State of California—Transportation Agency EDMUND G. BROWN Jr., Governor

DEPARTMENT OF CALIFORNIA HIGHWAY PATROL
P.O. Box 942898
Sacramento, CA 94298-0001
(916) 843-3001
(800) 735-2929 (TT/TDD)
(800) 735-2922 (Voice)

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The development of autonomous vehicle technology has the potential to enhance traffic safety and bring fundamental change to transportation. A significant concern with autonomous vehicles is the ability of the technology to recognize and react appropriately to the many situations and hazards inherent to vehicular travel on highways. One of the primary goals of the California Highway Patrol (CHP) is to promote the safe and efficient transportation of people and goods throughout California. As such, the CHP appreciates the opportunity to provide comments to the National Highway Traffic Safety Administration (NHTSA) regarding the "*Pilot Program for Collaborative Research on Motor Vehicles with High or Full Driving Automation.*"

Thank you for the opportunity to provide the enclosed comments on such an important traffic safety matter.

Sincerely,

FOR

W. A. STANLEY
Commissioner

Enclosure

cc: California State Transportation Agency
California Department of Motor Vehicles
California Department of Transportation

California Highway Patrol Comments on
Pilot Program for Collaborative Research on Motor Vehicles with High or Full Driving Automation
[Docket No. NHTSA–2018–0092]

The California Highway Patrol (CHP) appreciates the opportunity to provide comments to the National Highway Traffic Safety Administration (NHTSA) on a potential nationwide pilot for highly and fully automated vehicles (AVs). Overall, the CHP recommends that any national pilot program be based on a clear understanding of the roles and expectations for local, state, and federal governments, with established protocols to encourage communication, transparency, and data-sharing between entities. It is also critical that a national pilot account for public safety needs, including requiring AVs to comply with state and local traffic laws, providing information to law enforcement and first responders on how to interact with AVs, and establishing mechanisms to share safety and enforcement-related data. Please see below for our responses to specific questions from the advance notice of public rulemaking.

Question 1.
What potential factors should be considered in designing the structure of a pilot program that would enable the Agency to facilitate, monitor and learn from on-road research through the safe testing and eventual deployment of vehicles with high and full driving automation and associated equipment?

Comments:
Creating a standard structure for the AV pilot program and participants is essential to obtain concise and accurate information. A successfully structured pilot program should be equitable for all and contain the following elements:

- Public education to establish public trust.
- Establishment of an advisory committee to include diverse opinions from both public and private entities.
- Creation of an AV rating system to establish benchmarks and effectively measure advancements in AV technology.
- Establishment of effective liaisons and collaborative relationships between local, state and federal stakeholders to ensure communication and efficiency.
- Development of standardized data collection and distribution.
- Development of test or study scenarios for AVs covering a wide variety of operational design domains, including varied locations, roadway configurations, weather and other environmental factors.
- Development of clear roles and expectations for local, state and federal governments (encompassing guidelines, statutes, and regulations) that reaffirm traditional division of responsibilities between local, state, and federal entities.

Question 2.
If NHTSA were to create a pilot program, how long would there be a need for such a program? What number of vehicles should be involved? Should NHTSA encourage the conducting of research projects in multiple locations with different weather conditions, topographical features, traffic densities, etc.?

Comments:
The length for such a program would be variable based upon the number of participants. Fewer participants will equate to less data, thus creating the need for a longer pilot program. The inverse would also be true.

The NHTSA should attempt to obtain a representative sample of AVs from across the development spectrum to ensure an effective cross-sample of information is obtained. Conducting tests in multiple locations would be beneficial in providing a much greater cross-sample of information, which would be valuable in understanding the challenges, some of which may not even be known today, which safe and efficient AV deployment will be required to overcome.

Question 3.
What specific difficulties should be addressed in designing a national vehicle pilot program for vehicles with high and full driving automation either through the exemption request process relevant for Federal Motor Vehicle Safety Standards (FMVSS) or more broadly related to other areas of NHTSA and/or other authorities?

