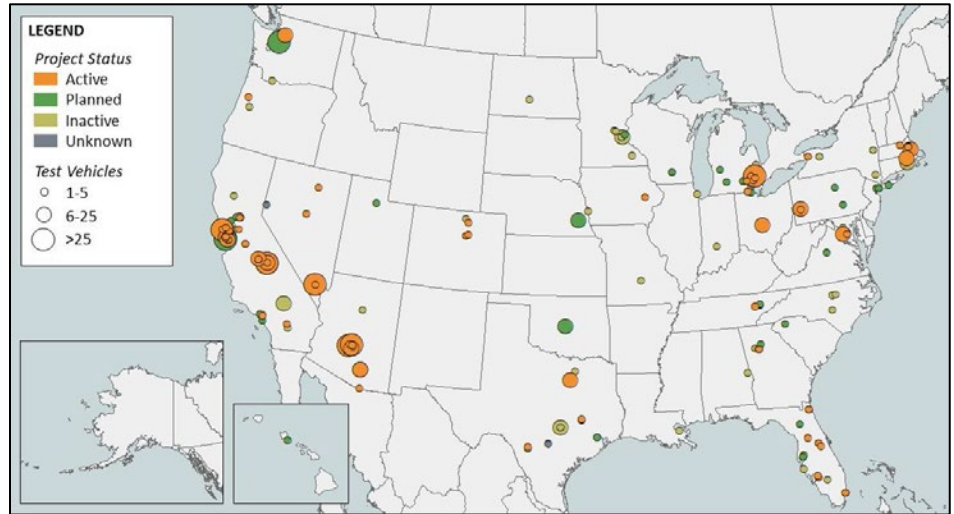


# Highly Automated or “Self-Driving” Vehicles

## What is the current state of the technology today?

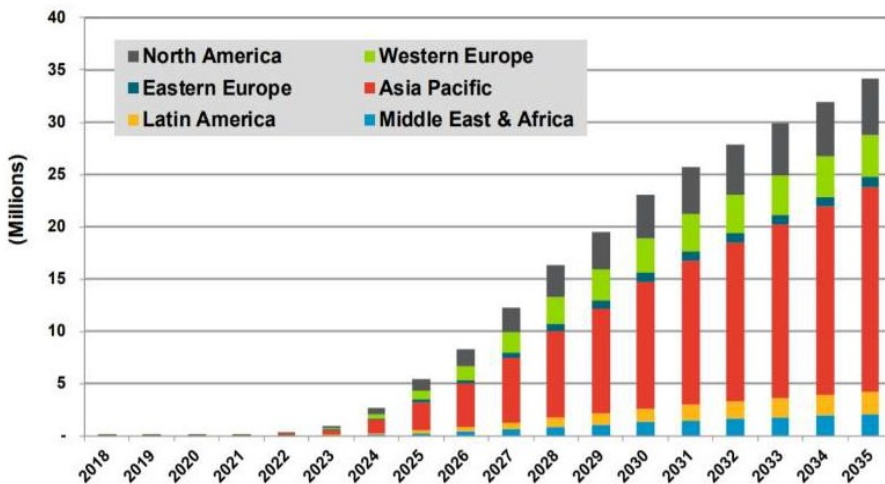
At present, automated or “self-driving” vehicle technologies are in research and development.

Developers are testing components and systems through simulation and modeling, controlled track testing and limited on-road testing with vehicle operators and monitors. As of March 2019, NHTSA had identified on-road testing and development in 34 States and the District of Columbia as shown in Figure 1.



**Figure 1: Map of U.S. Automated Vehicle Test Sites**  
Source: NHTSA/Volpe Center – March 2019

## When will self-driving vehicles be available?



**Figure 2: Estimated AV Deployments by Region**  
Source: Navigant Research – January 2019

Self-driving vehicles are a future technology concept rather than one that you’ll find in a dealership in the next few years. Several companies have announced plans to deploy their vehicles in company owned, operated and maintained ride-sharing or delivery fleets.

A variety of technological hurdles must be overcome before these types of vehicles could be available for sale in the United States. NHTSA is committed to supporting the innovators who are developing these types of vehicles to ensure their safe testing and deployment before they are available to consumers. Figure 2 shows a recent estimate on deployment rates worldwide.

