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FOR HIGHWAY SAFETY

HIGHWAY LOSS
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Large truck safety research at the Insurance Institute for Highway Safety

NRC Panel on Understanding Driver Fatigue
Factors in Motor Carrier Safety and Driver Health
Washington, D.C. • May 28, 2014

Adrian Lund, Ph.D. President IIHS & HLDI

The Insurance Institute for Highway Safety,

founded in 1959, is an independent, nonprofit, scientific and educational organization dedicated to reducing the losses — deaths, injuries, and property damage — from crashes on the nation's highways.

The Highway Loss Data Institute,

founded in 1972, shares and supports this mission through scientific studies of insurance data representing the human and economic losses resulting from the ownership and operation of different types of vehicles and by publishing insurance loss results by vehicle make and model.

Both organizations are wholly supported by auto insurers.

Insurance Institute for Highway Safety

105 employees as of May 2014



Arlington, VA – headquarters

- 66 employees
 - Research & Communications (48)
 - Highway Loss Data Institute (18)



Ruckersville, VA – VRC

- 39 employees

IIHS truck safety research spans vehicle and driver issues

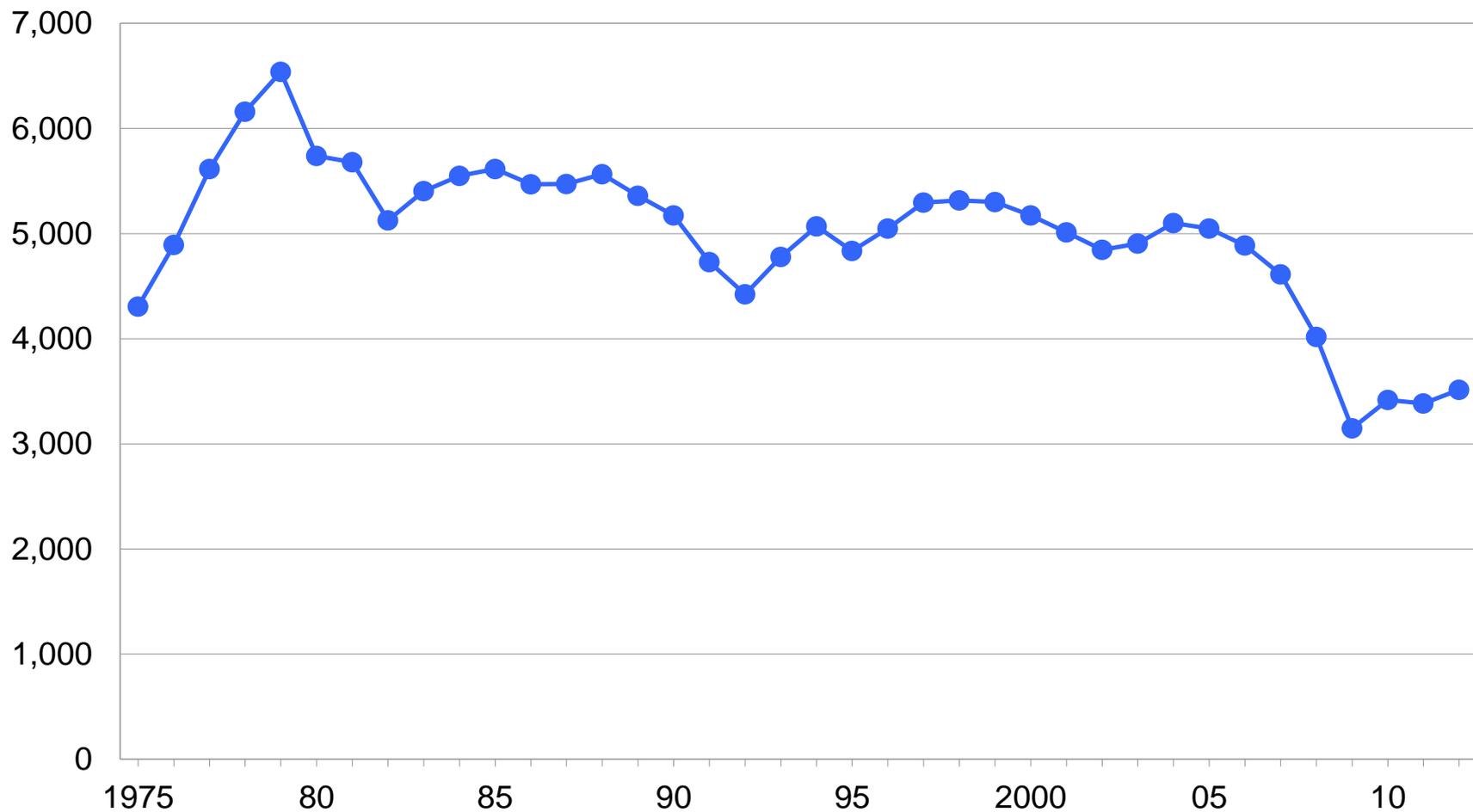
- Truck underride
- Truck size and weight
- Truck configuration
- Front brake disconnection
- Trucks and pedestrians
- Trucks and speed limits
- Drug use
- Hours of service
- Crash avoidance technology
- Statistical monitoring

Recent declines in deaths from large truck crashes are not evidence that large trucks are safer.

