

Cadillac Tops Tesla in Consumer Reports' First Ranking of Automated Driving Systems

CR finds that these features make driving easier but introduce new safety risks

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In Consumer Reports' first-ever ranking of partially automated driving systems, Cadillac's Super Cruise (shown above) was top-rated because our testing shows it does the best job of balancing high-tech capabilities with ensuring that the car is operated safely and that the driver is paying attention.

These systems offer driving convenience features that will be available on more vehicles in future model years. When engaged, they use cameras, radar, and other sensors—and sometimes even mapping data—to try to keep a car centered in a lane and control speed so that the car remains a set distance in traffic from vehicles in front.

CR experts stress that the systems are not intended to be self-driving features. However, in the right circumstances, such as on long highway drives or in stop-and-go traffic, they can help relieve driver fatigue and stress.

The risks come if automakers allow the systems to operate in situations where they can't do so safely and if the systems make it easy for drivers to feel like they don't need to pay attention.

In CR's rankings, Tesla's Autopilot came in second, followed by Nissan/Infiniti's ProPilot Assist and then Volvo's Pilot Assist system.

Autopilot scored highly for its capabilities and ease of use, while Nissan's system was better at keeping drivers engaged. Volvo scored comparatively lower.

CR Ranks Automated Driving Systems

We evaluated four systems to judge not only how well the technology works but also how well it monitors driver engagement and reacts if drivers don't respond to warnings.

Super Cruise

Tested on Cadillac CT6



Automation System Rating



Super Cruise uses a camera to watch where the driver's eyes are looking.

- Capability & Performance
- Ease of Use
- Clear When Safe to Use
- Keeping Driver Engaged
- Unresponsive Driver

Autopilot

Tested on Tesla X/S/3



Automation System Rating



Autopilot performed well and is easiest to use in stop-and-go traffic.

- Capability & Performance
- Ease of Use
- Clear When Safe to Use
- Keeping Driver Engaged
- Unresponsive Driver

ProPilot Assist

Tested on Infiniti QX50/Nissan Leaf



Automation System Rating



Drivers may find it difficult to turn the system on, testers found.

- Capability & Performance
- Ease of Use
- Clear When Safe to Use
- Keeping Driver Engaged
- Unresponsive Driver

Pilot Assist

Tested on Volvo XC40/XC60



Automation System Rating



The Pilot Assist system displays are small and hard to decipher.

- Capability & Performance
- Ease of Use
- Clear When Safe to Use
- Keeping Driver Engaged
- Unresponsive Driver

Our tests were designed to determine how well each system performs, not only at the task of steering and controlling a car's speed but also at helping drivers pay attention to the road when the systems are turned on.

CR believes it's a critical distinction because research shows that when these systems are engaged, drivers may pay less attention and become overreliant on the automated steering and speed control.

"We have been evaluating these systems on a case-by-case basis for a few years, but we are at a tipping point where they are now going mainstream," says Jake Fisher, director of auto testing at Consumer Reports. "Stacked up against each other, you can really see significant differences. The best systems balance capability with safeguards—making driving easier and less stressful in the right situations. Without proper safeguards, overreliance on the system is too easy, which puts drivers at risk."

Consumer Reports is so concerned with drivers relying too much on these systems that the organization also is closely watching how the car companies market them. Our engineers have pointed out when automakers send mixed messages and suggest that these systems have self-driving, or autonomous, capabilities.

For example, CR contacted Volvo for this article to ask about its Pilot Assist system and why it was being listed on the automaker's website under "Autonomous Driving." This seemed contrary to the stated intent that the system is designed for drivers to keep their hands on the wheel. Based on this feedback, Volvo changed the language on its site last week to remove the connection between Pilot Assist and autonomous driving.

CR tested and ranked these four particular systems because they're among the most capable and well-known on the market. Other automakers, such as Honda and Toyota, offer similar features, but they aren't marketing their automation capabilities the same way.

The top-rated Super Cruise by Cadillac tries to ensure that drivers stay focused by training a small camera on their eyes that assesses whether they're watching the road. If the system determines that a driver isn't paying enough attention, the driver gets red warning lights on the steering wheel, audible alerts, and/or a vibrating seat before the system starts to slow the car down.

As consumers replace older cars, shoppers are more likely to encounter these features as they become available on more-affordable cars, SUVs, and trucks. In just a few years, tens of thousands of drivers could join this transportation revolution—and CR is pushing manufacturers to roll out the technology as safely as possible.