Comments:
Exemptions should be thoroughly explained and justified by the applicant. We encourage that exempted AVs be extensively tested on closed courses prior to operation on public roads. For example, if an AV is granted an exemption for a modified seating position (e.g., a roundtable type of seating position) there is a potential for increased/different injuries to passengers, should the AV be involved in a crash. There are many additional considerations in just this one example, such as safety restraints, anchor points, airbag locations, etc. Should a seating position exemption be approved, NHTSA should consider implementing certain restrictions; for example, not allowing children to ride in the exempted AV. However, any alternate method of compliance through exemption should meet or exceed existing applicable FMVSS.

Additional considerations in designing a national vehicle pilot program may include:

- Should there be a limit to passengers allowed in an AV granted FMVSS exemptions?
- Should there be limited exemptions for operation in certain weather elements (lighting, time usage, chain requirements)?
- Should baseline qualifications be established for a vehicle to be considered for exemption?

Question 4.
How can existing statutory provisions and regulations be more effectively used in implementing such a pilot program?

Comments:
The CHP has no comments on how existing statutory provisions and regulations may be more effectively used in implementing the pilot program.

Question 5.
Are there any additional elements of regulatory relief (e.g., exceptions, exemptions, or other potential measures) that might be needed to facilitate the efforts to participate in the pilot program and conduct on-road research and testing involving these vehicles, especially those that lack controls for human drivers and thus may not comply with all existing FMVSS?

Comments:
- The CHP has no comments on additional elements of regulatory relief.

Vehicle Design for Safe Operation

Question 6.
What vehicle design elements might replace existing required safety equipment and/or otherwise enhance vehicle safety under reasonably anticipated operating conditions?

Comments:
The following vehicle design elements have the potential of being altered/exempted:
- Controls and displays.
- Rearview mirrors.
- Accelerator control systems.
- Occupant protection in interior impact.
- Head restraints.
- Impact protection for the driver from the steering control system.
- Steering control rearward displacement.
- Seating systems.
- Occupant crash protection.
- Seatbelt assemblies.
- Seatbelt assembly anchorages.
- Child restraint systems.
- Side impact protection.
- Child restraint anchorage systems.
- Ejection mitigation.
- Egress warning stickers.
- Low speed vehicles.

Vehicle Design for Risk Mitigation

Question 7.
What types of performance measures should be considered to ensure safety while allowing for innovation of emerging technology in vehicles with high and full driving automation participating in a pilot program?

Comments:
The addition/creation of a Rating/Point System consisting of the following should be considered:

- Disengagements.
- Crashes.
- Traffic violations/citations.
- Miles operated.
- Number of vehicles.
- Compliance with current state and local traffic laws.
- Compliance with peace officer directions.

Vehicle Design Safety Elements

Question 8.
How should the Operational Design Domains (ODD) of individual vehicle models be defined and reinforced and how should federal, State and local authorities work together to ensure that they are observed?

Comments:
From an enforcement perspective, there are many complications that could arise if each vehicle participating in the pilot has a unique ODD. There needs to be consideration of how NHTSA plans on enforcing the pilot program if vehicles or manufacturers decide not to operate within their predesignated ODD. Additionally, how will NHTSA track crashes, citations, or any other actions taken against any AVs involved in the pilot program?

It may become necessary to define the AVs based upon their specific ODD, which may or may not allow them to participate in any pilot program. Any pilot program would need to define the ODD and ensure that only those vehicles meeting those requirements be allowed to participate. Additionally, there needs to be a system that ensures effective communication and information-sharing between the federal and state governments. This communication would allow NHTSA to effectively enforce the pilot program by seeking assistance from state agencies that would have oversight over the vehicles involved in the pilot program.

Data and Reporting

Question 9.
What type and amount of data should participants be expected to share with NHTSA and/or with the public for the safe testing of vehicles with high and full driving automation and how frequently should the sharing occur?

