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Two NHTSA-Sponsored Research Projects in Maryland

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Current AV projects conducted by Westat

1) **Automated Vehicle Communication and Intent with Shared Road Users**
   - On-going until July, 2019
   - Westat is subcontractor to University of Michigan

2) **Automated Driving Systems and Legacy Vehicle Interaction**
   - On-going until March, 2020
   - Westat is prime contractor

Both projects focus on human factors issues

Project 1
Automated Vehicle Communication and Intent with Shared Road Users

- Highly automated vehicles
- Communication = visual, auditory, no connected vehicle technology considered
- Intent = current state and planned actions of AV
- Shared road users = other drivers, pedestrians, bicyclists

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Automated Vehicle Communication and Intent with Shared Road Users

Like backseat passengers, occupants of a highly automated vehicle are not in control.

Occupants are a completely unreliable source of information!

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Project Objectives

- Identify needs of shared road users to predict intent of highly automated vehicles
- Identify the specific implicit and explicit cues that are currently used to predict the intent of drivers
- Develop method to assess understanding of new external signaling systems for AVs

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Automated Vehicle Communication and Intent with Shared Road Users

- Study 1 – Interviews with driving instructors
  - Completed. Summary report submitted to NHTSA.
- Study 2 – Determine cues used by drivers, pedestrians, & bicyclists
  - Data collection complete & data reduction ongoing
- Study 3 – Lab testing AV communication concepts
  - In protocol development
- U.S. – E.U. “Twinning” with interAct project (our big sister)
  - Agreement to share information
  - Conference calls
  - Face to face meetings at least once per year
  - Joint papers or presentations

Study 2 - Background

- What information is communicated by the actions of human drivers to shared road users?
- Drivers communicate their intentions
  - explicitly (e.g. turn signal, hand gestures, flashing headlamps); automatically (backup lights)
  - implicitly (e.g. speed changes, position in lane, following distance, glance direction)

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Method

- Participants (drivers, pedestrians, bicyclists)
- Verbal commentary procedure
- Video and audio recording
- Two-way real-time communication
- Follow-up probe questions
- Fixed test routes
- Naturalistic, participant-defined routes

Rockville, MD – Town Center area

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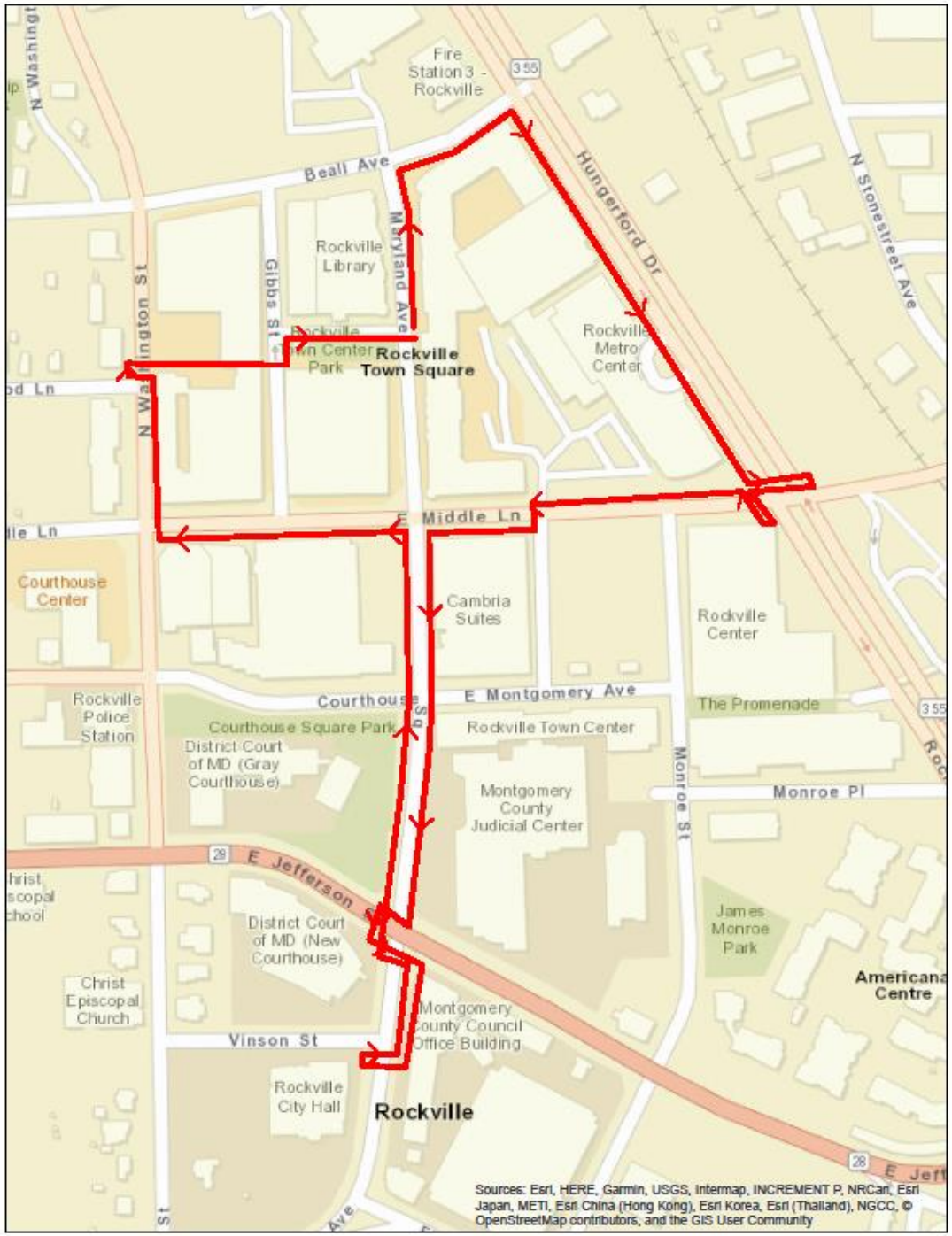
Pedestrians - Fixed Route




