Best Practices for Regulation of
Autonomous Vehicles on Utah Highways
Report to the Utah Legislature

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A Glimpse into the Transportation Future
Connected and Autonomous Technologies
Mission
Innovating transportation solutions that strengthen Utah’s economy and enhance quality of life.

Strategic Goals
- Zero Crashes, Injuries, Fatalities
- Optimize Mobility
- Preserve Infrastructure
“If I had asked people what they wanted, they’d have said faster horses.”

- Henry Ford
Electricity may be the driver. One day your car may speed along an electric super-highway, its speed and steering automatically controlled by electronic devices embedded in the road. Highways will be made safe – by electricity! No traffic jams, no collisions, no driver fatigue.
Automated and Autonomous Vehicles

1.9 million miles - 20 crashes

- Drives by sensors:
  - LiDar (64 laser beams)
  - Digital Cameras
  - GPS
  - Radar sensors

- Technology motivated by:
  - Safety
  - Reduced energy use
  - Democratization of access
Automated and Autonomous Vehicles

Automated Features Available

- Parallel Parking Assist
- Lane Departure Warnings / “Lane Keeping”
- Adaptive Cruise Control
- Automatic Emergency Braking
- “Traffic Jam” driving: automated steering, braking, acceleration
NHTSA Policy
- Vehicle Performance Guidance
- Model State Policy
- Current Regulatory Tools
- New Tools

NHTSA regulates:
- vehicle performance and safety

States continue to regulate:
- vehicle licensing
- traffic laws and enforcement
- insurance
- liability
# Summary of SAE International’s Draft Levels of Automation for On-Road Vehicles (July 2013)

SAE’s draft levels of automation are descriptive rather than normative and technical rather than legal. Elements indicate minimum rather than maximum capabilities for each level. “System” refers to the driver assistance system, combination of driver assistance systems, or automated driving system, as appropriate.

NHTSA’s levels of automation are provided to indicate approximate correspondence.

<table>
<thead>
<tr>
<th>SAE level</th>
<th>SAE name</th>
<th>SAE narrative definition</th>
<th>Execution of steering and acceleration/deceleration</th>
<th>Monitoring of driving environment</th>
<th>Backup performance of dynamic driving task</th>
<th>System capability (driving modes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Non-Automated</td>
<td>the full-time performance by the human driver of all aspects of the dynamic driving task, even when enhanced by warning or intervention systems</td>
<td>Human driver</td>
<td>Human driver</td>
<td>Human driver</td>
<td>n/a</td>
</tr>
<tr>
<td>1</td>
<td>Assisted</td>
<td>the driving mode-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task</td>
<td>Human driver and system</td>
<td>Human driver</td>
<td>Human driver</td>
<td>Some driving modes</td>
</tr>
<tr>
<td>2</td>
<td>Partial Automation</td>
<td>the driving mode-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task</td>
<td>System</td>
<td>Human driver</td>
<td>Human driver</td>
<td>Some driving modes</td>
</tr>
</tbody>
</table>

### Automated driving system (“system”) monitors the driving environment

| 3         | Conditional Automation | the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task with the expectation that the human driver will respond appropriately to a request to intervene | System                                              | System                                          | Human driver                          | Some driving modes             |
| 4         | High Automation        | the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task, even if a human driver does not respond appropriately to a request to intervene | System                                              | System                                          | System                               | Some driving modes             |
| 5         | Full Automation        | the full-time performance by an automated driving system of all aspects of the dynamic driving task under all roadway and environmental conditions that can be managed by a human driver | System                                              | System                                          | System                               | All driving modes              |
BUSINESS DAY

Self-Driving Tesla Was Involved in Fatal Crash, U.S. Says

By BILL VLASIC and NEAL E. BOUDETE JUNE 30, 2016

DETROIT — The race by automakers and technology firms to develop self-driving cars has been fueled by the belief that computers can operate a vehicle more safely than human drivers.

But that view is now in question after the revelation on Thursday that the driver of a Tesla Model S electric sedan was killed in an accident when the car was in self-driving mode.
Connected Vehicles

• The Connected Vehicle system will combine technologies:
  – advanced roadside (and central) infrastructure,
  – wireless communications, and
  – onboard computer processing, and

to provide vehicles the capability to detect threats and hazards on the roadway and to communicate this to the driver through alerts and warnings.

• Vehicle to Vehicle (V2V)
• Vehicle to Infrastructure (V2I)
• Vehicle to Others (V2X)
Connected Vehicles

UDOT Connected Vehicle Project – Redwood Road
Connected Vehicles

Hackers Remotely Kill a Jeep on the Highway—With Me in It

I WAS DRIVING 70 mph on the edge of downtown St. Louis when the exploit began to take hold.

Though I hadn’t touched the dashboard, the vents in the Jeep Cherokee started blasting cold air at the maximum setting, chilling the sweat on my back through the in-seat climate control system. Next the radio switched to the local hip hop station and began blaring Skee-lo at full volume. I spun the control knob left and hit the power button, to no avail. Then the windshield wipers turned on, and wiper fluid blurred the glass.

As I tried to cope with all this, a picture of the two hackers performing these stunts appeared on the car’s digital display: Charlie Miller and Chris Valasek, wearing their black t-shirts and khaki pants, standing in front of a laptop, their glasses glinting in the sunlight.
Connected Automation for Greatest Benefits

**Autonomous Vehicle**
Operates in isolation from other vehicles using internal sensors

**Connected Vehicle**
Communicates with nearby vehicles and infrastructure

**Connected Automation**
Leverages autonomous vehicle capabilities
Summary

- Automated Vehicles are coming incrementally
- Connected Automation provides the highest chance of success
- Technology is evolving fast, but is still evolving
- There are issues to resolve
- We need to leverage the benefits and implement as it evolves
Licensing, Training & Driver Education
Recommendations & Considerations

• Committee for further study
  – Vehicle safety
  – Data and personal security
  – Infrastructure preparation
  – Training and licensing
  – Vehicle registration
  – Enforcement
  – Regional and national consistency

• Goals and strategic direction from policymakers
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