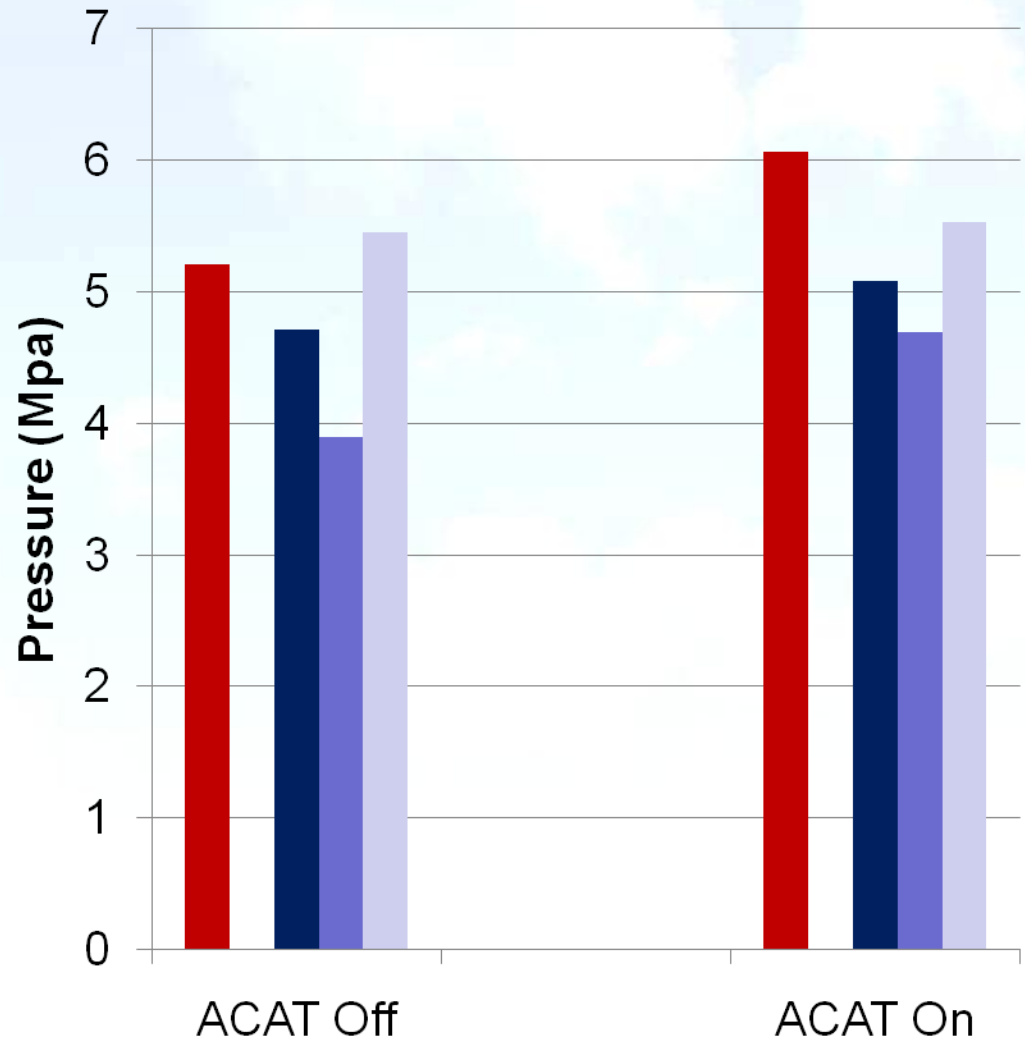
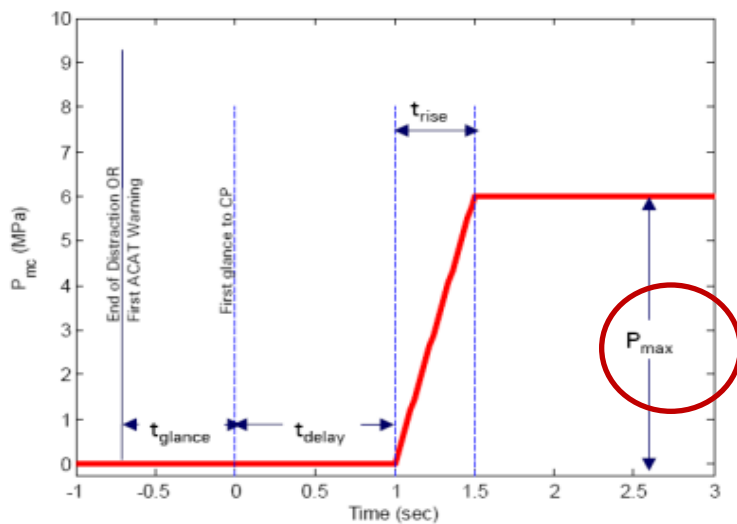
■ Adult ■ Teen
■ Experienced ■ Novice