Comments:
The elements listed by NHTSA in Question 15 are sufficient. However, at a minimum, participants should share the following:

- The type of testing permit (with or without a driver).
- The circumstances or testing conditions at the time of a disengagement, including:
    - Location (freeway, highway, rural road, street, or parking facility).
    - Whether the vehicle was operating with or without a driver at the time of the disengagement(s).
    - A description of the facts causing the disengagement(s), including: weather conditions, road surface or traffic conditions, construction, emergencies, or crashes. The description should be written in plain language with enough detail that a non-technical person can understand the circumstances triggering the disengagement.
    - The party initiating the disengagement (autonomous technology, test driver, remote operator, or passenger).
- The report should include the total number of miles that each AV tested in autonomous mode.

Participants should share data monthly.

Question 10.
In the design of a pilot program, how should NHTSA address the following issues—

a. confidential business information?
Focus on safety aspects; agreements with participants that clearly define how information will be handled/executed prior to participation.

b. privacy?
Compliance with all federal and state statutes regarding privacy; develop a disclosure agreement outlining specific privacy rights and exclusions which is agreed to prior to participation.

c. data storage and transmission?
National database, with information provided by both federal and state-level stakeholders, and available to both.

d. data retention and reporting?
Data should be retained for five years post-pilot program and reporting should be on a quarterly basis.

e. other elements necessary for testing and deployment?
Clearly define any privacy expectations regarding the autonomous vehicle data recorder.

Additional Considerations in Pilot Program Design

NHTSA seeks comments on whether there are additional critical areas to consider in the design of a safe pilot program for the testing and deployment of vehicles with high and full driving automation.

Question 11.
In the design of a pilot program, what role should be played by—
a. The 12 safety elements listed in A Vision for Safety?
b. The elements listed below,
i. Failure risk analysis and reduction during design process (functional safety)?
ii. Objective performance criteria, testable scenarios and test procedures for evaluating crash voidance performance of vehicles with high and full driving automation?
iii. Third party evaluation?
A. Failure risk reduction?
B. Crash avoidance performance of vehicles with high and full driving automation?
iv. Occupant/non-occupant protection from injury in the event of a crash (crashworthiness)?
v. Assuring safety of software updates?
vi. Consumer education?
vii. Post deployment Agency monitoring?
viii. Post-deployment ADS updating, maintenance and recalibration?
c. Are there any other elements that should be considered?

Comments:
The CHP has no comments relative to the design of the pilot program.

Question 12.
Are there any additional critical areas to consider in the design of a safe pilot program for the testing and deployment of vehicles with high and full driving automation?

Comments:
The primary concern for law enforcement is public safety and the safety of first responders resolving an incident involving an AV. It is recommended NHTSA consider requiring participants in the pilot program to submit a Law Enforcement

Interaction Plan (LEIP). The California Department of Motor Vehicles requires submission of a LEIP to obtain a permit to test or operate a driverless AV. A LEIP provides law enforcement and first responders a basic understanding of how to interact with the involved AV and how to contact a representative from the AV manufacturer.

Issues Relating to Establishing a Pilot Program

Question 13.
Which of the following matters should NHTSA consider requiring parties that wish to participate in the pilot program to address in their applications?

