AUTOMATED VEHICLES

Essential Versus Non-Essential Advanced Driver Assistance Systems & Automated Vehicle Functions

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More than ever before, vehicle technologies are being designed with safety in mind. Passive safety features (i.e., not requiring driver input), such as crumple zones, airbags, and headrests, as well as active safety features (i.e., features that actively work to sense and monitor driving that are engaged by driver input or automatically) such as anti-lock braking have been introduced to enhance vehicle safety for many years. Advances in active safety features have led to the development of advanced driver assistance systems (ADAS), which is a set of electronic systems which support the driving task. ADAS is designed to improve safety and help prevent or mitigate collisions. It is an essential precursor to the development of higher levels of automation and ADAS can be grouped into the following five categories:

- collision warnings;
- collision intervention;
- driver control assistance;
- parking assistance; and,
- vision enhancements.

These systems are capable of assisting the driver in the driving task to help navigate the roadway. ADAS technology is designed to offer assistance to the driver but these systems are not designed to replace an attentive and engaged driver.

ADAS can help mitigate and reduce the severity of collisions, however, these safety benefits can only be accrued if drivers use this technology appropriately. Drivers must familiarize themselves with ADAS technology on their vehicle and its limitations so they do not over-rely on it. This fact sheet describes ADAS categories. It distinguishes between technologies essential to help support the driving task and improve safety and secondary, non-essential systems providing an indirect safety benefit.

Questions & Answers

What are essential ADAS?

Essential ADAS provide a direct safety benefit to the driver. They are developed specifically to improve driver and passenger safety. Primarily these systems help prevent crashes by alerting the driver to hazards or, in some cases, providing assistance as they navigate hazards. Some examples include[1]:

- Collision warnings
  - **Lane departure warning:** Alerts the driver when they have drifted over the lane markings.

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- **Blind spot warning:** Alerts the driver to objects/vehicles to the side and rear of the vehicle in their blind spot.
- **Forward collision warning:** Alerts the driver when obstacles detected in the path of the vehicle are slow-moving or stopped.
- **Parking collision warning:** Alerts the driver to objects detected close to the rear section of the vehicle when reversing at low speeds or while parking.
- **Rear cross traffic warning:** Alerts the driver to vehicles approaching from the side and rear when reversing.

> Collision intervention

- **Automatic emergency braking:** Applies a brake force to reduce the speed of the vehicle when a potential collision with an obstacle is detected in order to prevent or decrease the severity of a collision.
- **Automatic emergency steering:** Helps to steer the vehicle when a potential collision is detected in order to avoid or reduce the severity of a collision.
- **Reverse automatic emergency braking:** Applies a brake force when an obstacle is detected behind the vehicle while reversing to prevent or reduce the severity of a collision.

> Driver control assistance

- **Adaptive cruise control:** Assists with acceleration or braking to ensure a safe following distance is maintained. The driver can decide to maintain the distance or turn off the feature to perform a lane change and pass the vehicle.
- **Lane-keeping assistance:** Assists with steering the vehicle to maintain its position in the lane.
- **Active driving assistance:** Assists with acceleration, steering and braking, under certain circumstances.
- **Downhill control system:** Assists to decrease speed when travelling downhill without brake input from the driver to help maintain control of the vehicle.
- **Electronic stability control:** Applies the brakes to one or more wheels briefly when a loss of steering control is detected to prevent the vehicle from spinning out.
- **Anti-lock braking system (ABS):** Regulates brake pressure to stop brakes from locking when the brakes are applied heavily in an emergency. This is done to prevent skidding and allow the tire to maintain contact with the roadway.
- **Brake assist:** Boosts brake pressure when the brakes are applied heavily in an emergency to shorten the stopping distance.

What are non-essential ADAS?

Non-essential ADAS consists of features that assist in the driving task and provide indirect safety benefits.

> Parking assistance

- **Back-up driving monitor:** An in-vehicle monitor displays the view from a camera located on the rear of the vehicle to provide the driver with an additional tool to monitor the space between the back of the vehicle and other objects while backing up.

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Drivers must remain in control of their vehicle when ADAS is engaged. A key limitation of ADAS is it can only minimize human error, not prevent it.

- **Active parking assistance:** Assists the driver during a parking maneuver by controlling steering, and possibly other functions such as acceleration, braking, and gear shifting. The system may be capable of parallel and/or perpendicular parking.
- **Remote parking assistance:** Performs the parking maneuver without the driver physically present in the vehicle by controlling steering, acceleration, braking and gear shifting.