Results

Brake Response – Amplitude

- Adult
- Teen
- Experienced
- Novice



Results

Braking Responses

- ACAT improves response delay for adults
- Novice drivers are quicker to push the brake, but depress the pedal slower
 - Novices are the only group to exhibit an improved rise time with the ACAT on
- Experienced teens and adults apply greater brake pressure with the ACAT on

What have we learned?

What we now know:

- Teens only account for ~5% of VMT
 - but 15% of fatalities
- Teens are more likely to steer during a critical event than to brake
- Crash warnings increase the overall response rate to critical event for teens
 - Brake rise time is improved
 - Steering amplitude is decreased

What have we learned?

Limitation & questions in what we know:

- Why are teens getting into ROR crashes?
 - Is it their speed, brake timing, steering input, ...?
- To what extent is distraction involved?
 - What kind of distractions are common?
- Driving response data is from a simulator.
 - Simplified environment
 - Response to critical events only
 - Laboratory setting
 - Limited sample size

- What are teens doing in the real-world?

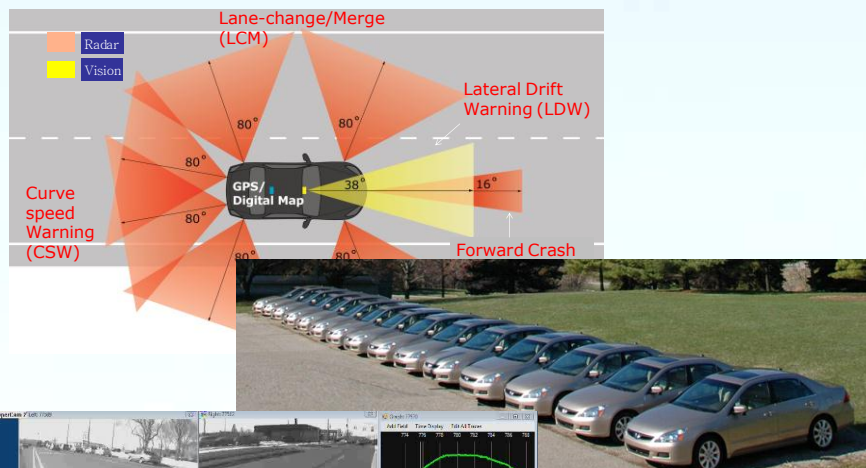
Teen IVBSS Study

Integrate Vehicle Based Safety System:

- Real world study of teen driving with and without Integrated Crash Warnings

Naturalistic Driving Study – 12 Accords

Equipped with Radar, vision and GPS based warnings systems



Teen IVBSS

40 drivers

- Teen (16.5 < age < 17 years)
- 20 Controls (no intervention)
- 20 Treatment (w/ intervention)

14 weeks of driving per participant

- First 3 weeks – Warning inhibited (Baseline)
- Next 8 weeks – Warnings enabled (Treatment)
- Last 3 weeks – Warning inhibited (Baseline)

