

**Crash Avoidance Potential of
Five Vehicle Technologies**

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**INSURANCE INSTITUTE
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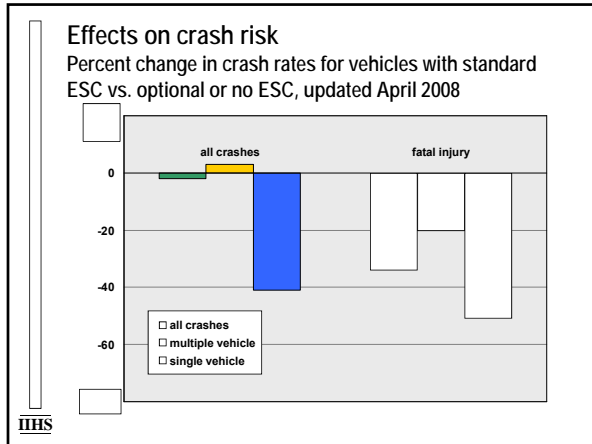
**Video on
Electronic stability control**

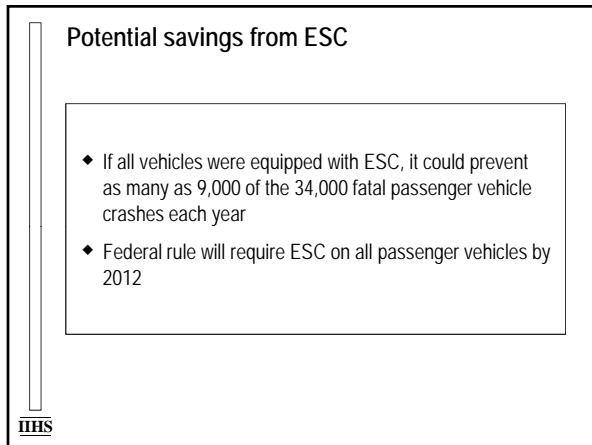
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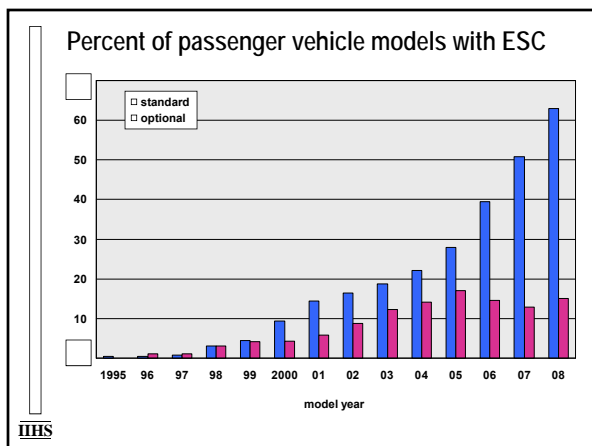
Avoiding crashes – Electronic stability control



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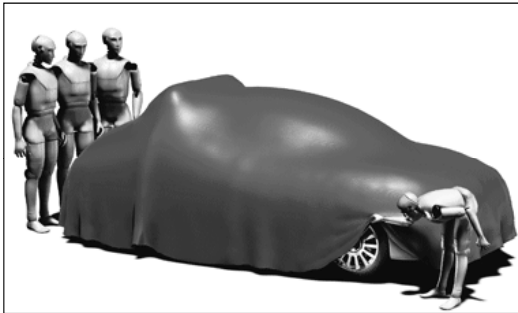


What accounts for spectacular success of ESC?

- ◆ ESC prevents many run-off-road and rollover crashes, types that often result in serious injuries and deaths
- ◆ ESC takes action for driver

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Everyone is curious about the car of the future



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Success of crash avoidance technologies depends on answers to 3 questions

- ◆ What is the size and nature of the crash problem?
- ◆ What kinds of information will elicit right responses from drivers?
- ◆ How will driver behavior change in response to technology?

