

Advanced Driver Assistance Systems



You should be able to:

- Prepare for ASE certifications.
- Explain the terms used to describe ADAS.
- Be aware that OEMs are moving towards common nomenclature.
- Explain purpose and effectiveness of ADAS.
- List, define, and explain common ADAS features.

Terms to know:

- ACC (Adaptive Cruise Control)
- ALC (Adaptive Light Control)
- AEB (Automatic Emergency Braking)
- BSD (Blind Spot Detection)
- CTA (Cross Traffic Alert)
- DDT (Dynamic Driving Task)
- LKA (Lane Keeping Assistance)

Terms to know: (cont)

- HUD (Head Up Display)
- HDC (Hill Decent Control)
- LDW (Lane Departure Warning)
- NV (Night Vision)
- ODD (Operational Design Domain)
- PA (Parking Assistance)
- SVC (Surround View Camera)

ADAS is an umbrella term.

- Many different technologies fit under the umbrella.
 - Note that many manufacturers still use different names for certain technologies, even if the move is toward common terms.
- ACC, BSD, and LDW were among the first to fit under the ADAS name.
- TPMS, HDC, and PA was next.

Dynamic Driving Task.

- DDT for short.
 - DDTs can be considered system (ADAS) outputs since they are activities that actively perform vehicle functions.
 - Steering, Throttling, Braking are examples of DDTs

Operational Design Domain.

- ODD for short.
 - The term refers to conditions (Environmental and otherwise) under which the system is designed to work. (Or not work)
 - A good example is a camera-based system.
 - Heavy rain, fog, and/or snow will tend to render those systems inoperable.
 - They will warn the driver that the system is not operating and to take over.



Blind Spot Detection



- BSD for short.
 - Warns against objects in the blind spot zone, typically from the windshield frame (B-pillar) and some ways back.
 - The blind spot zone is the area that cannot easily be observed in the side view mirrors.
 - Early systems were RADAR based, they now rely on inputs from multiple sensors in combination (RADAR, LIDAR, Camera, Ultrasonic).

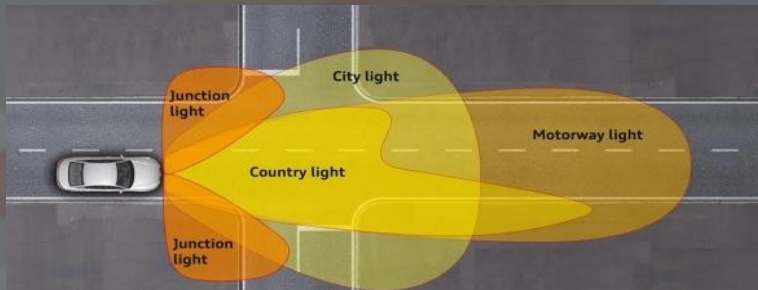
ADAS features.

- Adaptive Cruise Control (ACC)
 - Using sensors to maintain a safe distance to the vehicle in front of you by controlling vehicle speed.
 - Can use RADAR, LIDAR, Ultrasonic sensors, Cameras, or a combination of these.
 - Advanced ACC can bring the vehicle to a complete stop if needed as well as resume driving if the vehicle in front of you moves away.



Adaptive Light Control

- ALC for short.
 - These systems will switch headlights from high beam to low beam when meeting or closing in on another vehicle.
 - Some systems will also modify the beam pattern to minimize blinding oncoming traffic.



Lane Departure Warning.



- LDW for short.
 - Relies on cameras, either forward facing or rearward facing, to detect lane markings.
 - Problems are things like off ramps and obscured markings.
 - These systems will only provide a warning if the vehicle starts to wear over or into the markings and will not attempt to steer the vehicle.
 - The warning can be: Haptic (vibration in the steering wheel or seat), Visual (light, symbol), Sound.