## What safety regulations apply to self-driving vehicles?

All motor vehicles and motor vehicle equipment are regulated by NHTSA, including highly automated vehicles, partially automated vehicles, and vehicle equipment.

Self-driving vehicles are subject to existing Federal Motor Vehicle Safety Standards. More importantly, they are also subject to NHTSA’s broad authority relating to safety-related defects. This authority requires the recall of vehicles or equipment containing defects that pose an unreasonable risk of crashes occurring, or of death or injury in a crash. This authority applies equally to current and emerging vehicle technologies such as those in self-driving vehicles—including systems not covered by a Federal Motor Vehicle Safety Standard.

## What is NHTSA doing to facilitate the safe deployment of self-driving vehicles?

NHTSA is working to update existing regulations and standards and develop modern, flexible performance standards for safe motorized vehicles. At the most basic level, a safe vehicle must be able to achieve four performance goals:

- Avoid Crashes
- Obey Traffic Laws and Norms
- Protect Occupants
- Complete Intended Travel Mission

NHTSA is working with industry and academia and performing research on how self-driving vehicles could reliably and objectively demonstrate that they can achieve these four critical performance goals. NHTSA is also developing consumer communications strategies. The agency is seeking to ensure its international counterparts do not regulate prematurely, and will take a highly performance-oriented approach if it becomes appropriate to regulate.

NHTSA is taking an agency-wide approach to ensuring the safe deployment of self-driving vehicles. Our activities can be categorized into three main areas: research, rulemaking and communications.

### Vehicle and Equipment Safety Research

Safety Framework	Component & Cybersecurity Safety	Passenger Safety
<ul style="list-style-type: none"> <li>• Voluntary Guidance 2.0 and 3.0</li> <li>• Removing assumption of a driver from current standards - adapting current standards</li> <li>• Evaluating vehicle safety performance: How do we test a vehicle without a human driver?</li> <li>• Functional safety test design: How do we test software and account for software updates?</li> </ul>	<ul style="list-style-type: none"> <li>• Component safety such as sensors (cameras, radar, lidar) and software decision-making</li> <li>• Cybersecurity best practices</li> <li>• Hardening the vehicle against potential cyber attacks</li> </ul>	<ul style="list-style-type: none"> <li>• Developing crash dummies and tests for reclining/lying down and rear-facing seats and other potential seating arrangements</li> <li>• Alternative occupant protection systems such as new seat belt and air bag configurations</li> </ul>

### Rulemaking to Update Safety Regulations

Update Exemption Process	Removing Barriers & Assuring Safety	Passenger Safety
<ul style="list-style-type: none"> <li>• Streamlining process by reducing steps agency must take before seeking public comment on petitions</li> <li>• Updating petition requirements to remove artificial constraints on permissible safety evidence</li> </ul>	<ul style="list-style-type: none"> <li>• Updating and modernizing standards, including controls, tell-tales, and indicators needed by a human driver</li> <li>• Vehicle safety assurance</li> </ul>	<ul style="list-style-type: none"> <li>• Incorporating crash dummies and tests for reclining/lay-flat and rear-facing seats and other potential seating arrangements</li> </ul>

### Public Awareness and Communication

Public Awareness and Confidence	Understanding Roles	Safe Road Users Education
<ul style="list-style-type: none"> <li>• Building public confidence through, e.g., encouraging companies to issue voluntary safety self-assessments</li> <li>• Awareness of testing and deployment</li> </ul>	<p>Inform the public how to interact with self-driving vehicles</p> <ul style="list-style-type: none"> <li>• Vehicle occupants - controls, tell-tales and indicators</li> <li>• Pedestrians and other road users, including those with disabilities</li> <li>• Vehicle intent – How does a self-driving vehicle communicate its intent to other road users?</li> </ul>	<ul style="list-style-type: none"> <li>• Collaborate with Consumer Reports and SAE on consistent advanced vehicle terminology</li> <li>• Engage online automotive community, manufacturers, and dealers</li> <li>• Use social and paid media to increase consumer familiarity of advanced vehicle technologies</li> <li>• Outreach at consumer events</li> <li>• Enhance advanced vehicle technology material on NHTSA.gov</li> </ul>

