Regulatory Challenges for Road Vehicle Automation: Lessons from the California Experience

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Regulatory Challenges

- Automation breaks the traditional boundary between vehicle equipment and driving behavior
- Need to balance protecting public safety and encouraging innovation in vehicle technology
- Absence of technical standards
- Extremely high safety needed just to equal today’s manual driving (in U.S.):
  - 3.3 million vehicle hours between fatal crashes (375 years of 24/7 driving)
  - 64,400 vehicle hours between injury crashes (7+ years of 24/7 driving)
California Background

• SB 1298 amended Vehicle Code in July 2012
• Rules apply to SAE Level 3+ driving automation
• Testing regulations effective Sept. 2014
  – Permission for specific vehicles, drivers
  – Strict test driver requirements
  – Describe prior closed-course testing
  – No heavy vehicle, motorcycle testing now
  – Report certain driver interventions, but all crashes
• Permits for 10 manufacturers, 102 vehicles, 334 test drivers
Deployment Regulation Principles

• Public safety now depends on the technology, not on the trained test drivers
• Treat all developers equally
• Clear and unambiguous requirements representing real transportation needs to avoid temptations to “game the test”
• Compliance testing process clearly defined and not excessively complicated
• Transparency of results to gain public confidence, without jeopardizing developers’ intellectual property
Our Recommendations on Easy Topics

• No special driver licensing, training, or testing
  – But manufacturers should disclose all information provided to customers

• No special external markings on vehicles
  – Except if they can operate without driver

• Self-diagnostic capabilities to recognize calibration or tampering problems
  – Preclude operation of impaired vehicles

• Preclude operation outside operational design domain
Open Questions

• How to ensure that the AVs will not decrease safety?
  – Functional safety with respect to internal faults
  – Driving behavioral competency for handling external hazards

• Certification
  – What needs to be certified?
  – Who should perform the certification?
Functional Safety

- ISO 26262 as a starting point, but...
  - It is a process standard, not a performance standard, with no pass/fail criteria
  - Complicated and costly to apply
  - Designed for subsystems of limited complexity, not complex systems of systems
  - Automotive Safety Integrity Levels (ASIL) assume driver availability for fallback

- Therefore, it is not yet sufficient
Managing External Hazards

- Consider diversity of operational design domains
  - Urban, suburban, rural, or motorway
  - Traffic conditions, other road users
  - Weather and lighting conditions….

- What basic driving maneuvers are required for each, to screen out the incompetent?
  - Common hazard responses

- How to define pass/fail criteria?

- Is there a role for simulation?
  - How to validate the simulation?
What should be certified?

• Functional safety system development process?
  – Minimal relevant experience in U.S.

• Functional safety of the specific system design?
  – Complicated, expensive, and needs IP protection

• Performance testing relative to required behavioral competencies?
  – Complicated and expensive if the tests are to be complete enough to be meaningful

• Simulations of required behavioral competencies and performance under many scenarios?
  – How to certify realism of simulation?
Who should do the certification?

- **Manufacturer self-certification**
  - Typical for FMVSS safety standards in U.S.
  - Needs independent verification by agency
  - Public release of relevant data??

- **Third-party certification**
  - Common in Europe, not in U.S.
  - Third party needs proper certification
  - Could be hired by government or company

- **Government certification**
  - Needs public investment to build capabilities
  - Used for emissions in U.S.