Keeping Highways Safer: Latest Research from the Insurance Institute for Highway Safety

www.iihs.org

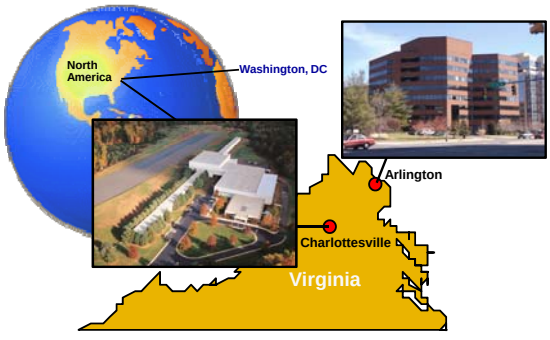
ASHE Mid-Atlantic Region
Technical Conference
Richmond, VA • May 9, 2011

Wen Hu, Ph.D.

Insurance Institute for Highway Safety (IIHS)

- Nonprofit, independent research and communications organization
- Mission to save lives, prevent injuries, and reduce property damage in crashes
- Research goal to determine what works and what doesn't to improve highway safety
- Funded by automobile insurance companies

Where are we?



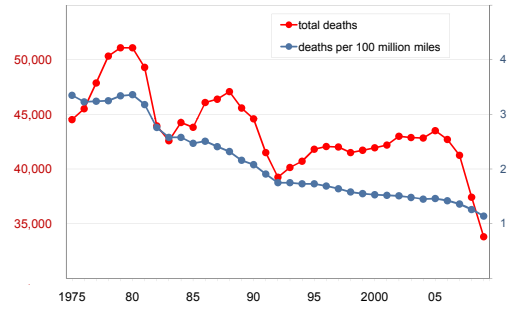
Haddon matrix

Recognizing opportunities to make a difference

	pre-crash	during crash	after crash
people			
vehicles and equipment			
environment			

Motor vehicle crash deaths and deaths per 100 million miles traveled

US, 1975-2009

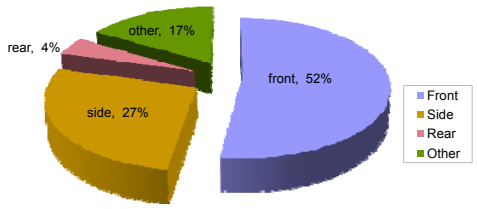


IIHS vehicle research center

Outside car companies, few facilities in the world are equipped to conduct the range of crash tests and other research the Vehicle Research Center can accommodate.

Passenger vehicle deaths by point of impact

2009



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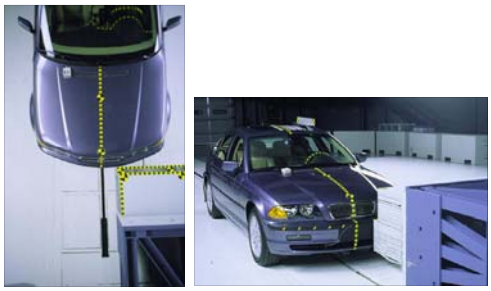
Front offset crash test configuration



IIHS Crashworthiness Evaluations
40 mph, 40% overlap

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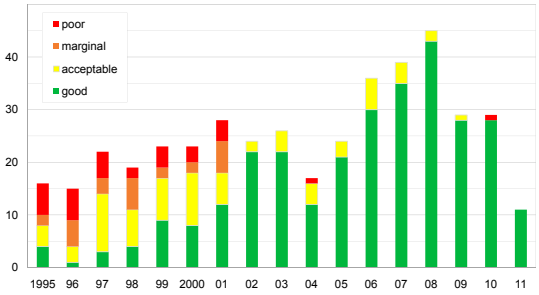
Frontal offset crash protection ratings

Improvements: 1995 to 2011



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Barriers in relation to typical passenger car

IIHS barrier taller and rides higher, contoured edges

FMVSS 214 barrier

IIHS barrier

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Side crashworthiness evaluations