The declines are attributable to improvements in passenger vehicles, and most recently, the economic downturn.

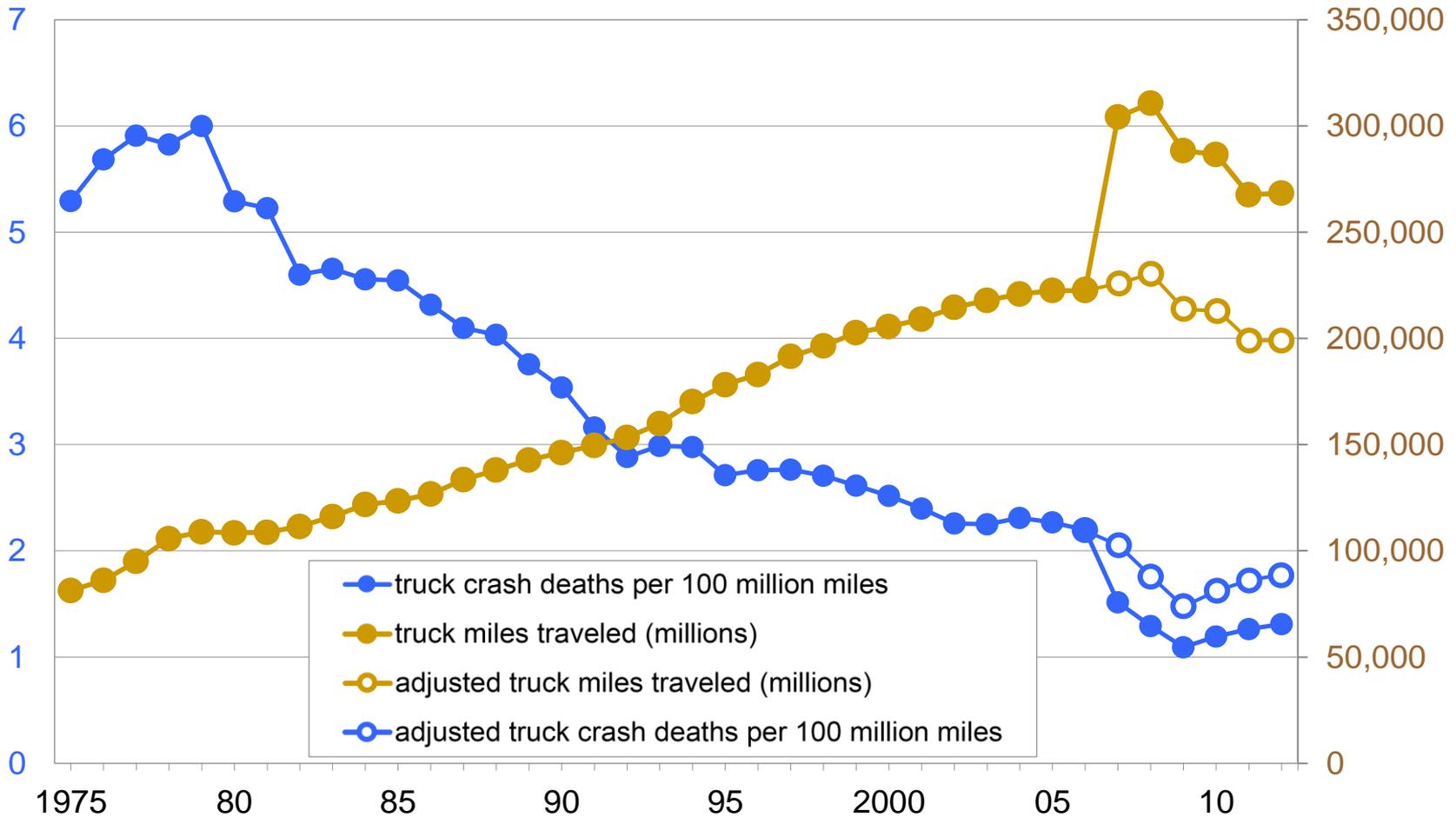
Deaths in crashes involving large trucks