Warning Systems

- Takata: Vision based
- Visteon: Radar based

NHTSA IVBSS

108 drivers

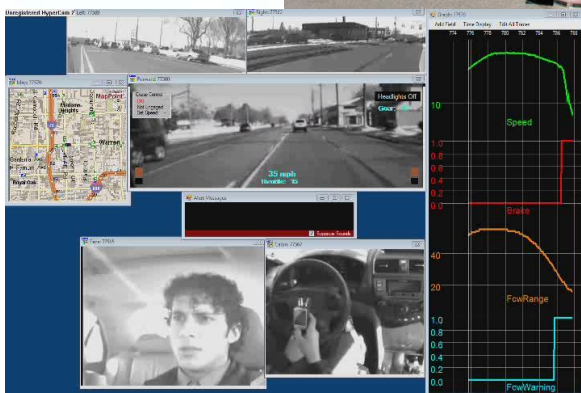
- younger (20-30 years)
- middle-aged (40-50 years)
- older (60-70 years)

6 weeks of driving per participant

- First 12 days – Warning inhibited (Baseline)
- Next 27 days – IVBSS warnings enabled (Treatment)

Warning Systems

- Takata: Vision based
- Visteon: Radar based



Teen IVBSS Study

Teen IVBSS Status:

- 40+ drivers to complete by October
 - 20 Treatment & 20 Control
- Warning rates appear higher than the adult data set
 - Too early to draw ANY conclusions
- 6 drivers have had minor to moderate crashes
 - 5 parking lot mishaps
 - Lots of vehicle damage, but little risk of injury
 - 1 rear end crash with minor injury in the other car

