

# **Autonomous Vehicles in California**

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# The Vision of the Future



**Advertisement from 1957 Independent Electric Light and Power Companies ad: “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.”**

# Californians lead the way – in being stuck in traffic!



**2015: 1<sup>st</sup> and 3<sup>rd</sup> place nationally with commuters stuck in traffic!  
Average commuter in #1, Los Angeles, stuck in traffic for 81 hours!**

**10 work days!**



**Average commuter in #3, the San Francisco Bay area, stuck  
in traffic for 75 hours!**

**9 work days!**



# The Human Cost of Bad Driving

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- **Annually over 32,000 traffic fatalities in the U.S. almost 10% of those fatalities occur in California.**
- **“A different human choice could have made the difference between life and death in 94% of the traffic crashes.”**
- **In over 35% of fatal accidents the brakes were never applied.**
- **20% of fatal accidents involve a distracted driver.**
- **40% involve alcohol.**

# What the public is seeing now!

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**Manufacturers advertising automated driving.**



Audi A4 with Traffic Jam Assist.mp4

# How does the law define “autonomous”?

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**CALIFORNIA VEHICLE CODE DEFINES AN  
AUTONOMOUS VEHICLE AS:**

**ANY VEHICLE EQUIPPED WITH TECHNOLOGY THAT  
HAS THE CAPABILITY TO DRIVE THE VEHICLE WITHOUT  
THE ACTIVE PHYSICAL CONTROL OR MONITORING BY  
A HUMAN OPERATOR. (Cal. Veh. Code sec. 38750 (a)(2)(A))**

**Driver Not Needed!**

# What about the stuff already on the street?

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**The system advertised by Audi, the Tesla upgrade from last fall, and the other systems in Volvo's, Honda's, and Mercedes are defined as not autonomous!**

**An autonomous vehicle does not include vehicles equipped with one or more collision avoidance systems, such as electronic blind spot assistance, automated emergency braking systems, park assist, adaptive cruise control, lane keep assist, lane departure warning, and traffic jam and queuing assist.**

**(Cal. Veh. Code sec. 38750 (a)(2)(B))**

# California Legislation - Senate Bill 1298

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- **As soon as practicable, but no later than January 1, 2015, DMV must adopt regulations setting forth requirements for:**
  - **Manufacturers' testing of autonomous vehicles on public roadways**
    - **Regulations approved and adopted in May 2014**
    - **Effective on September 16, 2014**
  - **Operation of autonomous vehicles on public roadways**
    - **Under development**



# Testing on California Public Roadways

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- **\$5 million in insurance, bond, or self-insurance**
- **Manufacturer has tested vehicle under controlled conditions that simulate, as closely as practicable, the real world conditions and has reasonably determined it is safe to operate the vehicles on public roads under those conditions**
- **Test driver requirements:**
  - **No DUI, not an at-fault driver, and no more than 1 point**
  - **Successful completion of test driver training program**
  - **Employee, contractor, or designee of manufacturer**
- **Test driver must be seated in driver seat during testing**
- **Report any accident within 10 days**
- **Report unanticipated disengagements of autonomous technology annually**
- **Testing permit valid for one year**
- **Vehicles excluded from testing: Commercial vehicles that are > 10,000 lbs GVW and motorcycles**

# Companies Testing in California

- VW/Audi (2 cars, 28 drivers)
- Mercedes (5 cars, 20 drivers)
- Tesla Motors (8 cars, 5 drivers)
- BMW (1 car, 6 drivers)
- Nissan (2 cars, 23 drivers)
- Honda (1 car, 2 drivers)
- Ford (2 cars, 5 drivers)
- Google Auto (74 cars, 243 drivers)
- Delphi (2 cars, 10 drivers)
- Bosch (2 cars, 25 drivers)
- Cruise Automation (7 cars, 30 drivers)
- Zoox (1 car, 8 drivers)
- Drive.AI Inc (1 car, 9 drivers)

108 Cars – testing on public streets

414 approved test drivers

# Reports of Accidents



- A manufacturer whose autonomous vehicle is in any manner involved in a accident originating from the operation of the autonomous vehicle on a public road that resulted in the damage of property or in bodily injury or death shall report the accident to the department within 10 days after the accident.
- Reports are on DMV website:  
[https://www.dmv.ca.gov/portal/dmv/detail/vr/autonomous/autonomousveh\\_ol316](https://www.dmv.ca.gov/portal/dmv/detail/vr/autonomous/autonomousveh_ol316)
- Number of reports – 11

 : 9 reports



: 1 report



: 1 report

# Reports of Disengagement

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- **A manufacturer shall retain data related to the “disengagement” of the autonomous mode.**
- **“Disengagement” means a deactivation of the autonomous mode when a failure of the autonomous technology is detected or when the safe operation of the vehicle requires that the autonomous test driver disengage the autonomous mode and take immediate manual control of the vehicle.**
- **Annual report – covering December 1 to November 30, due by January 1.**
- **7 companies were required to report. (on our web site: [https://www.dmv.ca.gov/portal/dmv/detail/vr/autonomous/disengagement\\_report](https://www.dmv.ca.gov/portal/dmv/detail/vr/autonomous/disengagement_report))**