1975-2012



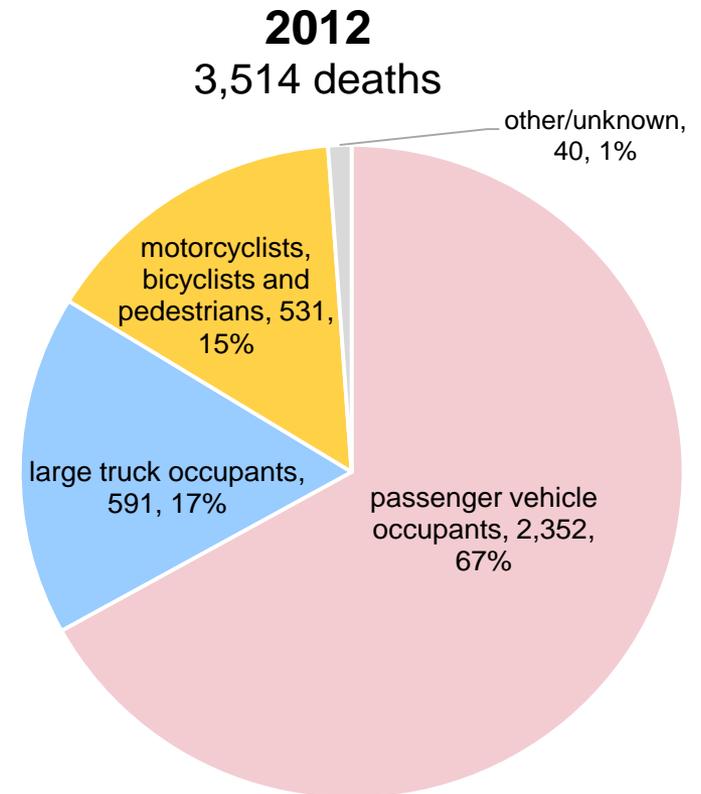
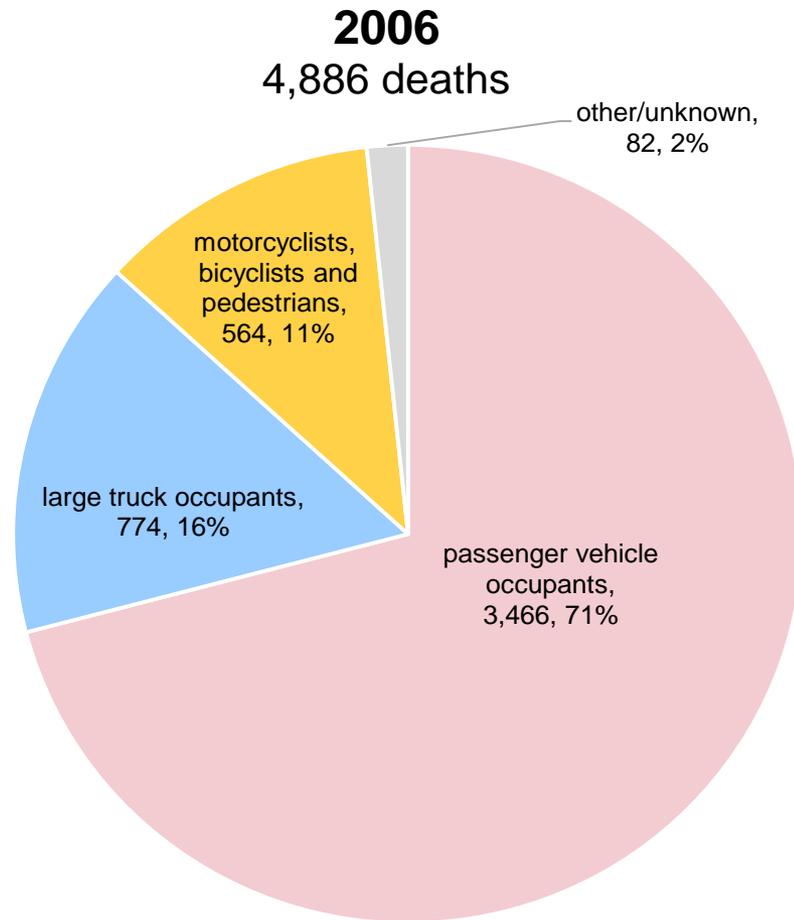
Deaths in crashes involving large trucks per 100 million miles traveled and truck miles traveled (millions)

