DRIVER EXPECTATIONS FOR CONTROL ERRORS, ENGAGEMENT, AND CRASH AVOIDANCE IN LEVEL 2 DRIVING AUTOMATION SYSTEMS

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Acknowledgements

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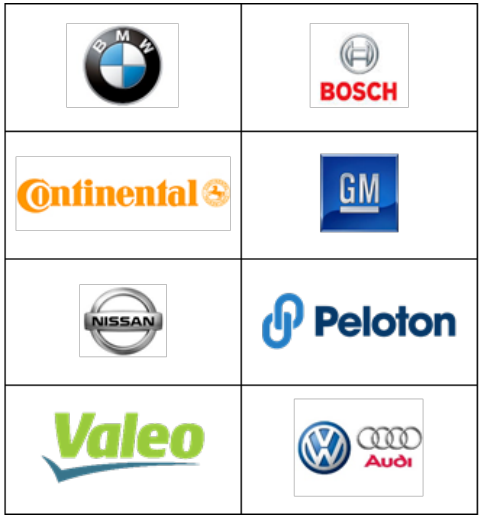
- Special thanks to project stakeholders



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Intelligent Transportation Systems
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Project Objective

Experiment investigating how driver expectations about Level 2 driving automation capabilities affect driver engagement and performance

- Many commercially available models offer a version of simultaneous lateral and longitudinal automation
  - Capabilities vary between makes and models
- Driver expectations about capabilities will impact the way they use this technology
- Experimental approach manipulates driver expectations independently from vehicle capability
  - Phase 1 (development and pilot collection) completed Q4 2017
  - Phase 2 (data collection and reporting) beginning Q1 2018

Expectation

Direct vs Indirect expectations

- Direct
  - Test drives
  - Own/operate
- Indirect
  - Prior to experiencing technology
- Sources of indirect expectation
  - News reports
  - Articles/blogs
  - Social media

Vehicle Details

Customized 2015 Infiniti Q50

- VTTI developed automation hardware and software
  - High capability (lane centering)
    - Limited driver intervention
  - Low capability (lane keeping)
    - Sinusoidal disturbance introduced
    - Requires driver intervention often
- Redundant rear seat controls
  - Initiate steering errors
  - Emergency takeovers*

Vehicle Details (cont.)

Camera Views

- VTTI Flex DAS
  - 1080p resolution
  - Front
  - Over the Shoulder
  - Driver Face
  - Foot
  - Rear

Design

Manipulate participant training to set expectation

- Training is either congruent, above, or below vehicle capability
- 4 x 2 x 6 mixed design
  - 4 levels of expectation (between)
  - 2 types of crash imminent scenario (between)
  - 6 non-driving task order conditions (between)
    - Non-driving task comparisons as within subjects factor

Training	Capability	Expectation
Low	Low	Congruent
Low	High	Below Expectations
High	Low	Above Expectations
High	High	Congruent

