



Operations Attachment: Pennsylvania Department of Transportation

Automated Vehicle Testing Guidance

Tempe, AZ

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pennsylvania
DEPARTMENT OF TRANSPORTATION

AUTOMATED VEHICLE TESTING GUIDANCE

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TESTING IN PENNSYLVANIA

Under existing Pennsylvania law, the driver of any vehicle is a natural person who drives or is in actual physical control of a vehicle. Currently during Highly Automated Vehicle (HAV) testing, a licensed driver is required to be seated in the driver's seat with the ability to intervene in situations where the Automated Driving System (ADS) experiences a system interruption or other problem rendering the ADS unable to safely perform the dynamic driving task and the vehicle is unable to come to a minimal risk condition on its own.

Under existing law, unmanned and/or remote testing on trafficways is prohibited.

NOTICE OF TESTING

Prior to testing on Pennsylvania trafficways, an HAV Tester shall submit a *Notice of Testing* application through the PennDOT website www.penndot.gov/av. The application will require submission or confirmation of the following information:

1) Tester Information

- a) Tester Name
- b) Address
- c) Mailing Address (if different from Address)
- d) Principal Point-of-Contact for Testing
 - i) Name
 - ii) Title
 - iii) Telephone Number
 - iv) Email Address

2) Vehicle Information (List All Applicable Vehicles Testing)

- a) License Plate Number
- b) State Issued
- c) VIN Number, if applicable¹
- d) Year, Make & Model
- e) Proof of Current Registration

3) Safety Driver Information (List All Applicable Employees, Contractors, and Designees)

- a) Legal Name (First, Middle, Last)
- b) Driver License Number
- c) State or Country Issued
- d) Training Completion Date
- e) Enhanced Performance Driver Training Completion Date, if applicable²

4) Location Information - List of Counties where testing is expected to occur. If

¹ Vehicle taken directly from an Original Equipment Manufacturer's assembly line, used for testing, and then immediately disposed of may not have a VIN Number.

² Refer to Section 7 – Operational Requirements.

testing will only occur on limited access trafficways in a County, only provide the trafficway.

5) Applicant Acknowledgements

- a) That the HAV complies with all applicable federal laws and regulations. If the National Highway Safety Administration has granted the manufacturer or tester an appropriate exemption or waiver for the vehicle(s), the tester shall be capable of providing proof upon request.
- b) That any HAV titled and registered in Pennsylvania complies with the requirements of 67 Pa. Code Ch. 175, relating to required safety and emissions inspections, as required, and the requirements of Chapter 17 of Title 75 of the Pennsylvania Consolidated Statutes, relating to financial and insurance responsibilities.
- c) That the HAV has been tested under controlled conditions (e.g., in simulation, closed track or on-road) for the Operational Design Domain (ODD) in which the Tester intends the HAV to operate and the Tester has reasonably determined that the HAV is capable of operation within the parameters of the ODD(s).
- d) That HAV is capable of operating in compliance with all applicable traffic and motor vehicle laws and can obey traffic control devices within its ODD.
- e) That during testing a safety driver will be present in the driver's seat of the HAV and is either in immediate physical control of the HAV or is actively monitoring HAV operations and can take over immediate physical control during operation.
- f) That the HAV can safely alert the safety driver, when applicable, that the safety driver must take control back of the HAV.
- g) That the HAV has a mechanism to engage and disengage the ADS that is easily accessible to the HAV safety driver, the secondary safety associate, law enforcement and other emergency responder personnel.
- h) That the HAV has an audio signal or visual display inside the cabin to indicate when the ADS is engaged.
- i) That the HAV is equipped with a means to record operational data before a collision occurs³. The data shall be made available to PennDOT and applicable law enforcement agencies upon request.
- j) That the Tester has considered and implemented reasonable measures, which may include industry standards, best practices, company policies, or other methods, to mitigate cybersecurity risk.
- k) That all safety drivers and secondary safety associates have successfully completed the HAV tester's safety driver training program.
- l) That quality controls are deployed and monitored to ensure the acknowledgements checked above are implemented, adhered to and measured to ensure safe operation.

6) Required Submissions – PennDOT requires the submission of either of the following:

³ At a minimum, the HAV should have the capability to record the HAV observed and how the HAV reacted to the information.