1975-2012



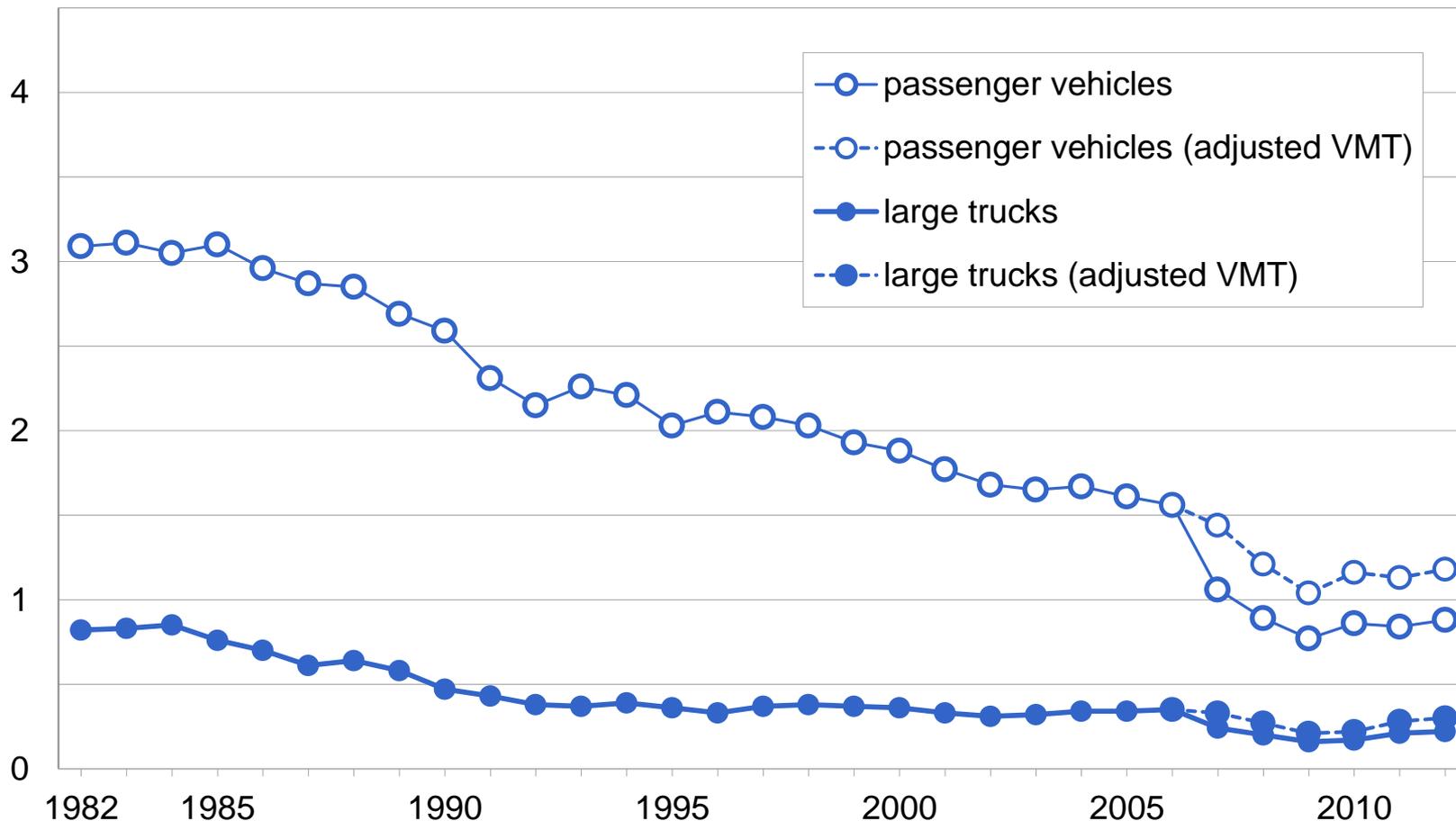
Magnitude of the large truck crash problem