a. "Safety case" for vehicles to be used in the pilot program (e.g., system safety analysis (including functional safety analysis), demonstration of safety capability based on objective performance criteria, testable scenarios and test procedures, adherence to NHTSA's existing voluntary guidance, including the submission of a voluntary safety self-assessment, and third-party review of those materials).
    i. What methodology should the Agency use in assessing whether an exempted ADS vehicle would offer a level of safety equivalent to that of a nonexempted vehicle? For example, what methodology should the Agency use in assessing whether an ADS vehicle steers and brakes at least as effectively, appropriately and timely as an average human driver?
b. Description of research goals, methods, objectives, and expected results.
c. Test design (e.g., route complexity, weather and related road surface conditions, illumination and institutional review board assessment).
d. Considerations for other road users (e.g., impacts on vulnerable road users and proximity of such persons to the vehicle).
e. Reporting of data, e.g., reporting of crashes/incidents to NHTSA within 24 hours of their occurrence.
f. Recognition that participation does not negate the Agency's investigative or enforcement authority, e.g., independent of any exemptions that the Agency might issue to program participants and independent of any terms that the Agency might establish on those exemptions, the Agency could conduct defect investigations and order recalls of any defective vehicles involved in the pilot program. Further, the Agency could investigate the causes of crashes of vehicles involved in the program.
g. Adherence to recognized practices for standardizing the gathering and reporting of certain types of data in order to make possible the combining of data from different sources and the making of statistically stronger findings.
h. For which types of data would standardization be necessary in order to make such findings and why?
i. To what extent would standardization be necessary for those types?
j. Occupant/non-occupant protection from injury in the event of a crash (crashworthiness).

k. Assuring safety of software updates.
l. Consumer education.
m. Post-deployment monitoring.
n. Post-deployment maintenance and calibration considerations.

Comments:
This question is directed at parties wishing to participate in the pilot program, and so CHP has no comment.

Question 14.
What types of terms and conditions should NHTSA consider attaching to exemptions to enhance public safety and facilitate the Agency's monitoring and learning from the testing and deployment, while preserving the freedom to innovate, including terms and conditions for each of the subjects listed in question 13? What other subjects should be considered, and why?

Comments:
Any AV with an exemption should not be operated on public roads until safety tests are conducted and the manufacturer self-certifies that the AV meets any established safety-standard requirements. Additionally, the exempted AV shall comply with all traffic laws within its deployed jurisdiction.

Additional considerations may include:

- What is an acceptable length for an exemption (only for testing or inclusive of deployment)?
- Should exemptions be allowed only in certain ODDs (private or public property, time of day, weather, specific justifications)?

Question 15.
What value would there be in NHTSA's obtaining one or more of the following potential categories of data from the participants in the pilot program? Are there other categories of data that should be considered? How should these categories of data be defined?

a. Statistics on use (*e.g.,* for each functional class of roads, the number of miles, speed, hours of operation, climate/weather and related road surface conditions).
b. Statistics and other information on outcome (*e.g.,* type, number and cause of crashes or near misses, injuries, fatalities, disengagements, and transitions to fallback mechanisms, if appropriate).
c. Vehicle/scene/injury/roadway/traffic data and description for each crash or near miss (*e.g.,* system status, pre-crash information, injury outcomes).
d. Sensor data from each crash or near miss (*e.g.,* raw sensor data, perception system output, and control action).
e. Mobility performance impacts of vehicles with high and full driving automation, including string stability of multiple consecutive ADS vehicles

and the effects of ADS on vehicle spacing, which could ultimately impact flow safety, and public acceptance.
f. Difficult scenarios (*e.g.,* scenarios in which the system gave control back to an operator or transitioned to its safe state by, for example, disabling itself to a slow speed or stopped position).
g. Software updates (*e.g.,* reasons for updates, extent to which updates are made to each vehicle for which the updates are intended, effects of updates).
h. Metrics that the manufacturer is tracking to identify and respond to progress (*e.g.,* miles without a crash and software updates that increase the operating domain).
i. Information related to community, driver and pedestrian awareness, behavior, concerns and acceptance related to vehicles with high and full driving automation operation. For example, if vehicles with high and full driving automation operated only in limited defined geographic areas, might that affect the routing choices of vehicles without high and full driving automation? For another example, if vehicles with high and full driving automation are programmed to cede right of way to avoid collision with other vehicles and with pedestrians and cyclists, might some drivers of vehicles without such automation, pedestrians and cyclists take advantage of this fact and force vehicles with high and full driving automation to yield to them?
j. Metrics or information concerning the durability of the ADS equipment and calibration, and need for maintenance of the ADS.
k. Data from "control groups" that could serve as a useful baseline against which to compare the outcomes of the vehicle participating in the pilot program.
l. If there are other categories of data that should be considered, please identify them and the purposes for which they would be useful to the Agency in carrying out its responsibilities under the Act.
m. Given estimates that vehicles with high and full driving automation would generate terabytes of data per vehicle per day, how should the need for data be appropriately balanced with the burden on manufacturers of providing it and the ability of the Agency to absorb and use it effectively?
n. How would submission of a safety assurance letter help to promote public safety and build public confidence and acceptance?
o. For all of the above categories of information, how should the Agency handle any concerns about confidential business information and privacy?