Participants

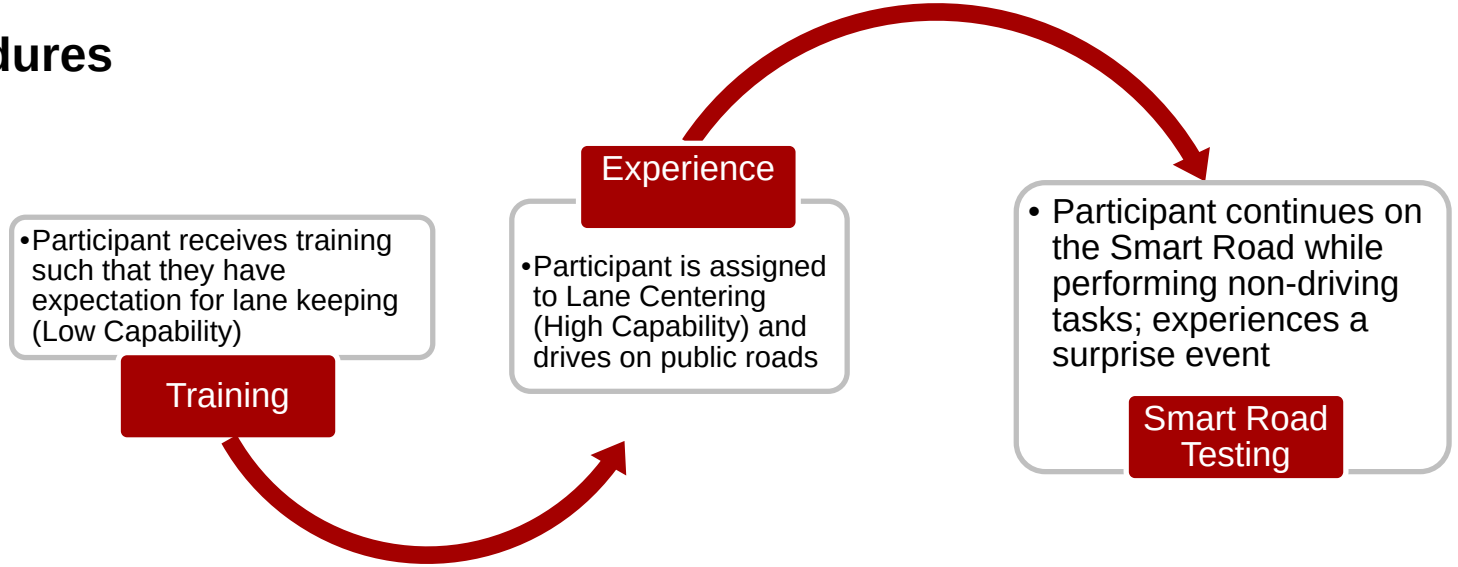
Data collection completed in two phases

- Phase I: 16 participants - Complete
- Phase II: 96 participants
- Gender balanced within two NHSA age groups
  - 24-39
  - 40-54

Task Orders	Crash Imminent Scenario	Expectation-Capability Combinations								Participants Per Combination
		Low-Low		Low-High		High-Low		High-High		
		Age Group		Age Group		Age Group		Age Group		
		Younger	Older	Younger	Older	Younger	Older	Younger	Older	
TO-1	Depart	1	1	1	1	1	1	1	1	8
TO-1	Reveal	1	1	1	1	1	1	1	1	8
TO-2	Depart	1	1	1	1	1	1	1	1	8
TO-2	Reveal	1	1	1	1	1	1	1	1	8
TO-3	Depart	1	1	1	1	1	1	1	1	8
TO-3	Reveal	1	1	1	1	1	1	1	1	8
TO-4	Depart	1	1	1	1	1	1	1	1	8
TO-4	Reveal	1	1	1	1	1	1	1	1	8
TO-5	Depart	1	1	1	1	1	1	1	1	8
TO-5	Reveal	1	1	1	1	1	1	1	1	8
TO-6	Depart	1	1	1	1	1	1	1	1	8
TO-6	Reveal	1	1	1	1	1	1	1	1	8
								Total Phase 1		16
								Total Phase 2		96
								Grand Total		112

Approach (cont.)

Procedures



Smart Road Testing - 12 Trials

1- Video | 2- Text | 3- Baseline | 4- Video | 5- Text | 6- Baseline | 7- Video | Resume Trials 8-12

Surprise Event

Surprise Events

Two types of surprise event scenarios

- Limitations of currently available systems
  - **Slowed vehicle reveal**
  - Road departure

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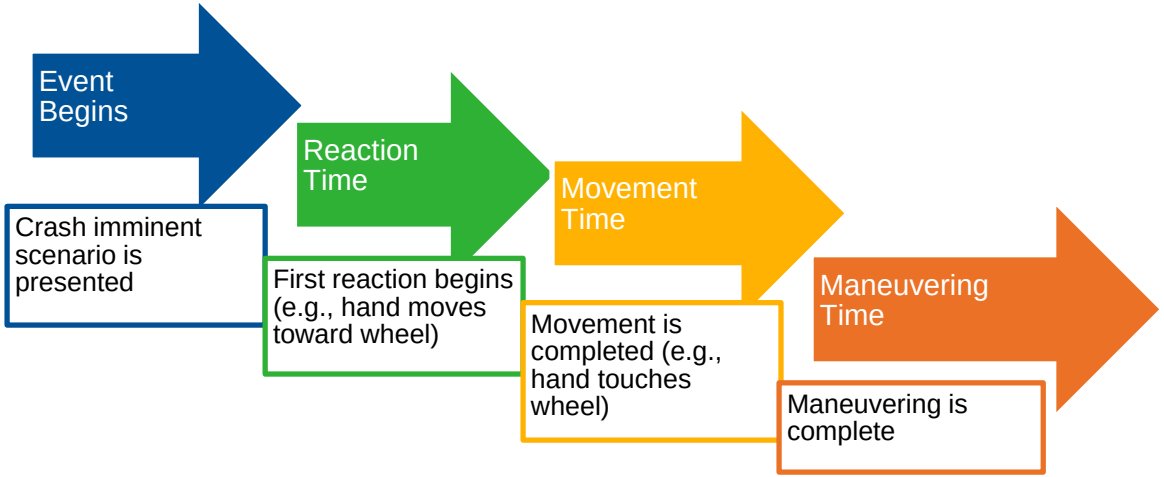
Planned Analyses

Focus on Driver Response, Engagement, and Trust

- Response times to surprise events
- Hands on wheel behavior
  - Capacitive wheel installed
- Eye glance analyses
- Subjective questionnaires



Questions?

Thank You!

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