Moving deformable barrier crash tests, 3,300 lb. barrier at 31 mph

injury measures from SID IIs dummies

head protection

structure

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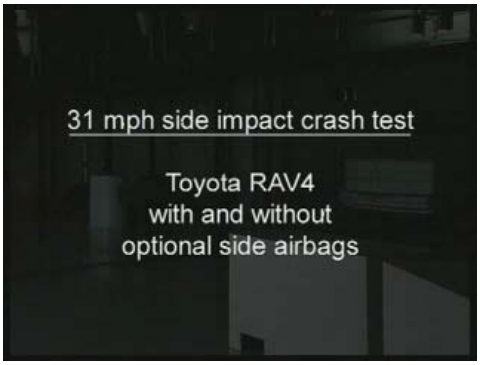

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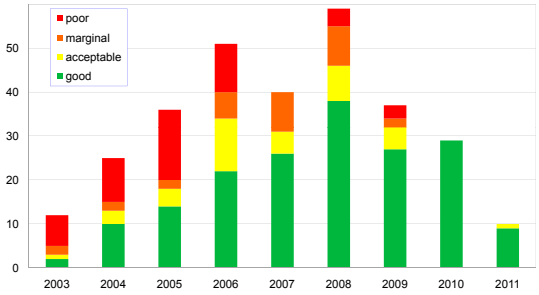
Side impact crash protection ratings

Improvements: 2003 to 2011



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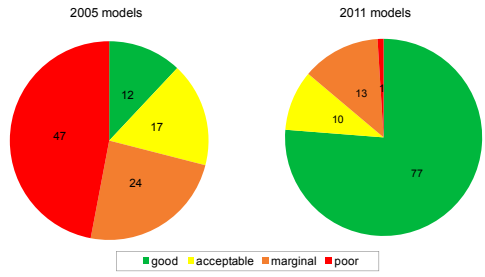
Rear crashworthiness ratings are improving

IIHS results for U.S. models



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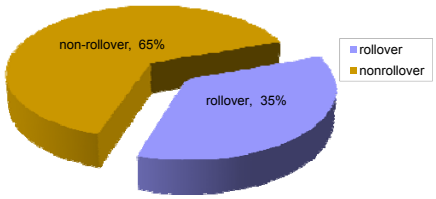
Passenger vehicle occupant deaths

Rollover vs nonrollover, 2009



Roof strength in rollovers

Roof strength ratings promote stronger roofs

Both vehicles after 15,000 lb force

Volkswagen Tiguan

G

Kia Sportage

P

Requirements for *TOP SAFETY PICK* award

- G evaluation in frontal crashworthiness test
- G evaluation in side crashworthiness test
- G evaluation in rear crash protection/head restraint test
- G evaluation in roof strength test
- Availability of electronic stability control

2011 *TOP SAFETY PICK* winners, as of May 2011

Large cars
Buick LaCrosse
Buick Regal
BMW 5 series
Cadillac CTS sedan
Chrysler 300
Dodge Charger
Ford Taurus
Hyundai Equus
Hyundai Genesis
Infiniti M37/M56
Lincoln MKS
Mercedes E class coupe
Mercedes E class sedan
Toyota Avalon
Volvo S80

Minicar
Ford Fiesta

Minivans
Honda Odyssey
Toyota Sienna

Small cars
Chevrolet Cruze
Chevrolet Volt
Honda Civic
Kia Forte
Kia Soul
Mazda 3 sedan/hatchback
Mini Cooper Countryman
Mitsubishi Lancer
Nissan Cube
Nissan Leaf
Scion tC
Scion xB
Subaru Impreza
Toyota Corolla
Volkswagen Golf
Volkswagen GTI

Midsize cars
Audi A3
Audi A4 sedan
Chevrolet Malibu
Chrysler 200
Dodge Avenger
Ford Fusion
Hyundai Sonata
Kia Optima
Lincoln MKZ
Mercedes C class
Subaru Legacy
Subaru Outback
Volkswagen Jetta sedan
Volkswagen Jetta SportWagen
Volvo C30
Volvo S60

