TIC web page

http://epd.wisc.edu/tic
TIC Resources

- One day training sessions around the state
  - Winter road maintenance
  - Highway safety
  - PASER and WISLR training
- Webinars on special topics
- PASER Manuals
  (Asphalt, Concrete, Gravel, Sealcoat over Gravel, Earth, Brick, Drainage)
- Work Zone and Flagger pocket guide books
- SAFER Manual
- Searchable Crossroads Newsletter Article Archive
- Video lending library (Over 200 titles)
- 23 fact sheets
- DNR Transportation Liaison link
- Implements Of Husbandry (IOH) Permit Evaluation Technical Resources
Safety Program Overview

- Coordination
- Data Collection and Integration
- Safety and Operation Studies
- Work Zone
- WEXI and Possibilities
- Wisconsin Driving Simulator
Agenda

1 | What are Autonomous Vehicles (AVs)?
2 | AVs are Already Here
3 | Wisconsin AV Proving Grounds
4 | Research and Development Opportunities
5 | Moving AVs Forward in Wisconsin
1 | What are AVs?
What is an Autonomous Vehicle (AV)?

- Often referred to as a ‘self-driving’ or ‘driverless’ vehicle
- A vehicle with sufficient built-in technology that allows sensing the driving environment and navigating without human input
- An autonomous vehicle detects its surroundings using a variety of sensor technologies
- Require little to no human input – reduces driver error and increases mobility
AUTONOMOUS VEHICLES IN WISCONSIN / WHAT ARE AVs?

https://www.youtube.com/watch?v=OXRQ7SMn0wl
How AVs Operate

- Location and navigation by GPS (satellite global positioning system) plus gyro sensor, accelerometer, etc.
- Situational awareness by RADAR, LiDAR, stereo video, and sometimes others
- Sophisticated hardware and software processing
- Connectivity and high-resolution basemap optional
Perceived and Real Challenges

• Are AVs safe?
• What happens when an AV malfunctions?
• Can someone hack into my vehicle?
• Who is responsible when an AV crashes?
• How does an AV operate on snow and ice?
• AV reaction to deer and pedestrians.
• I like to drive – not interested in AV!

Tesla Crash, May 2016, Florida
### National Safety Council – Safety Data...

#### December 2016

**Motor-Vehicle Deaths and Changes**

**United States, Twelve Months, 2013 to 2016**

<table>
<thead>
<tr>
<th>Month</th>
<th>Number of Deaths</th>
<th>Percent Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>2,642</td>
<td>2,572</td>
</tr>
<tr>
<td>February</td>
<td>2,296</td>
<td>2,248</td>
</tr>
<tr>
<td>March</td>
<td>2,791</td>
<td>2,589</td>
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<tr>
<td>April</td>
<td>2,719</td>
<td>2,720</td>
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<tr>
<td>May</td>
<td>2,988</td>
<td>3,038</td>
</tr>
<tr>
<td>June</td>
<td>3,181</td>
<td>3,084</td>
</tr>
<tr>
<td>July</td>
<td>3,119</td>
<td>3,227</td>
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<tr>
<td>August</td>
<td>3,378</td>
<td>3,277</td>
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<tr>
<td>September</td>
<td>3,184</td>
<td>3,069</td>
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<tr>
<td>October</td>
<td>3,173</td>
<td>3,304</td>
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<tr>
<td>November</td>
<td>3,076</td>
<td>3,175</td>
</tr>
<tr>
<td>December</td>
<td>2,822</td>
<td>3,095</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>35,369</td>
<td>35,398</td>
</tr>
</tbody>
</table>

Traffic Fatalities Rising

Nationally:
- Increased for 2\textsuperscript{nd} straight year
- Largest two-year increase in 50 years
- Approaching 40,000 deaths
- Road to Zero emphasizes AV

Wisconsin:

Sources: National Highway Traffic Safety Administration, National Safety Council, and Wisconsin DOT
2 | AVs Are Already Here
Automated Vehicles are Already on the Roads

• “Automated” means various levels and features of automation, which exists today
• … leading to fully autonomous or driverless vehicles that can operate anywhere, yet years away
• Distinct from but overlapping with “connected” vehicles
Motivations and Opportunities

• Motivated primarily by safety gains
  • ~90% of crashes attributable to human error
  • Distracted driving continues to worsen
  • Need to carefully navigate the era of partial automation

• Many other motivations:
  • Economic development
    • Startup and tech jobs
  • Underutilized vehicles
  • Efficient use of infrastructure
  • Accessibility and equity
  • Agriculture and defense sectors
  • AVs integral to automation, artificial intelligence enablement, construction, manufacturing
What are Other States and Federal Agencies Doing?