- a) A Safety and Risk Mitigation Plan (“Safety Plan”)⁴ shall include, at a minimum:
 - i) A general overview of the intended ODD for testing.
 - ii) A description of how the disengagement technology complies with industry standards.
 - iii) A description of pre-testing and ongoing validation methods to ensure continued functionality of the software and hardware systems.
 - iv) A description of the criminal background and driver record checks required by the Tester for safety drivers.
 - v) A description of safety driver training program that includes a description of:
 - (1) How the tester informs HAV safety drivers of any relevant HAV-related operational issues, including, but not limited to, any operational limitations of the ADS and the safe operating parameter(s) for the given ODD for the conditions under which the HAV is tested on trafficways, including, but not limited to:
 - (a) Safety driver knowledge of HAV operations
 - (b) Safety driver’s decision-making process when driver manually disengages ADS system
 - (2) Measures to prevent driver fatigue/inattentiveness/carelessness, including but not limited to:
 - (a) Distracted Driving avoidance techniques
 - (b) Fatigue and Wellness Awareness
 - (c) Drug and Alcohol Impairment Awareness
 - (3) A description of the safety measures in place in case of an ADS disengagement, regardless of the reason for the disengagement.
 - (4) A description of the testers driver training program and how that program addresses:
 - (a) Confirmation of Basic Driving Skills including, but not limited to,
 - (i) Basic Vehicle Operation
 - (ii) Visual Search
 - (iii) Night Operations, if applicable
 - (iv) Hazard Perception
 - (v) Responses to Vehicle Malfunctions
 - (vi) Responses to Sudden Emergencies
 - (vii) Responses to Driving Distractions
 - (viii) Responses to an Aggressive Driver
 - (ix) Responses to Adverse Weather Conditions
 - (x) Post-Crash Procedures
 - (b) Basic knowledge of Vehicle Controls/Instruments/Safety Components
 - (c) Basic Trip Procedures, including, but not limited to:
 - (i) Pre-trip Inspection Outside the Vehicle
 - (ii) Pre-trip Preparation Inside the Vehicle
 - (iii) Trip Planning
 - (iv) Post-trip Procedure

⁴ The Safety and Risk Mitigation Plan (“Safety Plan”) is operator focused and aims to ensure that the Tester has an adequate program to ensure driver training that encompasses both traditional driver performance expectations and proper driver-HAV test vehicle interaction.

- (d) Divided visual and mental attention tasks particular to the operation of HAV.
- b) Alternatively, a company may provide PennDOT with a Voluntary Safety Self-Assessment as established by NHTSA in the 2017 Voluntary Guidance for Automated Driving Systems, Section I.

7) Operational Requirements

- a) For operations on trafficways posted at or under 25 mph, the tester must meet the criteria of Section 6, above.
- b) For operations on trafficways posted above 25mph, the tester must meet the criteria of Section 6 above *and* there must be a secondary safety associate present in the vehicle (in the forward passenger seat if installed in the vehicle).
- c) Testers requesting use of a single safety driver for operations on trafficways posted above 25mph must present evidence of an enhanced performance driver training plan for Department review.

TESTING AUTHORIZATION PROCESS

Upon receipt of the Notice of Testing application, PennDOT shall have ten (10) business days to approve, decline, or request clarification. If approved, PennDOT shall provide the Tester with an “Authorization Letter” which is valid for a year, with annual renewals. If clarification is needed, PennDOT shall outline where additional information is necessary. The Tester shall have thirty (30) days to respond to PennDOT. Upon receipt of the additional information, PennDOT shall have ten (10) business days to approve, decline, or request clarification on the updated application.

If declined, PennDOT shall provide a written explanation to the Tester providing the reasons why the application was declined and provide an opportunity to meet with PennDOT. The Tester may resubmit until authorization is granted.

MODIFICATION TO NOTICE OF TESTING

After receiving the “Authorization Letter,” the HAV Tester shall electronically notify PennDOT if there are material changes in the testing program or if there are material modifications to the ODD such that the submitted Notice of Testing no longer accurately or adequately describes the scope of the testing program.

SUSPENSION OR REVOCATION OF AUTHORIZATION

PennDOT may suspend or revoke testing authorization where any act or omission of the Tester or one of its agents, employees, contractors, or designees makes the conduct of HAV testing on trafficways by the Tester an unreasonable risk to the public. Reasons for temporary suspension or revocation includes, but is not limited to:

1. A determination that the Tester falsified any responses in the “Notice of Testing” application;
2. A Tester’s HAV is involved in an incident that results in serious bodily injury or death;
3. The Tester’s HAV-specific ADS technology is the subject of an active National Transportation Safety Board (NTSB) investigation;
4. The Tester’s HAV shares proprietary ADS software with any HAV that is part of an NTSB investigation; or
5. The Tester fails to disclose any known violations of reasons 2, 3, or 4.

