Autonomous Vehicle Revolution

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• Congress is considering significant state and local regulation preemption legislation in the
  • SELF-DRIVE Act which preempts states from enacting laws regarding the design, construction, or performance of
    highly automated vehicles or automated driving systems unless such laws enact standards identical to federal
    standards; and
  • AV START Act which preempts states from adopting, maintaining, or enforcing any law, rule, or standard regulating an
    HAV or automated driving system (ADS) regarding certain safety evaluation report subject areas;

• Concerning that only voluntary guidelines on AV development and deployment have been issued by the US DOT.

• Would federal preemption nullify California testing and deployment regulations?
• Over 85% of the roadway network and 48% of bridges in California are owned by cities and counties, valued at over
  $220 billion.

• US DOT is encouraging cities and counties to upgrade their infrastructure so that AVs can communicate with other road
  users and existing infrastructure (not the other way around).

• Liability and insurance remain unanswered questions
  • Who’s at fault and financially responsible when the cars are doing all the driving?
  • Can cities be on the hook if their infrastructure can be assigned blame?

• With AVs leaning towards non-ownership business models using more fuel efficient and all electric cars, who will pay for
  using our roads?

Should Cities Care Less About Driverless?
Fully Autonomous Vehicles are Already Here!

Who doesn’t want to roll like this?
Or like this?

Are we there yet?
### AV Testing & Deployment Regulation Timeline

<table>
<thead>
<tr>
<th>Section</th>
<th>Effective Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>AV Testing w/Driver Regs</td>
<td>9/16/14</td>
</tr>
<tr>
<td>AV Testing w/o Driver Regs</td>
<td>4/2/18</td>
</tr>
<tr>
<td>AV Deployment Regs</td>
<td>4/2/18</td>
</tr>
<tr>
<td>AV Deliver Vehicle Regs</td>
<td>TBD</td>
</tr>
</tbody>
</table>

### Permitted for Testing AVs in California

As of 2/13/19

| 2. Mercedes Benz                | 17. NIO USA, Inc. |
| 4. Delphi Automotive            | 19. NVIDIA Corporation |
| 5. Tesla Motors                 | 20. AutoX Technologies Inc |
| 7. Nissan                       | 22. Udacity, Inc |
| 8. GM Cruise LLC                | 23. Navya Inc. |
| 9. BMW                          | 24. Renovo.auto |
| 12. Zoox, Inc.                  | 27. CarOne LLC |
| 14. Faraday & Future Inc.       | 29. Pony.AI |
| 15. Baidu USA LLC               | 30. TuSimple |
|                                 | 31. Jingchi Corp |
|                                 | 32. SAIC Innovation Center, LLC |
|                                 | 33. Almotive Inc |
|                                 | 34. Aurora Innovation |
|                                 | 35. Nulimax |
|                                 | 36. Samsung Electronics |
|                                 | 37. Continental Automotive Systems Inc |
|                                 | 38. Voyage |
|                                 | 39. CYNGN, Inc |
|                                 | 40. Roadstar.AI |
|                                 | 41. Changan Automobile |
|                                 | 42. Lyft, Inc. |
|                                 | 43. Phantom AI |
|                                 | 44. Qualcomm Technologies, Inc. |
|                                 | 45. SF Motors Inc. |
|                                 | 46. Toyota Research Institute |
|                                 | 47. Apex.AI |
|                                 | 48. Intel Corp |
|                                 | 49. Ambarella Corporation |
|                                 | 50. Gatik AI. Inc. |
|                                 | 51. DiDi Research America LLC |
|                                 | 52. TORC Robotics Inc |
|                                 | 53. Boxbot Inc |
|                                 | 54. EasyMile |
|                                 | 55. Mando America |
|                                 | 56. Xmotors.ai, Inc. |
|                                 | 57. Imagry Inc. |
|                                 | 58. Ridecell Inc. |
|                                 | 59. AAA NCNU |
|                                 | 60. ThorDrive Inc |
|                                 | 61. Helm.AI Inc |
|                                 | 62. Argo AI, LLC |

*Without a Driver:*

1. Waymo LLC (October 2018)

Deployment/Public Use:

1. None to date.
AV Testing Permit Requirements w/ & w/o Drivers

1. Companies must enroll drivers in Pull Notice Program which pulls driver’s license records.
2. Companies must have $5 million surety bond or certificate of self-insurance.
3. Companies must have owner information filed with the Secretary of State with identities of officers, shareholders, and managers.
4. Companies must have driver/operator training program outlines.
5. Cars must have current California registration.
6. Companies must certify:
   1. AV will be operated for testing purposes only.
   2. Description of AV tech and features in the vehicle and functional capabilities of the tech.
7. Rules for disposal (cannot be sold to the public)
8. $3,600 non-refundable application fee for up to 10 vehicles and 20 drivers per application.
9. $50 fee for each additional 10 car/20 drivers.
10. Permit is good for 2 years.

Without a driver:

1. Items 1-10 listed to the left.
2. Continuous monitoring by the manufacturer.
3. Law enforcement interaction plan.
4. Written notification to local authorities where testing will take place.
5. Explanation of how company will monitor communication between car and remote operator and how all cars tested will be monitored.