Large SUVs
Buick Enclave
Chevrolet Traverse
GMC Acadia
Volkswagen Touareg

Midsize SUVs
Audi Q5
Cadillac SRX
Chevrolet Equinox
Dodge Journey
Ford Edge
Ford Explorer
Ford Flex
GMC Terrain
Hyundai Santa Fe
Jeep Grand Cherokee
Kia Sorento
Lexus RX
Lincoln MKT
Lincoln MKX
Mercedes GLK
Subaru Tribeca
Toyota Highlander
Toyota Venza
Volvo XC60
Volvo XC90

Small SUVs
Honda Element
Hyundai Tucson
Jeep Patriot
Kia Sportage
Subaru Forester
Volkswagen Tiguan

Underride

Portion of passenger vehicle slides under truck due to its greater height and ground clearance

Full-width, 35 mph tests

2007 Hyundai

Attachments failed

Severe underride with dummies' heads contacting hood/trailer

2011 Wabash

No failure

No underride

50% overlap, 35 mph tests

2007 Vanguard

Attachments failed

Severe underride with dummy's head contacting trailer

2011 Wabash

No attachment failure but outboard end bent forward

No underride

30% overlap, 35 mph test

2011 Wabash

Outboard end bent forward

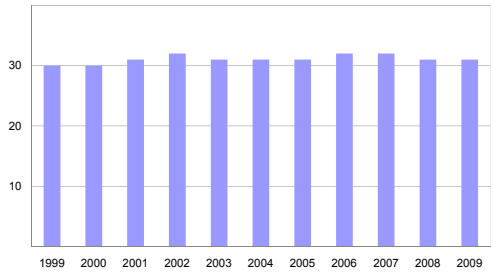
Severe underride with dummy's head contacting trailer

Conclusions: Upgrade federal regulations for rear underride guards (FMVSS 223/224)

- Increase force requirements
  - Crash tests at same impact speed used in government's rigid wall testing prove that current requirements aren't producing "overly rigid" guards
- Attachments of guards to trailer shouldn't be weakest point of system; require they remain intact during quasi-static testing
- Adjust outboard test location and/or force requirements to extend protection to the full width of the trailer
- Test guards while attached to trailers
- Re-evaluate practicality of lower ground clearance requirement
- Determine which types of trucks that are currently exempt can be dropped

In 2009, more than 10,500 people died in speeding-related crashes

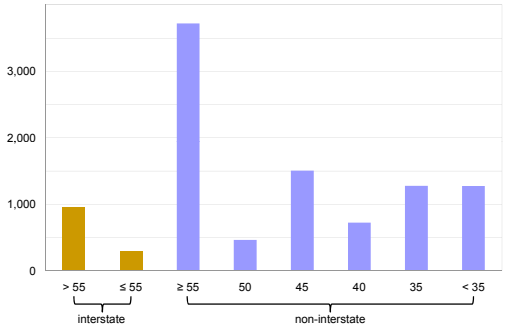
Percent of motor vehicle crash deaths involving speeding as a contributing factor, 1999-2009



Some myths about speeds and speed limits

- Speed variation – not high speed – is the real problem
- Speeding is a problem mostly on high-speed roads
- Raising speed limits eliminates widespread law-breaking without increasing travel speeds
- Roadway safety improvements and advances in vehicle design make it safe to travel at high speeds

Speeding-related fatalities by speed limit in 2009



Effects of 1974 National Maximum Speed Limit (NMSL) legislation

- NMSL of 55 mph established to conserve fuel
- Fatalities declined 16 percent, from 54,052 in 1973 to 45,196 in 1974
- Estimated 20,000 to 30,000 lives were saved by NMSL during 1974-1978 (NHTSA-FHWA, 1980)
- Travel speeds were reduced but compliance gradually eroded (TRB, 1984)

Effects of 1995 NMSL repeal on vehicle speeds

IIHS, 1997, 2008

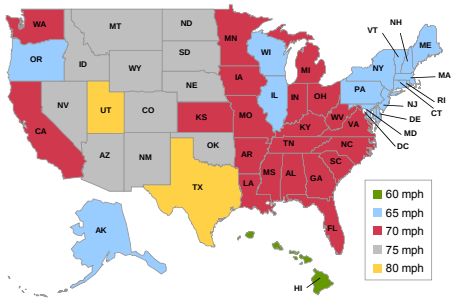
- On urban freeways where limits increased from 55 to 65 or 70 mph, within one year of change
  - proportion of passenger vehicles exceeding 70 mph increased 12-35 percent
- On rural interstates where limits increased from 65 to 75 mph, 10 years after change
  - proportion of passenger vehicles exceeding 80 mph tripled