"Consumers stand to gain a lot from the convenience of these systems, but only if automakers put safety first," says David Friedman, vice president of advocacy at Consumer Reports. "We want to see automakers put the same emphasis on safety as they do on innovating and marketing these systems."

Whether these systems actually improve a driver's safety remains to be seen, says Bryan Reimer, a research scientist in the MIT AgeLab and the associate director of the New England University

Transportation Center.

"It may be decades before we fully understand the impact that collaborative automated driving has on safety," he says. Reimer says that even the breakthrough of the automatic transmission has "made it a whole lot easier to hold the phone and drive."

Consumer Reports' Fisher says that given the current state of the technology, drivers must remain constantly engaged. "If you have one of these systems, or are interested in buying a car with one, you need to understand the reality: You are always responsible for driving the vehicle, no matter what the car is doing to help you out."

How We Rated These Systems

The systems were all put to the same tests on CR's 327-acre Auto Test Center track and on nearby Connecticut freeways. Testers drove these cars multiple times over the same route, both as a leading vehicle and as a following vehicle. Super Cruise could not be tested on our track because it is designed to operate only on divided highways without intersections that have been mapped by General Motors.

It's important to note that some automakers can change their systems on current and future vehicles with over-the-air software updates. Our evaluation looked at the systems as they were operating in September 2018.

The Testing Criteria

Here's what CR testers looked at.



How Capable Is the Automation?

The systems were tested on their ability to automate speed control and steering. We looked at how well the cars stayed centered in their lane, how often they touched lane lines, and how many times they crossed those lines. We measured each system's performance on straightaways, on curves, in lane merges, and during lane changes. We also evaluated their ability to control speed on the highway, in stop-and-go traffic, approaching a car ahead, and when the car

ahead had left the lane.

Autopilot and Super Cruise were the clear winners. These systems accelerated and slowed comfortably and were able to reliably keep the vehicle centered in the lane for several miles at a time. The Nissan and Volvo systems had trouble with curvy or hilly roads, and they had frequent lane departures.

Nissan says that its lane-centering is limited intentionally, to make sure that drivers don't lose engagement. "We're concerned about driver overtrust in the system," says Andy Christensen, lead technology expert for technology, planning, and research. "By dialing up the vehicle's control too high, you may wind up in a situation where the customer doesn't understand their role in driving."

Mikael Ljung Aust, a driver behavior specialist at the Volvo Cars Safety Centre in Sweden, agrees. He says that driver engagement remains a key concern for the company and that drivers should think of the system as more like "advanced power steering."

How Easy Is the System to Use?

Testers evaluated how easy it was for drivers to engage the systems and make adjustments to settings. They also reviewed the types and amount of information that were displayed to drivers—and how clear it was for drivers to see.

CR found that it's easy to engage Tesla's Autopilot and that it's clear to drivers whether the system is on or off. It has a unique display that provides the driver with information about what the car's sensors can recognize. The other three systems require multiple steps to engage them. To operate them, drivers might need to look away from the road to find the relevant information.

Nissan's ProPilot Assist cannot be engaged at low speeds unless there is a vehicle immediately in front of it, but the display doesn't explain this limitation. According to Nissan's Christensen, the system was intentionally set up to work that way.

"This may be a carryover from conventional cruise control back in the day," he says. "We haven't heard that this is a complaint from our users."

Cadillac spokesman Donny Nordlicht says the automaker updated Super Cruise this spring, providing clearer communication about when the system is available and making it easier for drivers to

turn the system on. He says Cadillac will continue to update the system as needed, which will depend in part on customer feedback.

Is It Clear to Drivers When to Use the System?

We evaluated systems for how clearly they communicate in real time when drivers should—and should not—be using the technology.

Cadillac's Super Cruise is the best system at knowing when it's within its operational limits. It can't be used on back roads or in other places where it could be difficult for the car to maintain control. Super Cruise is available only on limited-access highways that GM has already mapped, and if it cannot be engaged, it lets the driver know why.

Super Cruise is the only system that provides ample warning to the driver as it approaches merging lanes, off-ramps, and difficult traffic patterns. All the other systems lack early warnings and can be used in places they're not designed to be used. On some secondary roads, Tesla's Autopilot limits how fast the car can go but still allows the system to be used. It even allows use on small, curvy roads with poor lane markings—and operates erratically in these situations rather than locking the system out. While bad weather can disable all the systems, Nissan's ProPilot Assist and Volvo's Pilot Assist lock drivers out in moderate rain.