2006 and 2012

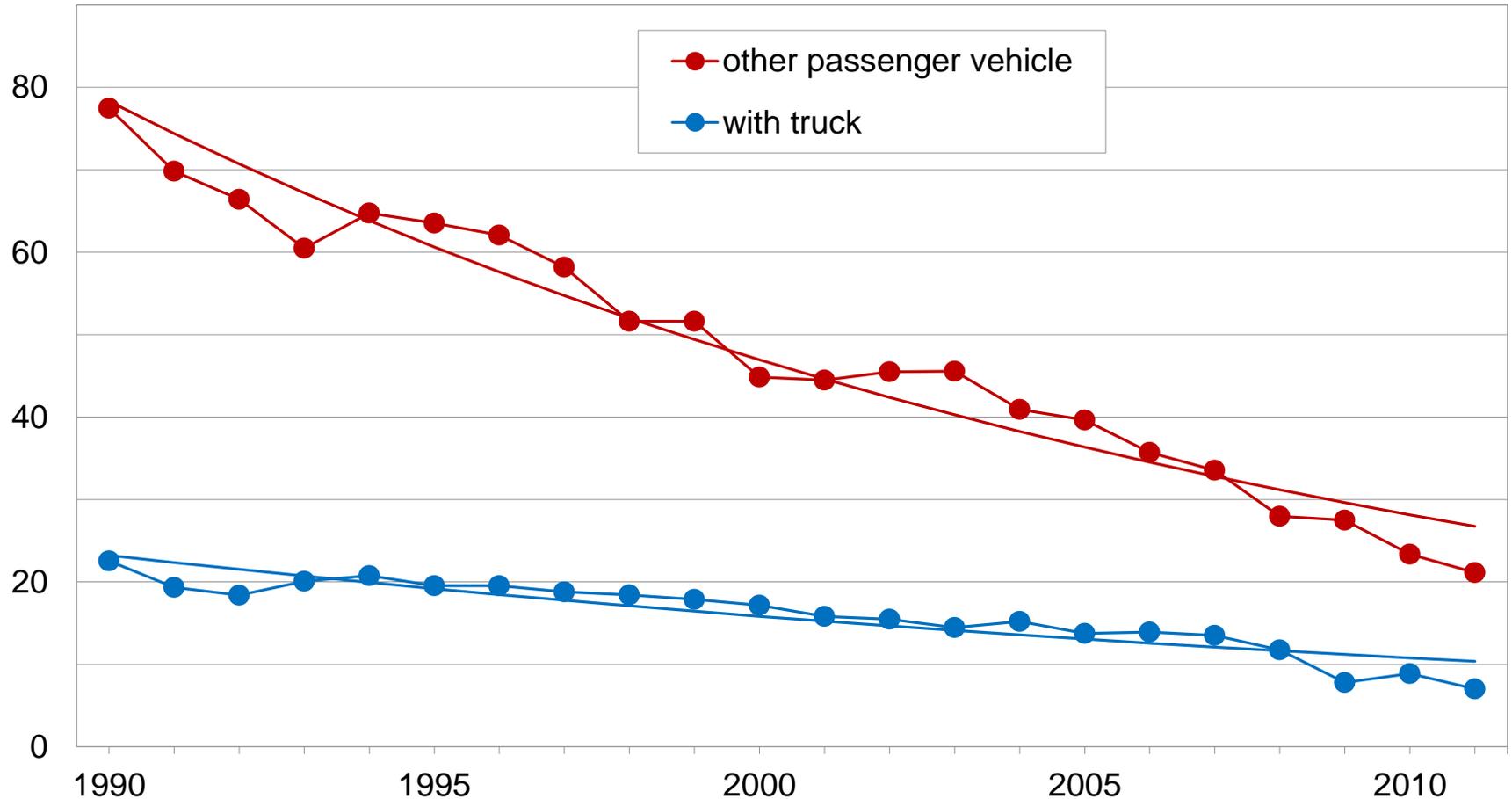


Occupant deaths in large truck crashes

Per 100 million truck miles, 1982-2012

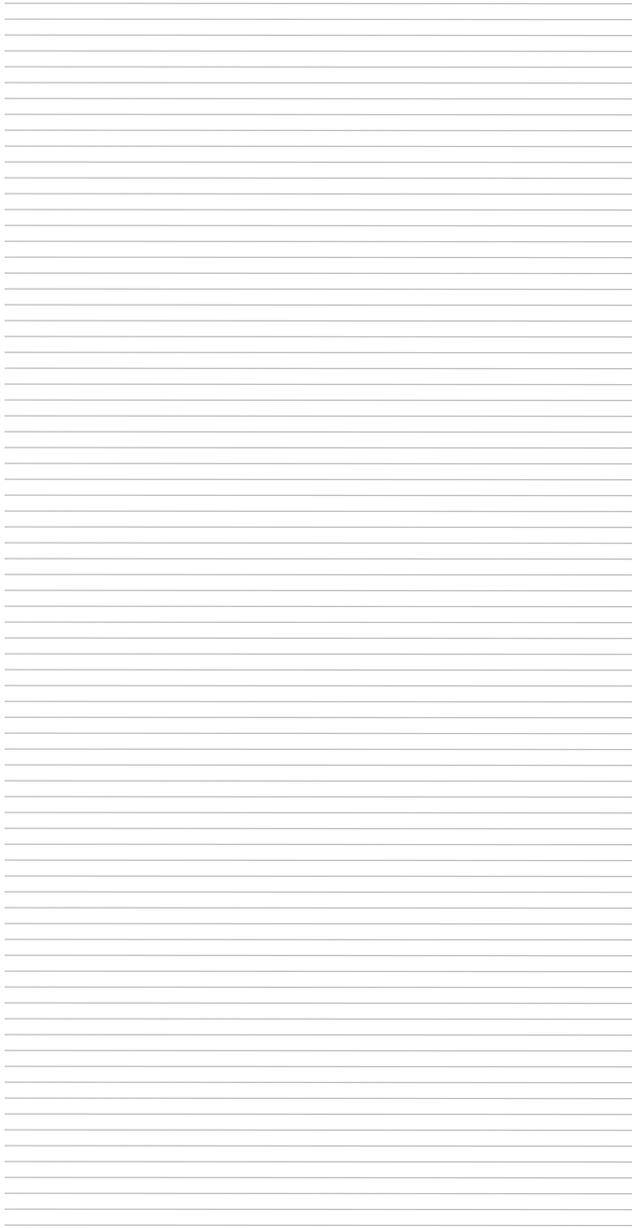


Passenger vehicle occupant deaths per million registered vehicles, 1-3 year old vehicles by vehicle contacted, 1990-2011