Effects of 1995 NMSL repeal on fatalities

- Fatality rates per vehicle mile traveled increased 17 percent on interstates in 24 states that raised speed limits (IIHS, 1999)
- Fatality rates per vehicle mile traveled on rural interstates in 23 states that increased speed limits to 70 mph or 75 mph were 35 and 38 percent higher than expected
  (Land Transport Safety Authority of New Zealand, 2002)
- 3 percent increase in road fatalities attributable to higher speed limits on all road types; 9 percent increase on rural interstates
  (Friedman et al., 2009)

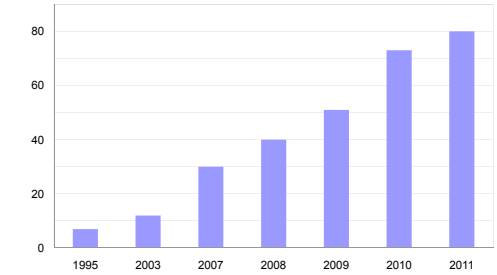
Maximum authorized speed limits

May 2011



US communities with speed cameras

1995-2011



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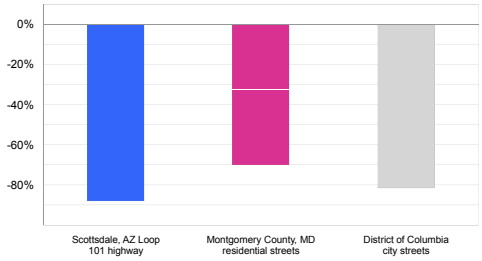
Reductions in proportion of vehicles exceeding speed limit by more than 10 mph after camera enforcement

Relative to comparison sites, IIHS (2003, 2008a, 2008b)



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Montgomery County, MD speed camera study

IIHS, 2008

- First Maryland community to use speed cameras
- Camera enforcement limited to school zones and residential streets with speed limits 35 mph or less

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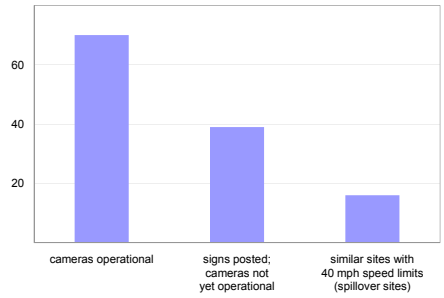
Percent reduction in odds of exceeding speed limit by more than 10 mph associated with camera enforcement

Relative to Virginia comparison sites



Reviews of international research show that speed camera enforcement reduces injury and fatal crashes

Cochrane Review
(Wilson et al., 2010)
28 studies

- 8-50% reduction in injury crashes in the vicinity of camera sites
- 11-44% reduction in fatal or serious injury crashes in the vicinity of camera sites
- 17-58% reduction in fatal or serious injury crashes over wider areas

Intersection crashes

- More than 2.2 million crashes in 2009
- 6,178 crashes every day
  - 222 serious non-fatal injuries
  - 20 deaths

Roundabouts are safer and more efficient

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Conversion of stop sign and traffic signal intersections to roundabouts:

- 40% reduction in all crashes
- 80% reduction in injury crashes
- 90% reduction in fatal & incapacitating injury crashes

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If 10 percent of signalized intersections in the United States were converted to roundabouts

IIHS, 2005

- Approximately 70,000 crashes prevented annually including:
  - 450 fatal crashes
  - 45,000 injury crashes
- Vehicle delays reduced by about 800 million hours
- Fuel consumption reduced by more than 500 million gallons

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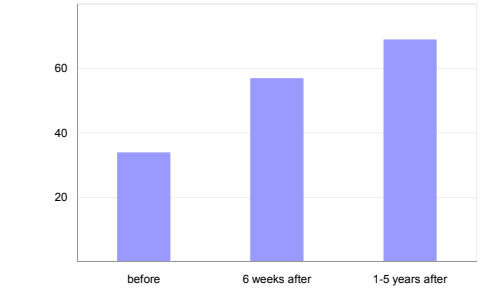
Percent of residents who favor roundabouts