Comments:
There would be value in NHTSA obtaining data in the categories listed above. These categories should encompass public safety and industry transparency as guiding principles.

Use of Exemptions to Provide Regulatory Relief for Pilot Program Participants

As part of this pilot program, NHTSA is considering what effect participation in the pilot program could have on the exemption process and vice versa.

Question 16.
How should the Agency analyze safety in deciding whether to grant such exemptions under each of the separate bases for exemptions in section 30113? Can the exemption process be used to facilitate safe and effective ADS development in an appropriate manner?

Comments:
Exemptions should be for a specific AV or, in rare cases, may be industrywide. The exemption applicant should provide a thorough reasoning and justification for each proposed exemption. After the submission of an exemption application, NHTSA should complete an in-depth analysis and evaluate the public safety risk prior to approval. The exemption process can be used to facilitate safe and effective ADS development in an appropriate manner, as long as public safety is not compromised by any exemption.

Question 17.
Could a single pilot program make use of multiple statutory sources of exemptions or would different pilot programs be needed, one program for each source of exemption?

Comments:
A strong argument could be made for two pilot programs. One for "conventional AVs" and the other for "AVs with exemptions". However, the "AVs with exemptions" pilot program could have multiple categories within the one program. For example, one category could be for AVs with "manual" controls removed and another category for AVs with modified seating positions.

Question 18.
To what extent would NHTSA need to implement the program via new regulation or changes to existing regulation? Conversely, could NHTSA implement the program through a non-regulatory process? Would the answer to that question change based upon which statutory exemption provision the agency based the program on?

Comments:
It is recommended this program be implemented through a new regulation. This would clearly draw a line between conventional vehicles, AVs, and AVs with exemptions. A possible downside to this would be the length of time required to promulgate regulations.

An alternative would be an amendment to existing regulations to allow the development of a pilot program which, if feasible, may be a more expeditious alternative.

Question 19.
How could the exemption process in section 30113 be used to facilitate a pilot program? For vehicles with high and full driving automation that lack means of manual control, how should NHTSA consider their participation, including their continued participation, in the pilot program in determining whether a vehicle would meet the statutory criteria for an exemption under section 30113?
More specifically:

a. Would participation assist a manufacturer in showing that an exemption from a FMVSS would facilitate the development or field evaluation of a new motor vehicle safety feature providing a safety level at least equal to the safety level of the FMVSS, as required to obtain an exemption under section 30113(b)(ii)? If so, please explain how.

b. Would participation assist a manufacturer in showing that compliance with the FMVSS would prevent the manufacturer from selling a motor vehicle with an overall safety level at least equal to the overall safety level of nonexempt vehicles, as required to obtain an exemption under section 30113(b)(iv)? If so, please explain how.

c. The Agency requests comment on what role a pilot program could play in determining when to grant an exemption from the "make inoperative" prohibition under section 30122 for certain "dual mode" vehicles. Relatedly, what tools does NHTSA have to incentivize vehicles with high and full driving automation that have means of manual control and thus do not need an exemption to participate in the pilot program?

Comments:
The CHP has no comments relative to how section 30133 can be used to facilitate this pilot program.