# Reporting Disengagement

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- **Bosch reported 625 disengagements in 935 miles driven.**
- **Delphi reported 405 disengagements in 16,662 miles driven.**
- **Google reported 341 disengagements in 424,331 miles driven.**
- **Nissan reported 106 disengagements in 1,485 miles driven.**
- **Mercedes-Benz reported 967 disengagements in 1,337 miles driven.**
- **Tesla Motors reported zero disengagements (No testing on public streets)**
- **Volkswagen reported 260 disengagements in 14,945 miles driven.**

# Reasons for Disengagement

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- **Weather conditions during testing**
- **Software discrepancy**
- **Unwanted maneuver of the vehicle**
- **Traffic Light Detection – poor sun conditions**
- **Construction Zone**
- **Other unexpected driver behavior**
- **Driver was uncomfortable**
- **Technology evaluation management**

# Reasons for Disengagement

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- “There were 69 events across our fleet in which safe operation of the vehicle required the disengagement by the driver... of the 69 reportable safe operation events, 13 were ‘simulated contacts’ – events in which, upon replaying the event in our simulator, we determined the test driver prevented our vehicle from making contact with another object.”
- “In 10 of the 13 simulated contact events, the SDC’s (self-driving car) predicted behavior would have, in simulation, caused contact... in these cases, we believe a *human driver could have taken a reasonable action* to avoid the contact but the simulation indicated the *SDC would not have taken that action.*” Google Report on disengagements (emphasis added)

# Draft Deployment Regulations

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- **Identify all areas where the vehicle can operate autonomously and certify it is incapable of operation outside those areas.**
- **Identify commonly occurring restrictions on operation (snow, fog, rain, construction zones)**
- **Identify what the vehicle will do if the autonomous technology fails**
- **Certify that the AV technology will obey traffic laws**



# Third Party Demonstration Test

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- **Certifications made by the manufacturer are validated by a third-party testing organization that is independent from the manufacturer.**
- **The third-party testing organization will conduct a vehicle demonstration test and provide an independent verification of the vehicle's ability to perform key driving maneuvers typically encountered in real world driving conditions.**

# Provisional Deployment Permit

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- **The Permit will be initially issued with a three year term**
- **Vehicles can only be operated by the manufacturer or made available to the public on a lease basis.**
- **Manufacturers will be required to submit reports on the performance, safety, and usage of the vehicles.**
- **Manufacturers will still be required to report accidents that occur while the vehicle is in autonomous mode**
- **Manufacturers will be required to report any safety-related defects in the autonomous technology.**

# Privacy and Cyber-Security

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- **Information Privacy – disclosure to operator of the information that is collected that is not necessary for safe operation of the vehicle and written approval to collect this information.**
- **Cyber Security – certification that the vehicles are equipped with self-diagnostic capabilities to detect unauthorized commands, alert the operator, and allow the operator to override spurious commands.**

# Public Workshops on Draft Regulations

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- **Government Code Section 11346.45: to increase public participation and improve the quality of regulations, state agencies shall involve parties who would be subject to the proposed regulations in public discussions regarding those proposed regulations, when they involve complex proposals.**
- **1<sup>st</sup> workshop held on January 27, 2015 – prior to a draft text.**
- **2<sup>nd</sup> workshop in Sacramento on January 28, 2016, to discuss the draft regulation.**
- **3<sup>rd</sup> workshop in Los Angeles on February 2, 2016, to discuss the draft regulation.**

# What happened at the Workshops

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- **Attendees included: advocates for the disabled, OEM's, auto industry trade associations, consumer advocates, local government representatives, the media, members of the public.**
- **Concern that requiring a driver will impede the development of the technology and prevent the disabled from enjoying the promise of mobility and independence.**
- **The U.S. relies on self certification and a rigorous NHTSA recall process – the third party demonstration test is not the way we do things.**
- **The regulations are ambiguous because they don't establish the standards that the third party tester will use.**
- **Why limit the deployment to just leasing the vehicles?**
- **The data that companies collect and are required to report could be sensitive trade secrets.**

# What About NHTSA

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- **January 14 – series of policy announcements.**
- ✓ **Re-do of the 2013 Policy statement in recognition that the introduction of the technology is imminent: “...the governing principal should be that technologies with proven, data-supported benefits that would make the roads safe should be encouraged.”**
- ✓ **Work with the states to come up with a model policy**
- ✓ **Provide operational guidance.**
- ✓ **Give interpretations on current rules – and for things that can’t be done by interpretation, use the exemption process.**
- ✓ **Come up with the any necessary Legislative authority.**

# Items that don't meet FMVSS



**There are 286 references to vehicle systems interacting with a human driver in current FMVSS**

*Review of Federal Motor Vehicle Safety Standards for Automated Vehicles.* March 2016

Volpe National Transportation Systems Center, U.S. Dept. of Transportation

**Problem! How can you certify a vehicle meets FMVSS if the driving system does not include a human operator?**

# What's next for California?

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- **Review comments received from the workshop.**
- **Continue to work with NHTSA**
- **Prepare a proposed regulation to be formally noticed.**
- **Commence the official rulemaking process.**



# The Vision of the Future

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**2016's vision of what the future will look like!**



DRIVE ME ENG 20150605\_MP4\_Full-HD.mp4

# Questions

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