Before and after construction
IIHS, 2006, 2007



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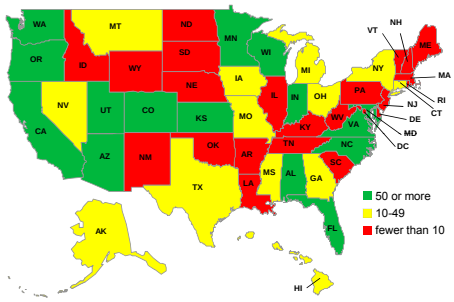
Progress in building roundabouts

August 2010



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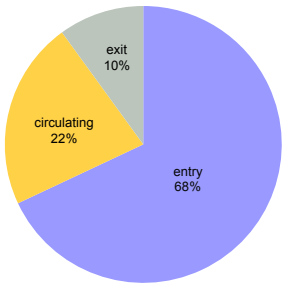
Crashes by location within roundabouts

Maryland, 1993-2005



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Crash types at entrances

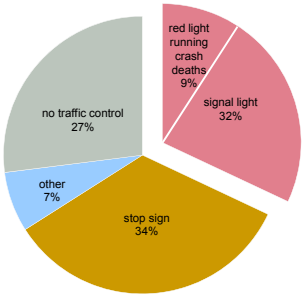
Maryland roundabouts, 1993-2005

	single lane	double lane
run off road	44%	35%
rear end	38%	21%
entering/circulating	16%	29%
sideswipe	0%	8%
pedestrian/bike	0%	5%
other	2%	3%

Features that enhance safety of roundabouts

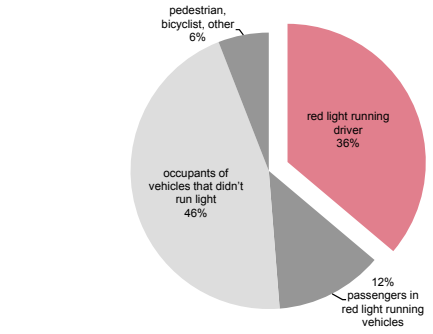
7,358 deaths at intersections in 2009

Distribution by type of traffic control



676 deaths in red light running crashes in 2009

Distribution by type of road user



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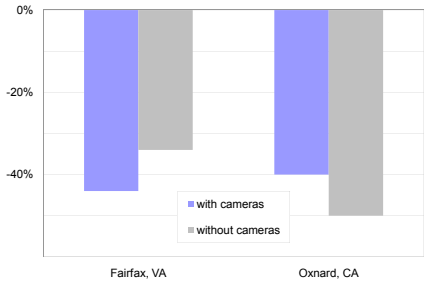
Reductions in red light violations at intersections with signal lights

With and without cameras, per 10,000 vehicles, IIHS (1999,1999)



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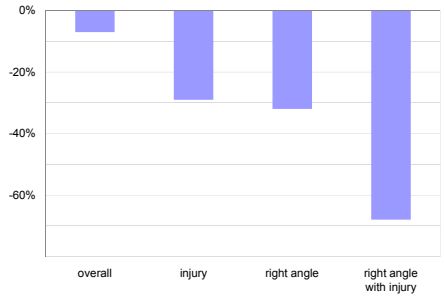
Citywide crash reductions at intersections with signal lights after camera enforcement

Oxnard, California, IIHS (2002)



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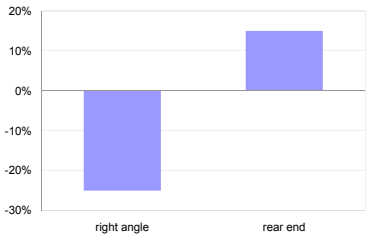
Changes in crashes attributed to red light cameras

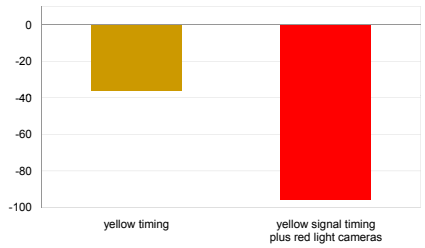
7 city study

Opponents point out that red light cameras can increase rear-end crashes. However, a study by the Federal Highway Administration (2005) found that an increase in rear-end crashes was more than offset by a large decrease in more severe angle crashes.