Reinstatement of Testing Authorization - Upon the suspension or revocation of authorization, the Tester shall be entitled to request reinstatement. Authorization may not be reinstated until Tester has established to PennDOT’s satisfaction that it has taken appropriate action to correct any deficiencies that caused the suspension or revocation *or* that the Tester can provide evidence that the HAV was not at-fault in an incident that resulted in serious bodily injury or death.

TEMPORARILY RESTRICTING TESTING

The Department and, if applicable, the Pennsylvania Turnpike Commission (PTC), reserve the right to request Testers temporarily prohibit or restrict testing on select trafficways or statewide during certain circumstances. The Department or the PTC shall notify the HAV Tester, with as much notice as practicable, about how, where, and when testing should be prohibited or restricted. To the extent practicable, the Department or the PTC shall contact all applicable Testers to explain the reasons for the restriction prior to issuance and will consider any specific Tester proposals to continue safe operations during the restriction period. When HAV Testing is no longer prohibited on a trafficway, the Department and/or Pennsylvania Turnpike Commission shall notify the HAV Testers within one (1) business day.

1. **Emergencies** - Includes extreme weather and declared emergencies. During emergencies, HAVs will only be prohibited if there are active restrictions for other classes of vehicles. To ensure safety, all ongoing testing should be concluded before the date and time specified in the notice.
2. **Special Events** – Includes, but not limited to, dignitary visits, major conventions/summits, and superload movements. Only special events with potential dynamic closures and/or safety/security concerns will be considered for temporary prohibition or restricted testing. The Department or PTC shall provide at least one (1) days’ notice to the HAV Tester. To the extent possible, the Department and the Pennsylvania Turnpike Commission shall attempt to provide three to five (3 to 5) days’ notice.
3. **Safety Concerns** – Includes, but not limited to, complex and/or irregular work zone patterns. The Department shall maintain a list of trafficways where testing is prohibited and notify HAV Testers three (3) business days in advance of the list changing.

A local municipality, city, or operating agency may request a temporary prohibition or restriction on the testing of a HAV for emergencies, special events or safety concerns, as defined above, by contacting the Department. The Department shall consider the request, and if the Department determines that the requested prohibition or restriction is necessary and justified to address a safety concern, the Department will notify the HAV Tester within the allotted window of time.

Restrictions do not apply to HAV being manually operated by the safety driver.

The Department recommends that the HAV Tester contact the Department or the PTC prior to testing to learn current trafficway conditions. The Department or the PTC can offer the HAV Tester a data feed of reported incidents and construction events.

DATA REPORTING

To document and measure the impact of HAV testing in Pennsylvania, PennDOT must collect certain data from all Testers. On a semi-annual basis, the HAV Tester will provide the following information to PennDOT through the “Semi-Annual Data Collection Form” found in Appendix A and on the PennDOT website www.penndot.gov/av:

- Approximate miles traveled by ADS-engaged HAVs in Pennsylvania.
- Type of roadway where the majority of testing occurred.
- Counties HAVs were tested on public trafficways.
- Approximate number of employees in Pennsylvania involved with HAV testing.
- If applicable, the approximate number of new jobs created in Pennsylvania because of HAV testing.
- If applicable, the approximate number of new facilities constructed, purchased, or rented in Pennsylvania because of testing.

The initial “Semi-Annual Data Collection Form” should be submitted to PennDOT on either June 1st or December 1st, ensuring less than six (6) months of testing has occurred before submission. Subsequent forms should only include information on testing that occurred since the last submission. If the Tester chooses to complete a physical form, it should be mailed to: PennDOT Office of the Secretary, Commonwealth Keystone Building, 400 North Street 8th Floor, Harrisburg, PA 17120.

CRASH REPORTING

The Tester shall forward an initial notification of the occurrence of any crash in Pennsylvania involving an ADS-engaged HAV on trafficways that results in the damage of property, serious bodily injury or death within a reasonably practicable timeframe, but in no case to exceed six (6) hours of any incident.