- Many private industry sites, testing, and collaborations
  - Toyota with MIT/UM/Stanford
  - Uber in Pittsburgh, research center near Detroit
- Nevada Center for Advance Mobility, a branch of the Governor’s Office of Economic Development
- Ohio: $15M upgrade of 35-mile stretch of road; state contributing $20M along with Ohio State’s $49M for AV test site and research
- Michigan: $80M ($20M from the state) to developed 300-acre test site
- USDOT awarded $45M to three Connected Vehicle Pilot Deployment Sites
- Potential USDOT funding of AV pilot sites
- Designated AV Proving Grounds
### AV Timeline

Difficult to predict, debatable, but certainly accelerating…

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
</table>
| 2015 | • driver assistance common  
      • some partial automation available to consumers |
| 2020 | • limited / conditional AVs widely available to consumers |
| 2025 | • autonomous shared mobility fleets |
| 2030 | • high automation required in all new vehicles |
| 2035 | • human operation is the exception in many places |
| 2040 | • transition to driverless largely complete  
      • fleet turnover continues… |
3 | Wisconsin AV
Proving Grounds
USDOT Identified 10 Locations

- Announced January 2017
- A peer network to share lessons learned and advise policy and best practices
Varying Levels of Automation

Critical implications for:

- Human operator expectations
- Where certain vehicles can safely operate

Operational Domain:

- Test Locations
- Everywhere

Level:

- Full (5)
- High (4)
- Conditional (3)
- Partial (2)
- Assistance (1)
- None (0)

Operational Domain:

- New Vehicles
- Existing Vehicles
- AV Microtransit
- Google, Apple
- Teslas Autopilot
- Driver Actively Monitors Environment to Level 2
- Situational Awareness Expected into Level 3
- ...years or decades?
Wisconsin Facilities

- **MGA Research Facility - Burlington, WI**
  - Early Stage | Closed Track | Low Speed Safety | Durability | Transit

- **Road America - Elkhart Lake, WI**
  - Early Stage | Closed Track | High Speed Mobility | Long Distance | Freight

- **UW-Madison / Epic Campus**
  - Mid-Stage | Limited-Use Facility | Low Speed Safety | Durability | Transit

- **City of Madison**
  - Mid/Late-Stage | Public Roads | Low Speed Safety | Mobility | Durability | Transit

- **Wisconsin DOT (W-Highway)**
  - Late-Stage | Public Roads | High Speed Mobility | Long Distance | Freight
Wisconsin Facilities

Road America, Plymouth

MGA Research, Burlington
4 | Research and Development Opportunities
R & D Priorities

- Data and sensing technologies
- System integration validation methods
- Vehicle performance
- Winter and other adverse weather conditions
- Transportation infrastructure
- Work zones and road hazards
- Security, both passenger and vehicle
- Privacy
- Temporary law violation
- Interaction with pedestrians, bicycles, scooters and non-automated vehicles
- Human-machine interfaces
- Bringing connected vehicle and autonomous technology together
- Driving decision-making
- Automated to manual transitions
Wisconsin’s Strategic Advantages

- Broad and interdisciplinary expertise
  - Sensing, robotics, safety, human factors, big data, cybersecurity, artificial intelligence, internet of things
- Hierarchy of test environments
  - Private, university/corporate campus, and public test sites
- Collaboration with industry
- Adverse winter weather
- Freight movement and agriculture applications
- Data infrastructure
- Leading research university partner
- Workforce development
5 | Moving AVs Forward in Wisconsin
Outreach, Awareness, and Engagement

- Workshops, conferences, and symposia
- Peer exchanges
- Policy briefings
- Industry and stakeholder testing and development
- AV demonstrations in Wisconsin as part of special events

April 10
Wisconsin CAV Summit
in Madison
Connected Transportation Research and Policy Enterprise

- Government – University – Industry collaboration
- Public-private partnerships
- Multiple disciplines required to address multiple facets
- Facilities and networks for development and commercialization
The Future of AVs in Wisconsin

• AVs will proliferate regardless, but many questions remain to be addressed

• Adapting the transportation system to be smarter is enabled by automated and related technologies

• An “open door” to AV development and integration can quickly move Wisconsin into a leadership position and bring research and private sector investment to our state
Contacts

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  608-890-3425 or bill@wisc.edu
THANK YOU.