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Status Report
special issue on
crash avoidance
features
April 17, 2008



Technologies available on 2009 vehicles sold in United States

	number of makes
forward collision warning	6
lane departure warning	7
blind spot detection	9
brake assist	35
adaptive headlights	18



Potential of crash avoidance technologies

- ◆ Prior estimates of effects based on experimental research on simulators, test track, or in field operational tests
 - Adaptive headlights reported to increase visibility of pedestrians on dark curves by 14 percent (Sivak et al., 1994)
 - Systems that warn drivers predicted to prevent 791,000 rear-end, 90,000 lane change, and 297,000 road departure crashes in US annually (NHTSA, 1996)
 - Warning systems could prevent 336,000 road departure crashes in US annually (Pomerleau et al., 1999)
 - Warning systems could prevent nearly 14,000 lane change and road departure crashes in European Union annually (Abele et al., 2005)

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Study objective

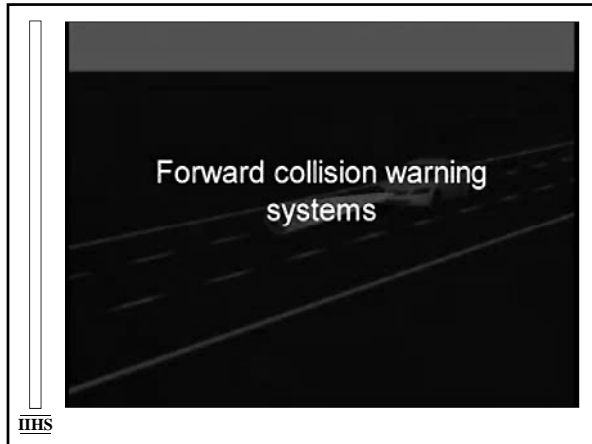
- ◆ Aim of current study was to quantify the maximum potential of five selected technologies
 - Forward collision warning/mitigation
 - Lane departure warning/prevention
 - Blind spot detection/warning
 - Emergency brake assist
 - Adaptive headlights

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Potential of crash avoidance technologies

- ◆ Included data on passenger vehicle crashes during 2002-06 from
 - Fatality Analysis Reporting System (FARS) – annual census of fatal crashes occurring on public roads in US
 - National Automotive Sampling System General Estimates System (NASS GES) – annual probability sample of police-reported crashes in US
- ◆ Records in NASS GES were weighted to produce national estimates
- ◆ Each crash was assigned to one of nine general categories
 - Changing lanes, angle, front-to-rear, single-driver, head-on, other front-to-front, sideswipe same direction, sideswipe opposite directions, and other
- ◆ Each crash then further separated into non-relevant and potentially relevant crash types for each of the five crash avoidance technologies

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Estimating maximum potential crash reductions from forward collision warning

- ◆ Some angle, front-to-rear, and single-driver passenger vehicle crashes are relevant: front of vehicle struck another vehicle, pedestrian, or other object in path
- ◆ Crashes classified as non-relevant include the following:
 - Driver intentionally turned, merged, or changed lanes
 - Successful avoidance of object in vehicle's path
 - Off-road crashes

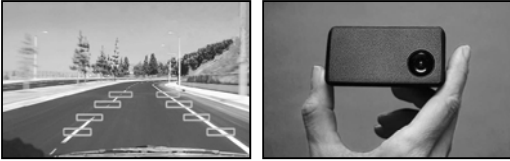
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Maximum potential annual crashes preventable by forward collision warning

all crashes	2,268,000
injury crashes	210,000
fatal crashes	7,166

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Lane departure warning




Camera mounted behind rearview mirror looks at road ahead and monitors vehicle position in relation to lane markings; if vehicle wanders out of lane, driver is warned with audible, visible, and/or haptic signals

Some designs may actively redirect the vehicle

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Infiniti lane departure systems



warning prevention

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Lane departure warning or prevention

	warning	prevention
Volvo	audible	no
GM	audible, visual	no
Audi	vibrating steering wheel	no
BMW	vibrating steering wheel	no
Infiniti	audible, visual	yes

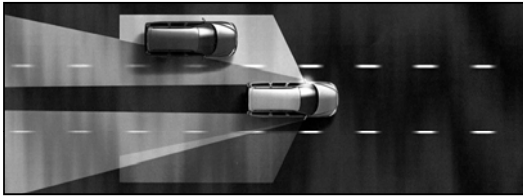
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Maximum potential annual crashes preventable
by lane departure warning

all crashes	483,000
injury crashes	87,000
fatal crashes	10,345

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Blind spot warning/detection