> Vision enhancements

- **Advanced forward lighting systems:** Adapts the headlights to changing driving conditions by orienting to illuminate the path of the vehicle, switching from high beam to low beam, or shining lights at a 90-degree angle at an intersection.
- **Night vision:** Displays enhanced images on the instrument cluster or head-up display.
- **Head-up display:** Projects vehicle data into the line of sight so the driver does not have to look away from their forward viewpoint.

If my vehicle has ADAS technology, does this mean it is automated?

No. According to the National Highway Traffic Safety Administration (NHTSA) and the Society of Automotive Engineers (SAE) International, vehicles with ADAS technology are classified as having Driver Assistance or Partial Automation.[2] The driver remains the primary controller of the vehicle, although ADAS can assist with elements of the driving task. This can be helpful if driving skills have not fully developed or if a driver's fitness to drive becomes limited. For instance, ADAS may be able to assist some driver populations to regain their mobility, such as older drivers.[3] Further, this technology could help at-risk drivers develop critical driving skills and mitigate risk-taking behaviours. However, this can only occur if the technology is used as intended. For example, forward collision warnings alert drivers to an impending collision, but offer no driving assistance and still require driver input or action to avoid the collision. Therefore, drivers must remain alert and able to respond to the road environment.[4]

What are the limitations of ADAS and what are my expectations as a driver?

Drivers must remain in control of their vehicle when ADAS is engaged. A key limitation of ADAS is it can only minimize human error, not prevent it. Core driving skills are still necessary to be safe while driving. Although subsequent levels of automation may reduce driver involvement, it is expected that only vehicles with full automation (corresponding to SAE level 5) would completely remove the driver from the driving task. Due to the challenges associated with achieving this level of automation, this technology is considered a longer-term goal and is decades away from being publicly available.

Are ADAS technologies currently available?

Many ADAS technologies such as blind spot warning or lane-keeping assistance have been available in Canada for several years, and may come standard on a vehicle or by request before purchase. A national survey by Transport Canada demonstrated that 85% of Canadians have heard of at least one ADAS technology. This survey also found that familiarity with ADAS technologies was associated with the greater likelihood of agreeing that these technologies improve road safety.[5] Drivers should consult vehicle manufacturers or dealers about technologies available in specific models and educate themselves about the functions and limitations of the ADAS technologies in their vehicles. User manuals contain safety-critical information about the functioning of ADAS features, however research suggests that user manuals should be complemented with other educational strategies to reach a broader audience.[6]

Can I turn off ADAS technologies?

Certain manufacturers may permit drivers to disengage some ADAS systems deemed non-essential to

enhancing driver safety. However, this is not the case for the majority of systems.[7] Drivers are encouraged to consult with vehicle manufacturers to ensure they understand how features function and whether they can be disengaged. If drivers are unable to operate or interact with certain safety systems, or desire specific features included in their vehicle purchase, they are encouraged to do independent research, consult safety test results, and explore options regarding which vehicles possess specific features and base their purchase upon that information. However, some ADAS technologies are vital, such as ABS braking, and should not be disengaged.[8] Disengaging such functions would severely reduce the positive impact of ADAS on road safety.

Will the presence of these systems lower insurance rates?

ADAS systems and automated functions are inherently more complex and sophisticated technologies which increase the cost of repairs. This fact will likely increase insurance rates in the shorter-term. However, as safety benefits are accrued as drivers safely adopt these technologies, it is anticipated fewer crashes will occur and insurance rates will decline. This outcome is largely dependent on whether drivers safely adopt technologies to reduce their collision risk. At the same time, it is also anticipated this technology will increase the purchase cost of vehicles. If positive road safety outcomes are substantial (in terms of fewer fatalities, injuries and collisions), insurance companies may not be willing to insure vehicles lacking these features in the longer-term. Yet, the true impact of these technologies on insurance rates is unknown and will have to be monitored as the technology develops.

Conclusion

ADAS technology is becoming increasingly prevalent in modern vehicles. Driver knowledge of the various ADAS technologies must keep pace with the availability and intended use of these technologies. Drivers must understand the purpose of ADAS technologies and how they function to assist the driver. Most importantly, drivers must also recognize the limits of ADAS technologies, and not rely on technologies to perform under conditions for which they were not designed, otherwise road safety benefits will not be achieved.

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1 Transport Canada 2019; American Automobile Association (AAA) 2019
2 Ziebinski et al. 2017; NHTSA 2017
3 Robertson et al. 2019; Reimer 2014
4 Lindgren & Chen 2006
5 Transport Canada 2021
6 Oviedo-Trespalacios, Tichon, J., & Briant 2021
6 Lindgren & Chen, 2006; Ziebinski et al. 2017
7 Lindgren & Chen 2006

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