General truck safety trend

- The number of deaths in large truck crashes has declined over time
- That decline appears to be related to the growing safety of passenger vehicles while truck safety has been stable for past 15 years
 - Truck occupant deaths per mile travelled have not declined in the past 15 years (ignoring economic effect in last five years)
 - Passenger vehicle occupant deaths per mile of truck travel have declined
 - Passenger vehicle occupant deaths have declined more for crashes with other passenger vehicles than for crashes with large trucks



Driver hours of service is a risk factor for large truck crashes

A proxy for fatigue-impairment as BAC is a proxy for alcohol-impairment

Risk factors in large truck crashes

Case-control study conducted by IIHS during June 1984-July 1986

- Large trucks involved in crashes on interstates in Washington state and a comparison group of large trucks not involved in crashes
 - Cases and controls matched for roadway, time of day, day of week
 - Data collected by Washington State Police
 - Trucks inspected and weighed and driver work schedules documented

Risk factors associated with large truck crash risk

	Crude odds ratio	Adjusted odds ratio
Driving more than 8 hours vs. 0-2 hours	1.8*	1.6
Logbook violation vs. no violation	3.0*	2.3*
Driver 30 or younger vs. younger than 30	1.7*	1.3
Interstate vs. intrastate carrier	1.8*	2.1*
Out-of-service equipment defects vs. no defects	1.9*	2.0*
Brake defects vs. no brake defects	1.5*	1.5
Steering defects vs. no steering defects	2.0*	2.1*
Double trailer vs. tractor-trailer	2.9*	3.2*

*p < 0.05

IIHS is in the process of updating risk factor estimates in a case/control study in North Carolina

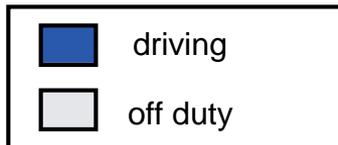
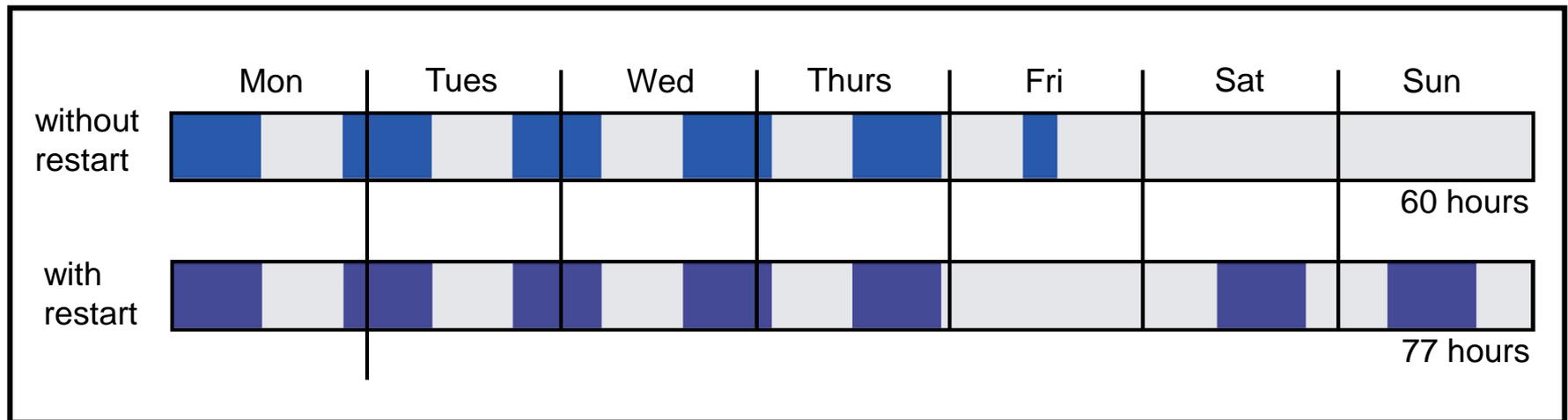
The 2003 revised hours of service rule did not make large trucks safer

Work rule change effective 2003, fully implemented January 1, 2004

	old rule	2003 rule
daily off-duty requirement	8 hours	10 hours
no driving after ...	15 hours on duty	14 hours since starting duty shift
limit on consecutive driving	10 hours	11 hours
nominal limit on weekly driving	60/70 hours in 7/8 day workweek	60/70 hours in 7/8 day workweek
restart provision	none	weekly clock restarts after 34 hours off duty; 2 restarts per 7 days
maximum 7-day driving (average over time)	60/61 hours using 7/8 day workweek	72/74 hours using 7/8 day workweek

Maximum hours of driving permitted per week with and without restart rule (7-day workweek example)

Work rule with compliance dates January 2004-June 2012



How did 2003 rule change affect drivers' work schedules?