AVEDA
Participant's Camera View


Researcher's Camera View
Pedestrian participant
EXXON

Project 2
Automated Driving Systems and Legacy Vehicle Interaction

"… *identify how automated driving system (ADS) vehicles and legacy vehicles may interact on the highway, how these interactions may be similar to or different from legacy-legacy vehicle interactions, and describe how these interactions could affect driving safety*"

Legacy vehicle = human driver in control

ADS vehicle = SAE Level 3 automation or greater

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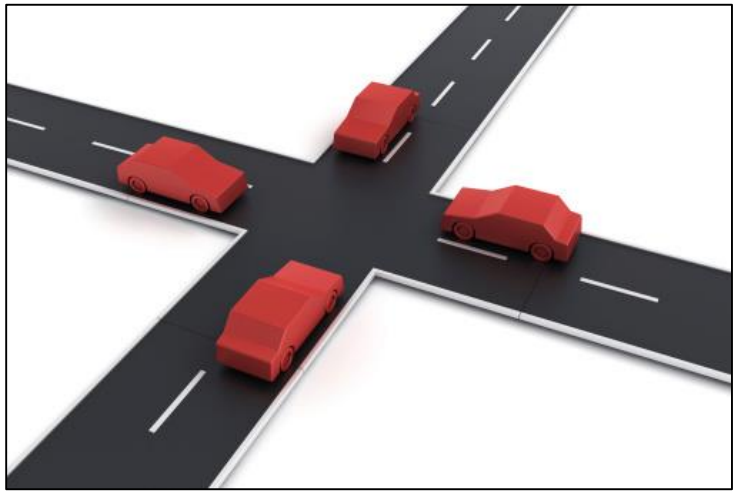
Examples

- Close following
- Perceiving/communicating intent
- Cautious behavior
- Quick, hard braking
- Environment/scenario-specific challenges



CONSUMERAFFAIRS Consumer News Buyers Guides

Autonomous car companies report getting rear-ended in most crashes, blame driver error

Experts suggest the issue may stem from computers driving more cautiously than the humans with which it shares the road

By Amy Martyn

10/20/2017 | ConsumerAffairs | Automotive News

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Overview of Research Approach

- Review and analysis of existing knowledge on legacy-legacy vehicle interaction and ADS-legacy vehicle interaction
- On-road observational study of natural traffic interactions with an automated vehicle

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Analytical Review - Objectives

- Critically review literature relevant to vehicle-vehicle interactions for:
  - Legacy vehicles
  - Early deployments of ADS vehicles
- Assess how ADS-legacy vehicle interactions may differ from legacy-legacy interactions from a safety perspective
- Identify potential risk mitigation approaches to address the interaction challenges posed by ADS

On-Road Observational Study - Proposed

- Objectives:
  - Compare how drivers interact with a nearby ADS vehicle as compared to a legacy vehicle
  - Determine whether drivers' interactions with a nearby ADS vehicle depend on
    - identification of the ADS vehicle
    - "driving style" of the ADS vehicle

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On-Road Observational Study - Proposed

- 2018 Cadillac CT6 with Super Cruise
- Level 2 Automation (lane keeping and ACC)
- Does not require hands on wheel

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On-Road Observational Study – Proposed

- Researcher operates instrumented vehicle on public limited access highways, recording behavior of the surrounding traffic

- Six conditions for data collection

	Legacy Appearance 	"Self-Driving" "Automation On"	"Self-Driving" "Automation Off"
Manual Control	8 hours	8 hours	8 hours
Automated Control	8 hours	8 hours	8 hours

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On-Road Study – Proposed Measures

- Number of overtaking vehicles in adjacent lane(s)
- Speed differential with vehicles in adjacent lane(s)
- Following distance behind research vehicle
- Number of “cut-ins” in front of research vehicle from left and right
- Other drivers distracted by research vehicle (head turns/glances based on video coding)
- Conflicts with vehicles merging into lane (e.g. evasive maneuver taken by researcher, or by other vehicle)
- Horn honks, and gestures by other drivers.

Questions & Comments…

Thanks for your attention!

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