Crash Avoidance Technologies: Assessing The Building Blocks For Tomorrow's Driverless Vehicles

I-95 Corridor Coalition Connected & Automated Vehicles Conference: What States Need to Know

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**IIHS** is an independent, nonprofit scientific and educational organization dedicated to reducing the losses — deaths, injuries and property damage — from crashes on the nation’s roads.

**HLDI** shares this mission by analyzing insurance data representing human and economic losses from crashes and other events related to vehicle ownership.

Both organizations are wholly supported by auto insurers.
Where are we?

- Washington, DC
- Arlington, VA
- Ruckersville, VA
Driver assistance features

Velodyne LIDAR
used by Google Self-Driving Car
325 ft range with 360° rotation

Ultrasonic sensors
15 ft range

Short-range radar
100 ft range
80° opening angle

Mono/stereo cameras
325 ft range, 45° opening angle

Mid-range radar
260 ft range, 16° opening angle

LIDAR
45 ft range, 27° opening angle

Mid-range radar
200 ft range, 60° opening angle

Mono/stereo cameras
325 ft range, 45° opening angle

Infrared
525 ft range
20° opening angle

Long-range radar
650 ft range, 18-20° opening angle
<table>
<thead>
<tr>
<th>Crash Prevention System</th>
<th>All Crashes</th>
<th>Injury Crashes</th>
<th>Fatal Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Crash Prevention</td>
<td>1,165,000</td>
<td>66,000</td>
<td>879</td>
</tr>
<tr>
<td>Lane Departure Prevention</td>
<td>179,000</td>
<td>37,000</td>
<td>7,529</td>
</tr>
<tr>
<td>Side View Assist</td>
<td>395,000</td>
<td>20,000</td>
<td>393</td>
</tr>
<tr>
<td>Adaptive headlights</td>
<td>142,000</td>
<td>29,000</td>
<td>2,484</td>
</tr>
<tr>
<td>Total Unique Crashes</td>
<td>1,866,000</td>
<td>149,000</td>
<td>10,238</td>
</tr>
</tbody>
</table>
Crash avoidance technology effects on insurance claims
Front crash prevention systems
Change in claim frequency

-30%
-20%
-10%
0%
10%

low speed
warning only
warning with autobrake

Mazda (smart city brake support)
Mazda (smart city brake support & FOW)
Volvo City Safety
Chrysler (with ACC, BSM & RCTA)
Honda Accord camera (with LDW)
Honda Accord radar (with LDW + ACC)
Mercedes-Benz
Volvo
Acura
Mercedes-Benz
Subaru (with LDW)
Volvo (with LDW)

PDL
collision

PDL collision warning only warning with autobrake
Front crash prevention systems
Change in claim frequency

-40% -30% -20% -10% 0% 10%

low speed
warning only
warning with autobrake

Bodily injury liability

MedPay
PIP

Mazda (smart city brake support)
Mazda (smart city brake support & FOW)
Volvo City Safety
Chrysler (with ACC, BSM & RCTA)
Honda Accord (with camera)
Honda Accord (with LDW + ACC)
Mercedes-Benz
Volvo
Acura
Mercedes-Benz
Subaru (with LDW)
Volvo (with LDW)
Speed reduction in 12 and 24 mph tests

- **Volvo S60**: 2 point advanced
- **Dodge Durango**: 3 point advanced
- **Subaru Outback**: 6 point superior
2014 Infiniti Q50
Speed reduction: 7 mph

2015 Subaru Legacy
Speed reduction: 6 mph

2014 Volvo S80
Speed reduction: 4 mph
Summary of technology effects on insurance claim frequency
Results pooled across automakers

- Forward collision warning
- FCW with autobrake
- Adaptive headlights
- Lane departure warning
- Side-view assist (blind spot)

Legend:
- Collision
- Property Damage Liability
- Bodily Injury Liability
Effectiveness of collision avoidance systems in police-reported crash data
Effects of systems on police-reported crashes

- 2009-14 data on police-reported crashes from states with VINs
  - Analyses include data from 19-26 states, depending on crash type
- Compared crash rates for vehicles with systems and same make/model/year vehicles without systems in most analyses
- In analyses of Volvo’s standard City Safety system, compared vehicles with system to similar vehicles in same class
- HLDI data
  - Insured vehicle years as exposure measure
  - Covariates: other collision avoidance technologies, calendar year, vehicle series/model year, state, vehicle density, rated driver age group, gender, marital status, insurance policy characteristics
Effects of front crash prevention systems on rear-end strikes with third-party injuries

Percent difference in crash rates
Effects of lane departure warning systems on single-vehicle run-off-road and head-on injury crashes

Percent difference in crash rates
Effects of lane departure warning systems on sideswipe injury crashes, with no prior lane change

Percent difference in crash rates

- Honda Accord (w/FCW)
- Mercedes-Benz (w/FCW + AEB)
- Subaru (w/FCW + AEB)
- Lane departure warning pooled
- Buick Lucerne (w/ESC + blind spot)
Spread of technology through the fleet
New vehicle series with electronic stability control
By model year

- Standard
- Optional
- Not available
Registered vehicles with electronic stability control
By calendar year

[Bar chart showing the percentage of registered vehicles with electronic stability control by calendar year, with bars divided into sections indicating standard, optional, and not available.
Registered vehicles with available electronic stability control, actual and predicted

By calendar year

![Graph showing the percentage of registered vehicles with available electronic stability control over time, with actual and predicted data points. The graph indicates a significant increase from 1995 to 2020, with a forecast reaching 100% by 2050.](image-url)
Registered vehicles with front crash prevention
By calendar year

- Standard
- Optional
- Not available
Year available features reach 95% of registered vehicles with and without hypothetical mandate

- front crash prevention
- lane departure warning
- adaptive headlights
- blind spot warning
- rear camera*
- rear parking sensors

* rear camera mandate
May 1, 2018
...I AM APPROACHING FROM YOUR LEFT AND AM MAKING PRECAUTIONARY ADJUSTMENTS...

ACKNOWLEDGED. NOT A PROBLEM UNLESS THE SLAB OF MEAT IN HERE INTERFERES...

Intermediate stage en route to driverless cars.
More information and links to our YouTube channel and Twitter feed at iihs.org

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