Long distance truck drivers interviewed at weigh stations in Oregon and Pennsylvania before (fall 2003) and after (fall 2004 and fall 2005) rule fully implemented on January 1, 2004

Typical weekly schedule under 2003 rules

Percent of respondents in 2005 IIHS survey of truck drivers

ever use restart	94
use restart regularly	81
time off duty before new weekly shift	
less than 34 hours	11
34 hours	23
more than 34 hours	66

Hours-of-service rule violations

IIHS interviews of truck drivers, 2003 and 2005

	2003	2005
percent who said they sometimes/often ...		
omit hours worked in logbook	33	26
drive more than daily limit	22	23
take less than required daily off duty	24	24
percent who worked longer than permitted during past month	28	26

Reported fatigued driving by long-distance truckers

IIHS interviews of truck drivers, 2003 and 2005

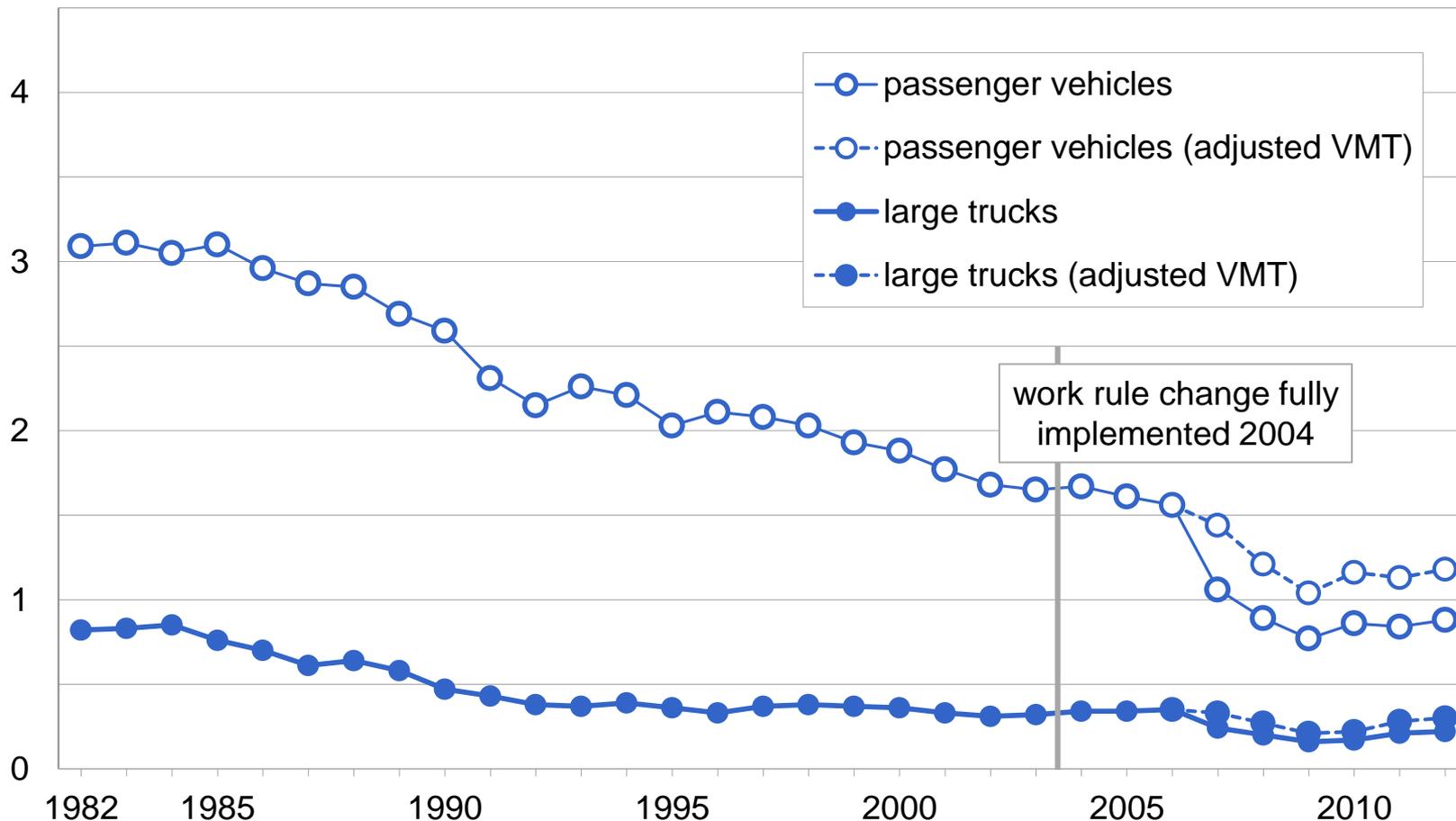
	2003	2005
fell asleep at wheel at least once in past month	13	21