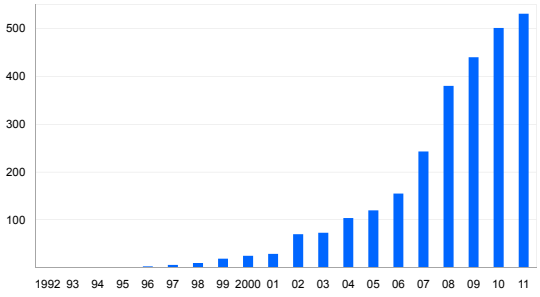
Reductions in red light violations per 10,000 vehicles from longer yellow signal timing and red light cameras

Philadelphia, IIHS (2008)



US communities with red light cameras

1992-2011



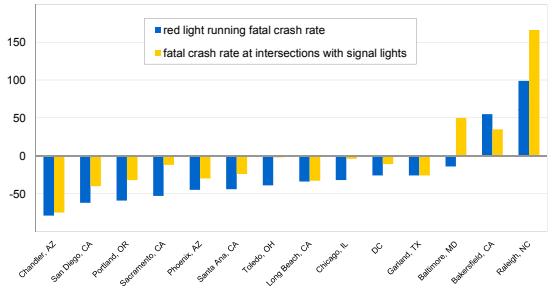
Changes in fatal crash rates in large cities with and without red light cameras

IIHS, 2011

- Cities with population 200,000+ in 2008
- Study groups
  - 14 cities with cameras during 2004-08 but not 1992-96
  - 48 cities without cameras in either period
- Per capita fatal crash rates compared during 2004-08 vs. 1992-96
  - Red light running crashes
  - Crashes at intersections with signal lights

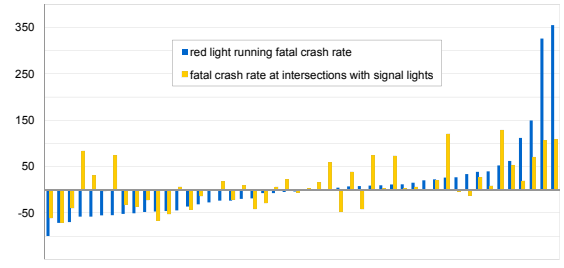
Percent change in fatal crash rates in large cities with red light cameras

2004-08 vs. 1992-96

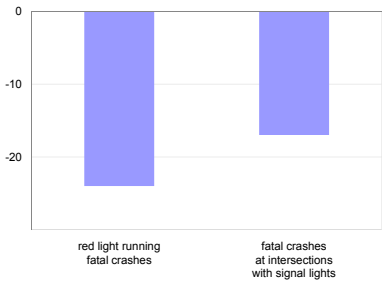


Percent change in fatal crash rates in large cities without red light cameras

2004-08 vs. 1992-96



Percent difference in actual fatal crash rates during 2004-08 in cities with red light cameras vs. expected rates without cameras



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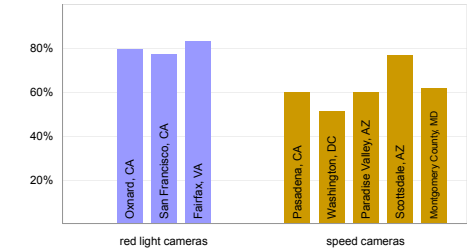
Surveys show that a majority of drivers support automated enforcement