Exemptions from Prohibitions Concerning Noncompliant Vehicles Under Section 30114

Next, under section 30114, the "Secretary of Transportation may exempt a motor vehicle or item of motor vehicle equipment from section 30112(a) of this title, on terms the Secretary decides are necessary, for research, investigations, demonstrations, training, competitive racing events, show, or display." NHTSA has historically focused these types of exemptions on the noncompliant vehicles made outside the U.S. However, NHTSA is examining whether the language of section 30114 gives NHTSA the discretion to create a level playing field by expanding the coverage of exemption under that section to any vehicle, regardless of whether it is domestic or foreign, that meets the criteria of that section, particularly vehicles with high and full driving automation that do not meet existing standards and whose manufacturers are or seek to become engaged in research and demonstrations involving those vehicles. If so, NHTSA would be able to establish the terms with which a participant would need to

comply to receive and continue to enjoy the benefits of an exemption. Such terms could include a wide variety of matters, including participation in a pilot program.

Question 20.
What role could exemptions under section 30114 play in the pilot program? Could participation in the pilot program assist a manufacturer in qualifying for an exemption under section 30114? Could participation be considered part of the terms the Secretary determines are necessary to be granted an exemption under section 30114 for vehicles that are engaged in "research, investigations, demonstrations, training, competitive racing events, show, or display"?

Comments:
Exemptions under section 30114 could expand the number of participants which may have an impact on the AV industry.

Positive effects:
- Allow for more participants (imports vs. domestic).
- The potential of gathering/sharing more data.

Negative effects:
- Manufacturers may not fully evaluate the technology due to an increased number of participants (in an attempt to be the first to deploy the technology).
- The exemption may create an increased risk to public safety (thorough review is necessary with a risk/gain analysis completed).

Exemption from Rendering Inoperative Prohibition

Finally, NHTSA has related exemption authority with regard to the "make inoperative" provision in its statute. Manufacturers, distributors, dealers, and motor vehicle repair businesses are prohibited from knowingly making inoperative any part of a device or element of design installed on or in a motor vehicle or motor vehicle equipment in compliance with an applicable FMVSS unless they reasonably believe the vehicle or equipment will not be used (except for testing or a similar purpose *during* maintenance or repair) when the device or element is inoperative.

However, NHTSA may prescribe regulations to exempt a person or a class of persons from this prohibition if the Agency decides the exemption is consistent with motor vehicle safety and the purposes of the Act. For example, pursuant to that authority, NHTSA has exempted from the "make inoperative" prohibition,28 as a class, all motor vehicle repair businesses that modify a motor vehicle to enable a person with a disability to operate, or ride as a passenger in, the motor vehicle to the extent that those modifications affect the motor vehicle's compliance with the FMVSS or portions thereof specified in paragraph (c) of 49 CFR part 595. Such an exemption may be warranted for certain "dual-mode"

vehicles, *i.e.,* those that may be operated with or without a human driver and are designed to have mandated and/or regulated components, such as brake pedals, retract under specified conditions. Comments are invited on this issue.

Question 21.
What role could a pilot program play in determining when to grant an exemption from the "make inoperative" prohibition under section 30122 for certain "dual mode" vehicles? Relatedly, what tools does NHTSA have to incentivize vehicles with high and full driving automation that have means of manual control and thus do not need an exemption to participate in the pilot program?

Comments:
The CHP has no comment relative to this question.

Other Potential Obstacles

The Agency also wishes to better understand any other potential obstacles either to the development of the pilot program or vehicles with high and full driving automation more generally.

Question 22.
If there are any obstacles other than the FMVSS to the testing and development of vehicles with high and full driving automation, please explain what those are and what could be done to relieve or lessen their burdens. To the extent any tension exists between a Federal pilot program and State or local law, how can NHTSA better partner with State and local authorities to advance our common interests in the safe and effective testing and deployment of ADS technology?

Comments:
The NHTSA must ensure open communication and data sharing with other government stakeholders as it moves forward with any pilot program or any regulatory issues and/or exemptions granted regarding AVs. This will help mitigate any tensions that may arise due to regulatory changes that might affect state and local laws.