TODAY’S VEHICLE TECHNOLOGIES
LEVELS OF DRIVING ASSISTANCE & AUTOMATION
LEVELS OF DRIVING ASSISTANCE & AUTOMATION

- Have you heard of Level 0 thru Level 5?
- How do you know what “Level” a vehicle is?
- What terms and definitions are used in the industry...
  - Where are we today?
EASY TO GET LOST
LEVELED OF DRIVING AUTOMATION

https://www.sae.org/blog/sae-j3016-update
<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAE Level 0™</td>
<td>You are driving whenever these driver support features are engaged - even if your feet are off the pedals and you are not steering.</td>
</tr>
<tr>
<td>SAE Level 1™</td>
<td>You must constantly supervise these support features; you must steer, brake or accelerate as needed to maintain safety.</td>
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<tr>
<td>SAE Level 2™</td>
<td>You are not driving when these automated driving features are engaged - even if you are seated in &quot;the driver's seat&quot;.</td>
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<tr>
<td>SAE Level 3™</td>
<td>When the feature requests, you must drive.</td>
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<tr>
<td>SAE Level 4™</td>
<td>These automated driving features will not require you to take over driving.</td>
</tr>
<tr>
<td>SAE Level 5™</td>
<td>These features can drive the vehicle under limited conditions and will not operate unless all required conditions are met.</td>
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### What does the human in the driver's seat have to do?

**These are driver support features**

- These features are limited to providing warnings and momentary assistance.
- Automatic emergency braking
- Blind spot warning
- Lane departure warning
- Lane centering OR adaptive cruise control
- Lane centering AND adaptive cruise control at the same time
- Traffic jam chauffeur

**These are automated driving features**

- These features provide steering OR brake/acceleration support to the driver.
- These features provide steering AND brake/acceleration support to the driver.
- Traffic jam chauffeur
- Local driverless taxi
- Pedals/steering wheel may or may not be installed
- Same as level 4, but feature can drive everywhere in all conditions

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STATE OF THE INDUSTRY
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- How do you know what “Level” a vehicle is?

Level applies to the system, not the vehicle
### STATE OF THE INDUSTRY

- **What Levels are these systems?**

<table>
<thead>
<tr>
<th></th>
<th>Blind Spot Warning</th>
<th>Automatic Emergency Braking</th>
<th>Pedestrian Automatic Emergency Braking</th>
<th>Lane Departure Warning</th>
<th>Lane Keep Assist</th>
<th>Adaptive Cruise Control</th>
<th>Lane Centering Assistance</th>
<th>Adaptive Cruise &amp; Lane Centering</th>
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<tr>
<td><img src="image1" alt="Icon" /></td>
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<td><img src="image7" alt="Icon" /></td>
<td><img src="image8" alt="Icon" /></td>
<td><img src="image9" alt="Icon" /></td>
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<tr>
<td>Levels</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>


STATE OF THE INDUSTRY

- Highest SAE Level of Driving Assistance & Automation on the road today (in the US)?
STATE OF THE INDUSTRY

- How prevalent are these systems on today’s vehicles?

The following slides are from the NHTSA Partnership for Analytics in Traffic Safety (PARTS) Initiative.

Market Penetration Rates for 2015-2020 MY vehicles in the study set, approximately 47 million vehicles.

https://www.nhtsa.gov/parts-partnership-for-analytics-research-in-traffic-safety
ADAS Market Penetration Rates
for Features Examined in PARTS Study

Penetration rates are reported for the following ADAS features:

- Blind Spot Warning (BSW)
- Automatic Emergency Braking (AEB)
- Pedestrian Automatic Emergency Braking (PAEB)
- Lane Departure Warning (LDW)
- Lane Keeping Assistance (LKA)

Note: Full document available at NHTSA.gov/PARTS
Blind Spot Warning (BSW)

BSW penetration increased from 29% to 62% over 6 years for vehicles in the PARTS study set.

Note: Rates represent a partial view of the U.S. automobile market, both in terms of manufacturers and models. Vehicles in the PARTS study may not be representative of the entire market.
Automatic Emergency Braking (AEB)

AEB penetration increased from 5% to 74% over 6 years for vehicles in the PARTS study set.

Note: Rates represent a partial view of the U.S. automobile market, both in terms of manufacturers and models. Vehicles in the PARTS study may not be representative of the entire market.

NHTSA/IIHS/Industry Voluntary Agreement
95% by 2022
Pedestrian Automatic Emergency Braking (PAEB)

PAEB penetration increased from 2% to 66% over 6 years for vehicles in the PARTS study set.

Note: Rates represent a partial view of the U.S. automobile market, both in terms of manufacturers and models. Vehicles in the PARTS study may not be representative of the entire market.
Lane Departure Warning (LDW)

LDW penetration increased from 12% to 71% over 6 years for vehicles in the PARTS study set.

Note: Rates represent a partial view of the U.S. automobile market, both in terms of manufacturers and models. Vehicles in the PARTS study may not be representative of the entire market.
Lane Keeping Assistance (LKA)

LKA penetration increased from <1% to 61% over 6 years for vehicles in the PARTS study set

Note: Rates represent a partial view of the U.S. automobile market, both in terms of manufacturers and models. Vehicles in the PARTS study may not be representative of the entire market.
MAZDA’S HUMAN-CENTRIC DESIGN PHILOSOPHY
MAZDA’S DRIVER ASSISTANCE TECHNOLOGIES

SMART BRAKE SUPPORT
Smart Brake Support helps detect vehicles (above 2 mph), pedestrians and bicyclists (6 - 50 mph) in your path. If an impact is predicted, the system will warn the driver and, if necessary, apply the brakes.

LANE-KEEP ASSIST
Lane-keep Assist adds to the warnings of the Lane Departure Warning System. When it senses a potential unintentional lane departure at speeds of 40 mph or higher, it will perform minor steering corrections to help prevent your vehicle from exiting the lane.

MAZDA RADAR CRUISE CONTROL WITH STOP & GO
Mazda Radar Cruise Control with Stop & Go maintains a set speed and minimum following distance from the traffic ahead. If the vehicle you’re following reduces speed, even down to a stop, your vehicle will automatically slow or stop as needed.
MAZDA’S DRIVER ASSISTANCE TECHNOLOGIES

Enhances cruise control functionality with low-speed lane centering up to about 40 mph.
THANK YOU

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