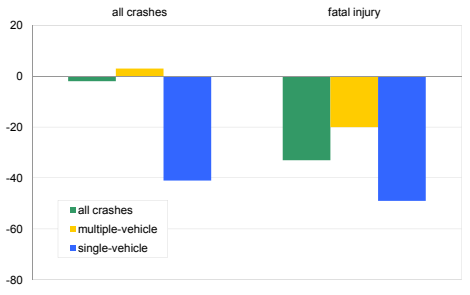
IIHS, 1990, 2000, 2003, 2008a, 2008b



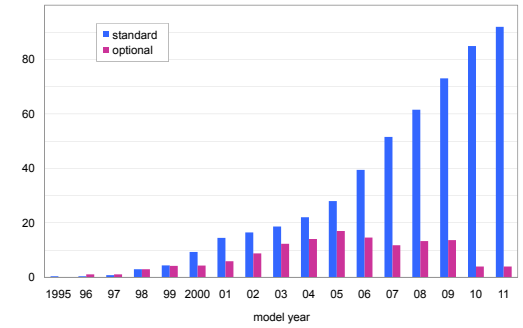
Crash avoidance technology

Effects of Electronic Stability Control on crash risk

Percent change in crash rates for vehicles with standard ESC vs. optional or no ESC, updated May 2010



Percent of vehicle models with ESC



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Crash avoidance technologies

lane departure warning/prevention

side view assist

forward collision warning

adaptive headlights

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Annual crashes that potentially could be prevented or mitigated with crash avoidance features for passenger vehicles, 2004-08

	all	injury	fatal
all passenger car crashes	5,825,000	698,000	33,035
total unique crashes	1,866,000	149,000	10,238
percent of crashes	32%	21%	31%

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Average annual pedestrian crashes and deaths potentially prevented or mitigated by pedestrian detection systems

Vehicle traveling straight, pedestrian crossing traffic

added crashes addressed by system capabilities	pedestrian crashes	pedestrian deaths
speed limit less than 40 mph, daylight, clear weather, no view obstruction	8,000	172

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Average annual pedestrian crashes and deaths potentially prevented or mitigated by pedestrian detection systems

Vehicle traveling straight, pedestrian crossing traffic

added crashes addressed by system capabilities	pedestrian crashes	pedestrian deaths
speed limit less than 40 mph, daylight, clear weather, no view obstruction	8,000	172
and non daylight conditions and speed limit 40 mph or greater	14,000	1,304
and inclement weather	2,000	137
and driver view obstruction	4,000	287
total	28,000	1,899

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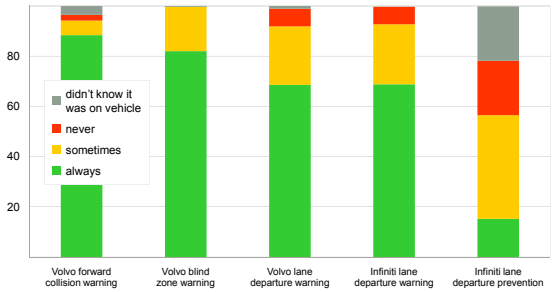
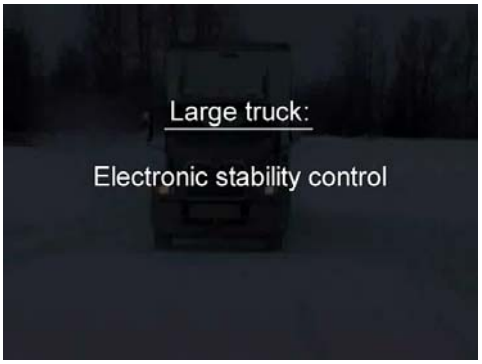
Percent of owners who drive with system turned on





Percent of large truck crashes that potentially could be prevented or mitigated with crash avoidance features for large trucks, 2004-08

	all	injury	fatal
all crashes	384,000	37,000	4,151
total unique crashes	107,000	12,000	835
percent of crashes	28%	34%	20%

Electric vehicle test program

Chevrolet Volt and Nissan Leaf

2011 Volt

2011 Leaf

Overall crashworthiness evaluations of electric vehicles

	front	side	roll over	rear
TOP SAFETY PICK — Chevrolet Volt 2011 models	G	G	G	G
TOP SAFETY PICK — Nissan Leaf 2011 models	G	G	G	G

Other electric vehicles arriving soon

Mitsubishi i-MiEV

Think City

Smart Fortwo electric

Wheego Life

Coda

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Dedicated to reducing deaths, injuries, and property damage on the highway

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