AV Deployment Permit Requirements – Post Testing

1. Companies must have $5 million surety bond or certificate of self-insurance.
2. Companies must certify where cars are going to operate and that those cars are incapable of operating outside such domains.
3. Companies must identify conditions and state the mechanism for safely disengaging from autonomous mode when operating under unreliable conditions (i.e. snow, ice, construction zones, etc).
4. Companies must explain how safe transition from autonomous mode to a driver will happen under undesirable conditions.
5. Cars must have data recorders that can record at least 30 seconds before a collision.
6. Companies must certify compliance with all current and future local, state and federal vehicle safety standards and regulations.
7. Companies must certify the ability to defend against, detect, and respond to cyber-attacks.
8. Companies must certify that they have conducted tests and that vehicles are safe for deployment on public roads in California.
9. $3,275 non-refundable application fee
10. Permit is good indefinitely, unless revoked/suspended by the DMV.
AV DMV
Definition of Deployment

“Deployment” means the operation of an autonomous vehicle on public roads by members of the public who are not employees, contractors, or designees of a manufacturer or for purposes of sale, lease, providing transportation services for a fee, or otherwise making commercially available outside of a testing program.

CA Testing Snapshot

• At least 28 companies tested vehicles in California from December 2017 thru November 2018.
• 62 companies are permitted to test, with only one of those permitted for testing w/o a driver.
• Over 321 autonomous vehicles were tested in California (excluding Waymo and Zoox) in 2018, up from the 71 in 2015, 103 in 2016, and 235 in 2017.
• More than 2 million miles have been driven in autonomous mode and more than 73 thousand “disengagements” (when a driver takes control of a vehicle) were reported.
• Waymo, GM Cruise, Zoox, Nuro, and Pony.AI made up the top 5 companies with the least amount of disengagement per 1000 miles, in that order, while Apple, SAIC, Mercedes Benz, Honda, and Qualcomm made up the bottom 5 companies with the most amount of disengagement per 1000 miles, in that order.
### Reasons for disengagements and other concerns

- Heavy pedestrian traffic
- Poorly marked lanes
- “Misclassified” traffic signals
- Failure to yield for cross traffic
- Delayed braking behind cars that cut quickly in front
- Drifting out of a lane
- Delayed perception of people walking into the street
- Unexpected illegal behavior by other drivers
- GPS disconnections
- Turning into lanes of traffic without enough space
- Failure to give way to another vehicle trying to enter a lane
- Planned turn into a roadway with oncoming traffic rapidly approaching
- Slow braking when approaching stop sign
- Wide right turns
- Difficulty around construction cones
- Failure to yield
- Running stop signs
- Software crashes
- Close following distance
- Poor parking
- Bridges mistaken for stopped car
- Not recognizing “no right on red” signage


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### SAE Automation Levels

0. No Automation
- The full-time performance by the human driver of all aspects of the dynamic driving task, even when enhanced by warning or intervention systems.

1. Driver Assistance
- 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.

2. Partial Automation
- The driving mode-specific execution by one or more driver assistance systems of both 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.

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.

4. High Automation
- The full-time performance by an automated driving system of all aspects of the dynamic driving task, even when enhanced by warning or intervention systems.

5. Full Automation
- The full-time performance by an automated driving system of all aspects of the dynamic driving task, even when enhanced by warning or intervention systems that can be managed by a human driver.

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Industry’s Policy Drive for AVs – Public Safety

Safety by the Numbers

• An estimated 39,141 people lost their lives on all modes of our transportation system in 2017. The vast majority—37,032 deaths—were from motor vehicle crashes.

• Driver Factors: Of all serious motor vehicle crashes, 94 percent involve driver-related factors, such as impaired driving, distraction, and speeding or illegal maneuvers.

• In 2017:
  - Nearly 11,000 fatalities involved drinking and driving.
  - Speeding was a factor in nearly 10,000 highway fatalities.
  - Nearly 3,500 fatal crashes involved distracted drivers.

• Commercial Vehicles: 13 percent of annual roadway fatalities occur in crashes involving large trucks.

• In 2017, 82 percent of victims in fatal large truck crashes were road users who were not an occupant of the truck(s) involved.

• Professional Drivers: Professional drivers are ten times more likely to be killed on the job, and nearly nine times more likely to be injured on the job compared to the average worker.

• Pedestrians were killed by motor vehicles in 2017, representing 16 percent of all motor vehicle fatalities.

• Highway-Rail Grade Crossing: Over the past decade, highway-rail grade crossing fatalities averaged 253 per year, representing about one-third of total railroad-related fatalities.

AV Legislation Across the U.S.

• In 2017, 33 states have introduced legislation. In 2016, 20 states introduced legislation.

• Sixteen states introduced legislation in 2015, up from 12 states in 2014, nine states and D.C. in 2013, and six states in 2012.

• Since 2012, at least 41 states and D.C. have considered legislation related to autonomous vehicles.


• Governors in Arizona, Delaware, Hawaii, Idaho, Illinois, Maine, Massachusetts, Minnesota, Ohio, Washington and Wisconsin have issued executive orders related to autonomous vehicles.
Questions?

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