Does the System Help Make Sure the Driver Is Paying Attention?

When steering and speed control are automated, the driver is more likely to stop paying attention or become distracted, research has shown. That's why it's critical that these systems have a way to ensure that the driver is still engaged with driving. We saw significant differences among the systems in how long they waited to warn the driver to respond, ranging from 4 seconds for the Super Cruise to 24 seconds for Autopilot. To put that in context, at 60 mph a car goes nearly the length of a football field in 4 seconds, and nearly six football fields in 24 seconds.

In CR's testing we found that Cadillac's Super Cruise's eye-tracking technology ensures that the driver's eyes are open and looking forward toward the road. None of the other systems we tested use eye tracking; rather, they prompt the driver to hold on to, or apply pressure to, the steering wheel. This is an insufficient way of measuring driver attention, and it provides little assurance that the driver is even awake. Because of the impressive ability of Tesla's Autopilot to keep the vehicle centered in its lane, it's easy for drivers to become overreliant on it. Pilot Assist from Volvo and Nissan's ProPilot Assist are far less capable, and that forces drivers to stay involved with steering, or risk leaving the lane on all but the straightest roads.

Tesla has a camera in the Model 3, but it's not being used currently to monitor what drivers are doing,



according to an email from a Tesla spokeswoman. “It might be utilized in potential future features, which could be added to Model 3 with software releases. Customers will receive prior notice if/when Tesla decides to use it,” she said in the email.

Volvo’s aim is to keep drivers engaged—and to shut out those who aren’t, says Aust of the Volvo Cars Safety Centre. “The basic point is this: If you can’t keep your hands on the wheel, you shouldn’t be using this function.”

What Does the System Do If Drivers Don't or Can't Respond?

We examined the escalation process for warnings, steering control, and speed control.

Each system behaves drastically differently when the driver fails to respond after warnings. Super Cruise and Autopilot issue two visual warnings, followed by an audible alert, before they start applying the brakes to stop the vehicle in its lane, and then turn on the hazard lights. The Super Cruise system will then call an emergency contact number, and the system is locked out until the car has been shut off and restarted. Similarly, Autopilot will go through the escalation process three times during a trip before it locks out the driver. ProPilot Assist has a unique process that applies sudden, hard braking before it brings the car to a complete stop. If Volvo’s Pilot Assist does not detect pressure pulling on the steering wheel after it has issued its visual and audible warnings, the system shuts off completely and does not apply braking or any lane assist. Only if the driver has previously enabled the lane-keeping system, which is separate from the Pilot Assist system, will the vehicle detect lane departure and provide some steering.

Volvo’s Aust says there’s little chance that a driver will become completely incapacitated, such as with a medical emergency, and

need the car to stop itself. “There’s a certain, super-small statistical likelihood that you may lose consciousness at exactly the wrong time,” he says. “And while we acknowledge that, it’s a small risk.”

What to Do Before You Buy

These automated systems are not limited to the vehicles CR tested, says Kelly Funkhouser, CR’s program manager for vehicle usability and automation. “It’s no longer only the luxury cars with this technology—mainstream vehicles are catching up, so it’s important that consumers pay attention now,” she says.

For example, the Nissan system is spreading through its lineup, and GM promises that Super Cruise will be available across its brands by 2020. Honda and Toyota have similar technology that can effectively do the same tasks as these four systems—even though they’re not marketed that way—and other automakers promise their own systems in the near future.

Shoppers who are considering a new car with this technology need to understand that it’s in its infancy, and although some manufacturers market this as safety technology, there is no data to support that assertion, Funkhouser says. They should test out the system while test-driving a car, and they need to make sure the salesperson thoroughly walks them through how the system operates. And they need to be aware that these systems won’t drive for them, no matter what the ads imply.

Funkhouser notes that the more capable automation is, the more often drivers tune out. As these systems become common, more must be done to make sure drivers stay aware and engaged.

“Driver monitoring becomes necessary when motorists can push a button and hand over control of the vehicle,” she says. “Manufacturers have the ability to monitor drivers and use that information to respond when attention fades, rather than relying on ineffective warnings.”