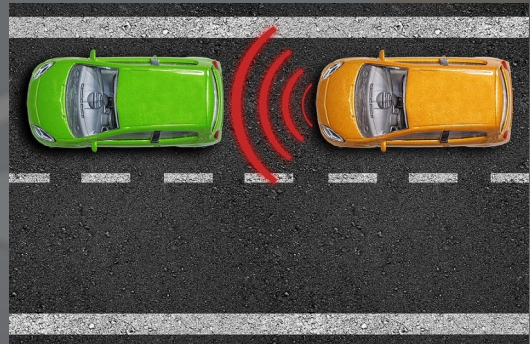
Lane Keeping Assistance.

- LKA for short.
 - A “natural evolution” of LDW.
 - Uses cameras and will attempt to keep the vehicle in the center of the lane.
 - If too aggressive may cause a ping pong or worming effect, which was a problem with earlier systems.
 - The software and hardware has evolved so the phenomenon is less noticeable (but may still be felt or observed through steering wheel movements).
 - LKA is often an integral part of partially self-driving vehicles.



Automatic Emergency Braking

- AEB for short.
 - Radar or camera or both.
 - Provides warnings at first.
 - Visual, audio, even haptic (vibration).
 - If no driver intervention the system will firmly apply the brakes at the last possible moment (That ought to get the driver's attention!).



Automatic Emergency Braking (cont).

- AEB systems may or may not have pedestrian detection capability and only be able to detect other vehicles.
 - It is important that the vehicle owner is aware of potential system limitations.
- Collision Warning Detection may be part of the system. CWD may take certain preliminary measures.

Collision Warning Detection.

- CWD normally takes place before AEB.
 - May precharge the brake system
 - May take up any seat belt slack.
 - May change the vehicle ride height.
- CWD may exist on vehicles without AEB.

Driver Alert Systems.

- May have different names.
 - Senses driver inattentiveness.
 - Drowsy/sleepy/unfocused.
 - Steering wheel input and/or cameras.
 - audio/visual/haptic.
 - May even bring the vehicle to a safe stop eventually.



Cross Traffic Alert.

- CTA for short.
 - Front or rear or both.
 - Front often cameras
 - Rear often radar. (RCTA – Rear Cross Traffic Alert)
 - The systems may be passive and only give warnings, or may also be active and will apply emergency braking if needed.



Hill Descent Control.

- Normally utilized on trucks and larger SUVs.
 - Manages braking and engine torque while going downhill at slow speed, maybe less than 25 miles per hour.
 - The driver steers the vehicle.

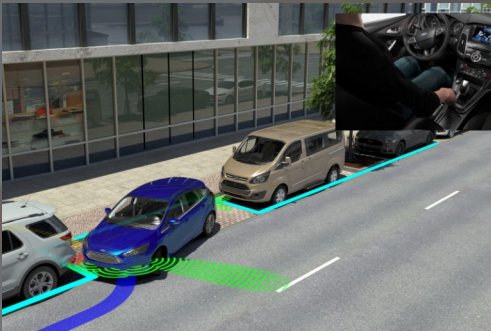


Parking Assistance Systems.

- PA or PAS for short.
 - Initially specifically designed to help with parallel parking. As we know, this tends to be the more challenging parking maneuver for many.
 - Ultrasonic sensors measure the opening as the vehicle drives by the spot, if PA is engaged.
 - The level of functionality varies in different implementations.

Parking Assistance Systems (cont).

- Some will do steering, brake, and throttle.
 - Others will leave some of these functions to the driver, for example the brakes.
- Newer systems will also do straight in and angled parking in addition to parallel parking.



Night Vision.



- NV for short.
 - Thermal camera (passive) or infrared (active) camera.
 - Projects image on a Heads Up Display (HUD) or on a screen.
 - Longer range than camera or radar based systems.
 - May incorporate subject or object recognition.

Surround View Camera.

- SVC for short.
 - Four or more cameras.
 - May show a 360 degree view or a top-down view.
 - The top down view is synthesized based on input from the four or more cameras.
 - Works best at slow speed like backing up.
 - May have lines superimposed showing distance, angles, and projected vehicle path.



Home work.

- There is home work on Brightspace.
 - (4) Advanced Driver Assistance Systems.
 - Please refer to Brightspace for when the home work is due.