Radar or digital cameras detect whether vehicles are moving
within blind spot zones night or day and warn drivers

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Blind spot warning/
detection systems

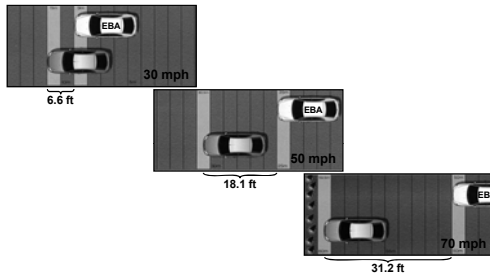
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Maximum potential annual crashes preventable
by blind spot warning/detection

all crashes	457,000
injury crashes	24,000
fatal crashes	428

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Emergency brake assist
Comparison of stopping distances at various speeds



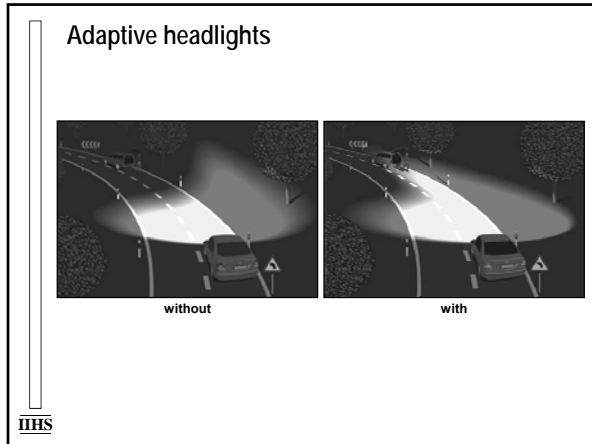
When sensors detect panic braking, system boosts
braking power to reduce stopping distance

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Maximum potential annual crashes preventable
by emergency brake assist


all crashes	417,000
injury crashes	61,000
fatal crashes	3,079

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Maximum potential annual crashes preventable by adaptive headlights

all crashes	143,000
injury crashes	31,000
fatal crashes	2,553



Maximum crashes potentially preventable By type of system

	all	fatal
forward collision warning	2,268,000	7,166
brake assist	417,000	3,079
lane departure warning	483,000	10,345
blind spot detection	457,000	428
adaptive headlights	143,000	2,553
total unique crashes	3,435,000	20,777




Best evaluations compare real-world performance of vehicles with and without a new technology




Test track assessments can be misleading
Antilock brake example

- ◆ Intended to decrease stopping distances and increase control and stability of vehicle during hard braking
- ◆ Stopping distances were reduced on test track, and crash reductions were predicted
- ◆ Early results: increase in crashes fatal to occupants of vehicles with antilock brakes – primarily single vehicle
- ◆ Latest results: increase in fatal crashes appears to have disappeared, but antilock performance still disappointing

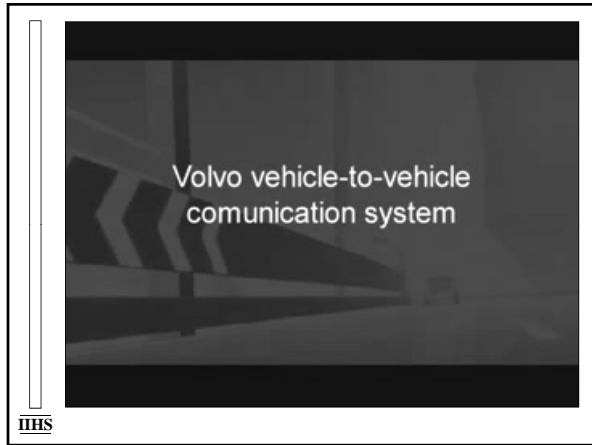


Current IIHS research on crash avoidance technologies

- ◆ Interviews with drivers of vehicles with technology
 - e.g., their experience with systems; how often they turn them off; what they like and don't like
- ◆ Examining insurance claim histories of vehicles equipped with technology compared with similar vehicles without technology







For more information:

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