Notifications required under this section shall be reported to:

- Department of Transportation's Statewide Traffic Management Center: 717-346-4400
- Pennsylvania Turnpike Commission: 866-332-5889

The Tester will provide, to the extent possible:

- Name of HAV Tester
- General location of the crash
- Approximate date and time of the crash
- To the extent known, the severity of the crash
- Name and title of HAV representative reporting the crash

As the investigation progresses, the Tester shall keep the Department and the PTC abreast of new information as it becomes available.

GLOSSARY OF TERMS

“Secondary Safety Associate.” An individual who qualifies as a Safety Driver and is present in HAV to provide support, guidance, relief or other support services to the Safety Driver, as per a Tester’s Safety and Risk Mitigation Plan.

"Automated Driving System (ADS)." The hardware and software that is collectively capable of performing all aspects of the dynamic driving task for a Highly-Automated Vehicle.

“Crash.” For purposes of required reporting for Highly Automated Vehicle testing, a crash involving either serious bodily injury (as defined in 18 PA.C.S. § 2301) to or death of any person; or damage to any vehicle involved to the extent that it cannot be driven under its own power in its customary manner without further damage or hazard to the vehicle, other traffic elements, or the trafficway, and therefore requires towing.

“Driver.” A natural person who drives or is in actual physical control of a vehicle.

“Dynamic Driving Task.” The operational (steering, braking, accelerating, monitoring the vehicle and trafficway) and tactical (responding to events, determining when to change lanes, turn, use signals, etc.) aspects of driving, but not the strategic (determining destinations and waypoints) aspect of the driving task.

“Highly Automated Vehicle (HAV).” A motor vehicle with equipped with an ADS that can operate in high or full automation and where the ADS performs the dynamic driving task with no requirement that a driver, or a safety driver respond to any request to intervene or take control of the vehicle. This definition encompasses automated vehicles considered to be Level 3, 4 or 5 under SAE J3016.

“Minimal Risk Condition.” An operating mode where an ADS brings an HAV to a safe stop or safe running condition because of an ADS system malfunction, a failed request for safety driver intervention, or other occurrence that prohibits the ADS from fully and completely performing the dynamic driving task.

“Operation.” The driving of an HAV on a trafficway for the purpose of testing an ADS.

“Operational Design Domain (ODD).” The HAV Tester’s definition of the conditions in which the ADS, or the differing automated components thereof, is intended to operate with respect to roadway types, geographical location, speed, range, lighting conditions for operation (day and/or night), weather conditions, and other operational domain constraints, including a description of how the ADS provides for object and event detection and response under of normal driving scenarios, expected hazards (e.g., other vehicles, pedestrians), and unspecified events (e.g., emergency vehicles, temporary construction zones) that could occur within the operational domain.

"Safety Driver." An individual employed by or otherwise affiliated with an HAV Tester who has successfully completed the Tester's safety driver training program and can take immediate manual or remote control of the HAV.

"Person." A natural person, firm, co-partnership, association, or corporation.

"Safety and Risk Mitigation Plan." Plan developed by an HAV Tester to provide adequate safety in case of ADS failure. The plan should contain no proprietary information regarding the ADS.

"Trafficway." The entire width between property lines or other boundary lines of every way or place of which any part is open to the public for purposes of vehicular travel as a matter of right or custom.

APPENDIX A - Semi-Annual Data Collection Form

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Semi-Annual Data Collection Form

To document and measure the progress of HAV testing in Pennsylvania, PennDOT must collect fundamental data from all HAV Testers.

Full Name _____

Company / Agency _____

Mailing Address _____ City _____ State _____ Zip _____

Phone _____ E-mail _____

Date _____ Reporting Period _____

Please indicate the approximate miles traveled by ADS-engaged HAVs in Pennsylvania:

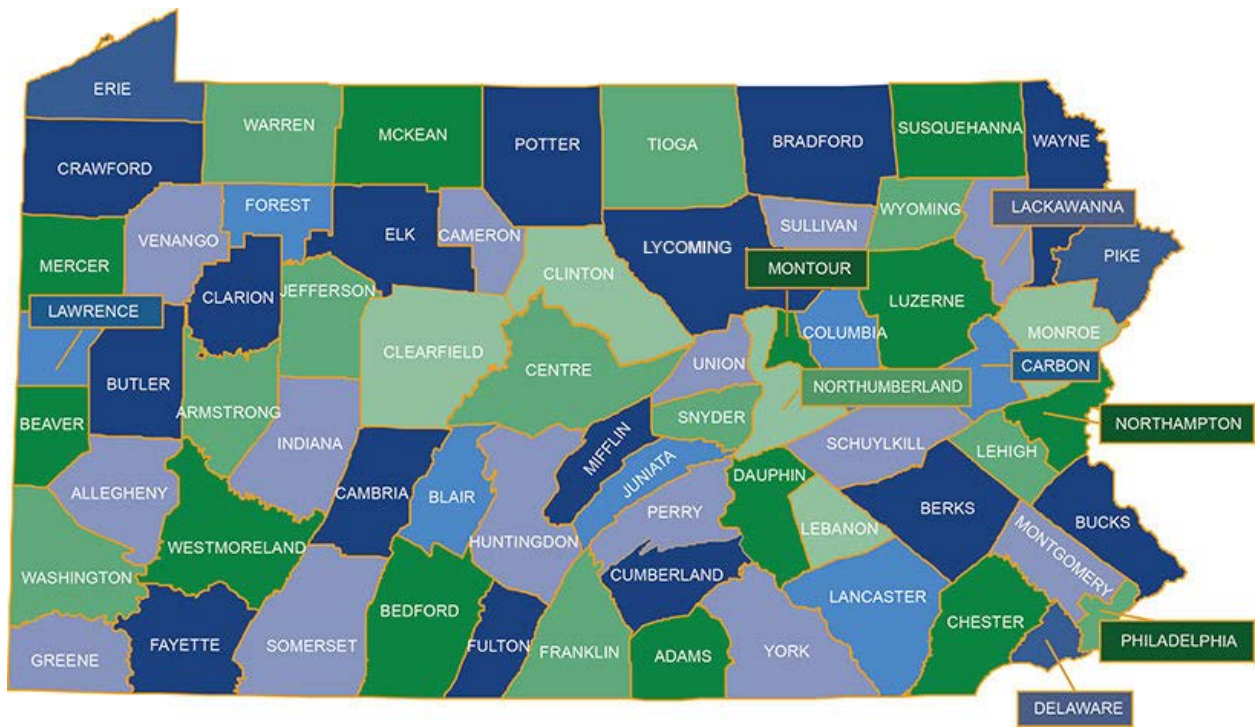
0 to 999 miles	<input type="checkbox"/>
1,000 to 9,999 miles	<input type="checkbox"/>
10,000 to 19,999 miles	<input type="checkbox"/>
20,000 to 34,999 miles	<input type="checkbox"/>
35,000 to 49,999 miles	<input type="checkbox"/>
50,000+ miles	<input type="checkbox"/>

Please indicate where the majority of testing occurred:

Limited Access Roadways	<input type="checkbox"/>
Arterial Roadways	<input type="checkbox"/>
Equal Testing	<input type="checkbox"/>

Please list the counties where HAVs were tested on public trafficways:

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Please indicate the approximate number of employees in Pennsylvania involved with HAV testing:

0 to 24 Employees	<input type="text"/>
25 to 99 Employees	<input type="text"/>
100+ Employees	<input type="text"/>
No Change Since Previous Submission.....	<input type="text"/>

Please indicate, if applicable, the number of new jobs created in Pennsylvania as a result of HAV testing:

0 to 24 Jobs	<input type="text"/>
25 to 99 Jobs	<input type="text"/>
100+ Jobs	<input type="text"/>
No Change Since Previous Submission.....	<input type="text"/>

Please indicate, if applicable, the number of new facilities constructed, purchased, or rented in Pennsylvania as a result of testing:

0 to 1 Facilities	<input type="text"/>
2 to 4 Facilities	<input type="text"/>
5+ Facilities	<input type="text"/>
No Change Since Previous Submission.....	<input type="text"/>

Confidentiality

To the extent that PennDOT may be furnished or given access to knowledge, information, data, compilations of data, customer-identifying information, reports, and documents that are confidential, trade secrets of, and proprietary to the Tester (i.e., information not in the public domain) including, but not limited to, information about and on the Tester's products, customers, and business operations and strategy ("Confidential Information"), PennDOT will not disclose the Confidential Information, except to employees, affiliates, agents, or professional advisors who need to know it and who have agreed in writing (or in the case of professional advisors are otherwise bound) to keep it confidential. PennDOT will ensure that those people and entities will use the Confidential Information only to exercise rights and fulfill obligations under this Agreement, and that they keep it confidential. PennDOT is required to comply with the Act of February 14, 2008 (P.L.6, No.3), as amended, known as the Right-to-Know Law, unless otherwise exempted.