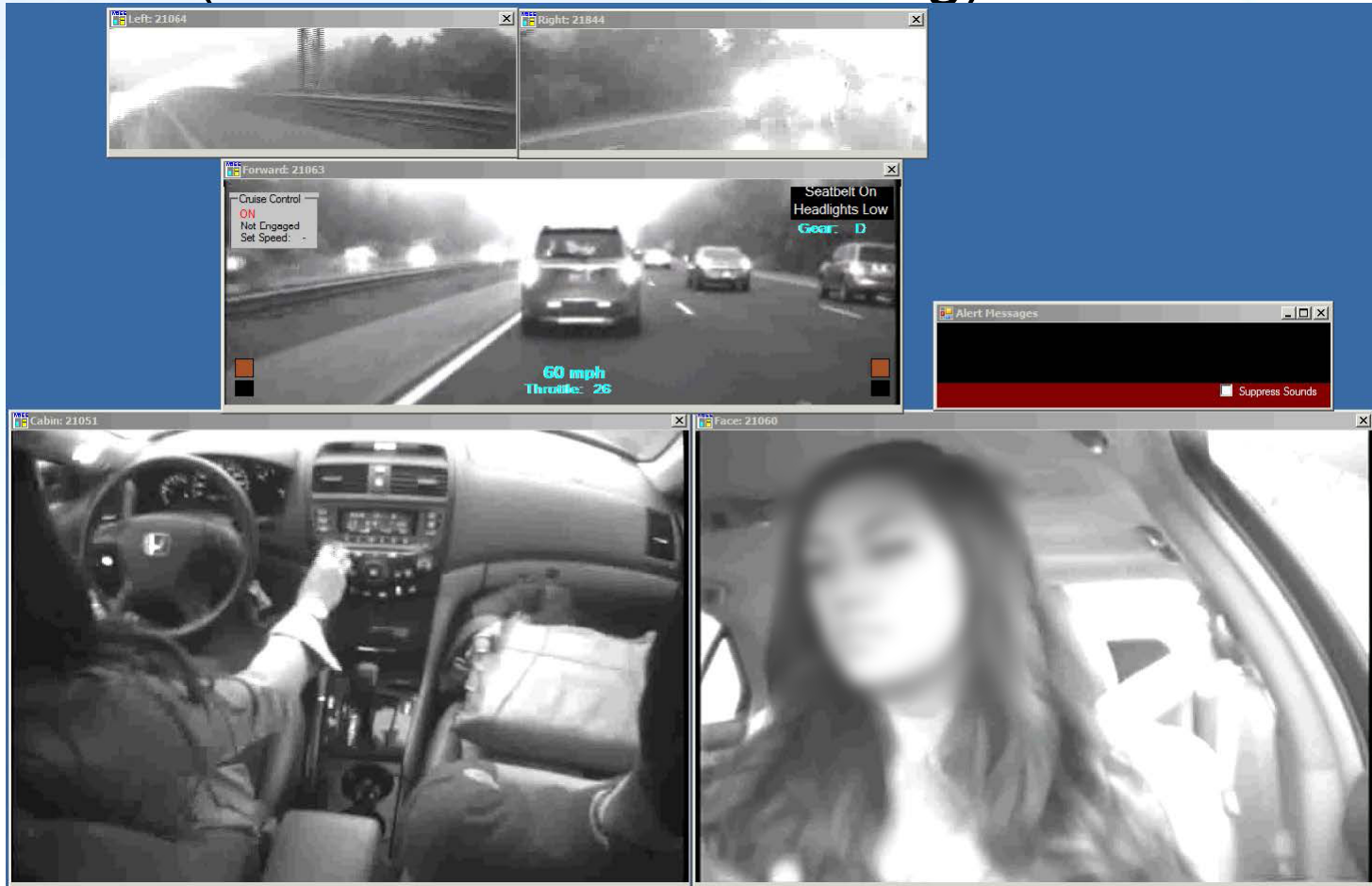
Warning Rates per 100 miles

Driver #	Treatment/Control	Gender	FCW Dis	FCW En	IVBSS	CSW Dis	CSW En	IVBSS	LDWCaut Dis	LDWCaut En	IVBSS	LDWIm Dis	LDWIm En	IVBSS	LCM Dis	LCM En	IVBSS
1	T	M	1.23	1.52	0.19	0.47	0.71	0.30	3.96	3.94	5.56	1.04	0.71	1.01	0.75	0.56	0.61
2	T	M	0.00	0.21	0.19	1.96	1.86	0.30	3.08	2.07	5.56	1.96	0.83	1.01	0.84	2.90	0.61
3	T	F	0.16	0.47	0.19	0.08	0.32	0.30	3.32	1.10	5.56	0.24	0.63	1.01	0.08	0.32	0.61
4	T	F	0.80	1.05	0.19	0.48	1.24	0.30	2.71	1.91	5.56	0.64	0.48	1.01	1.12	1.05	0.61
5	T	M	1.38	1.13	0.19	0.35	0.28	0.30	21.40	7.94	5.56	1.73	0.57	1.01	0.00	0.00	0.61
6	T	F	0.30	0.97	0.19	0.60	2.74	0.30	27.57	8.87	5.56	2.41	1.29	1.01	0.15	1.61	0.61
7	C	M	0.43	N/A		0.43	N/A		3.76	N/A		0.11	N/A		0.00	N/A	
8	C	M	0.00	N/A		0.34	N/A		17.12	N/A		2.61	N/A		0.23	N/A	
9	C	F	0.27	N/A		1.14	N/A		4.22	N/A		0.40	N/A		2.01	N/A	
10	C	F	0.19	N/A		0.09	N/A		7.74	N/A		1.12	N/A		0.19	N/A	
11	C	M	0.88	N/A		1.39	N/A		13.42	N/A		2.11	N/A		1.17	N/A	

Teen IVBSS Study

Teen IVBSS Examples:

- FCW (Forward Crash Warning)



Teen IVBSS Study

Teen IVBSS Examples:

- Rear end crash



Teen IVBSS Study

Teen IVBSS Limitations:

- Sample is limited to Ann Arbor area teens
- Only novice drivers
 - < 17 years old
- They know they are being studied
 - Systems are explained to them at time of release
- Systems are warning systems only
- Systems are not near OEM production level
 - High rates of false warnings for FCW & CSW

Conclusion

Simulator Results

- Teens and Adults responses are not consistent
 - Teens are more likely to respond
 - That response is more likely to be steering
 - Teen response time is quicker than adults
 - Response intensity is lower than adults
- Crash warnings improved response rates
 - Improvements were less for teens than adults

On-road Results

- Crash/Near Crash events are not clear cut
- Environment influences driver response
- Stay Tuned

Acknowledgements

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For Teen ACAT

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For Teen IVBSS

Thank You!