Death rates in large truck crashes before and after 2003 HOS rule change (fully implemented in 2004)

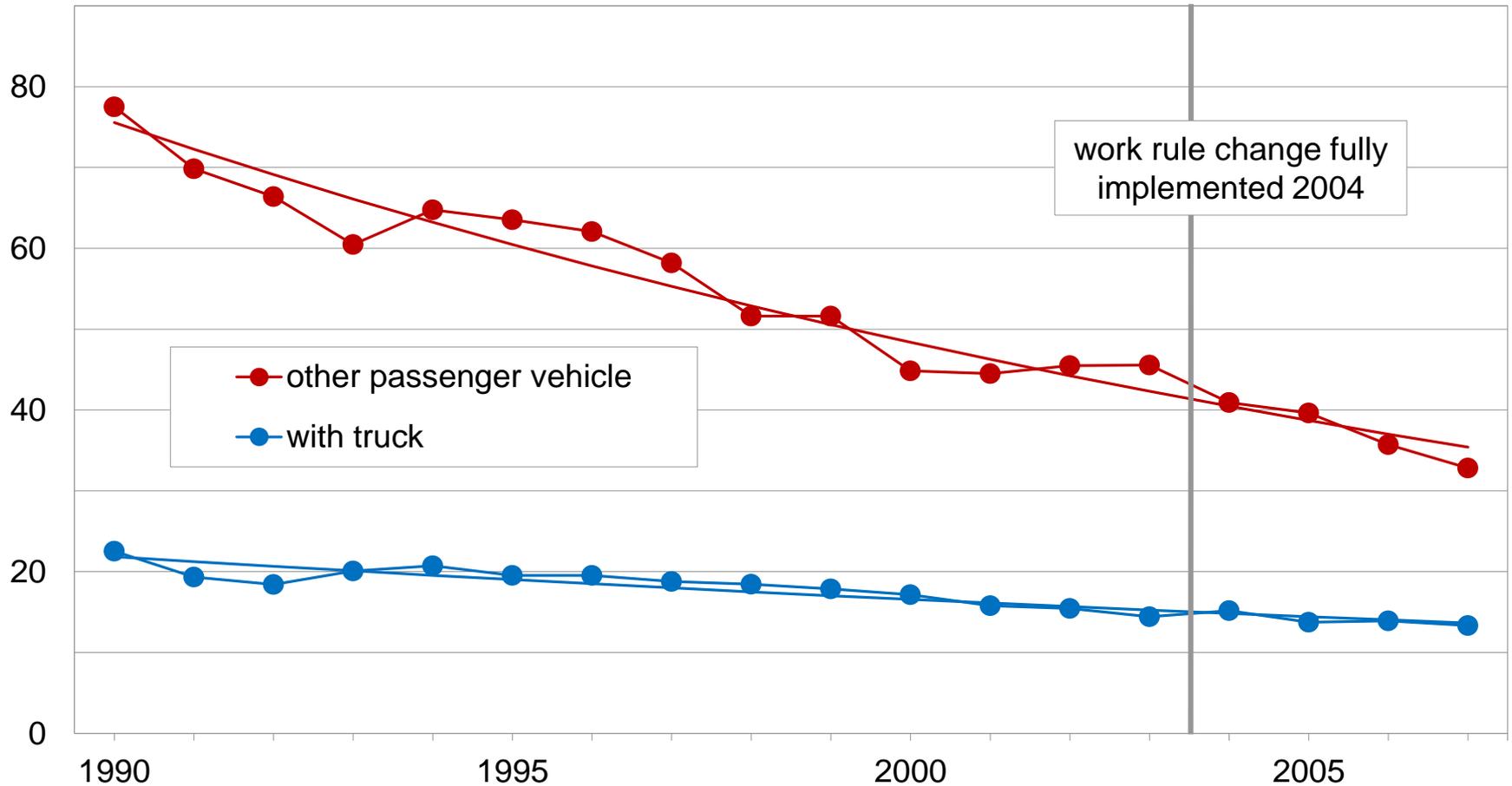
- Per 100 million miles of large truck travel, deaths in large truck crashes declined 2 percent (from 2.30 in 2001-03 to 2.26 in 2004-06), largely due to the increased safety of passenger vehicles
 - Large truck occupant deaths increased from 0.32 to 0.34 (6 percent)
 - Passenger vehicle occupant deaths in crashes with large trucks declined from 1.70 to 1.61 (6 percent)
- Rate of passenger vehicle occupant deaths per million registered vehicles, 1-3 year old vehicles, 2003 vs. 2007:
 - Deaths in crashes with large trucks declined 8 percent (from 14 to 13)
 - Deaths in crashes with other passenger vehicles declined 28 percent (from 46 to 33)

Occupant deaths in large truck crashes

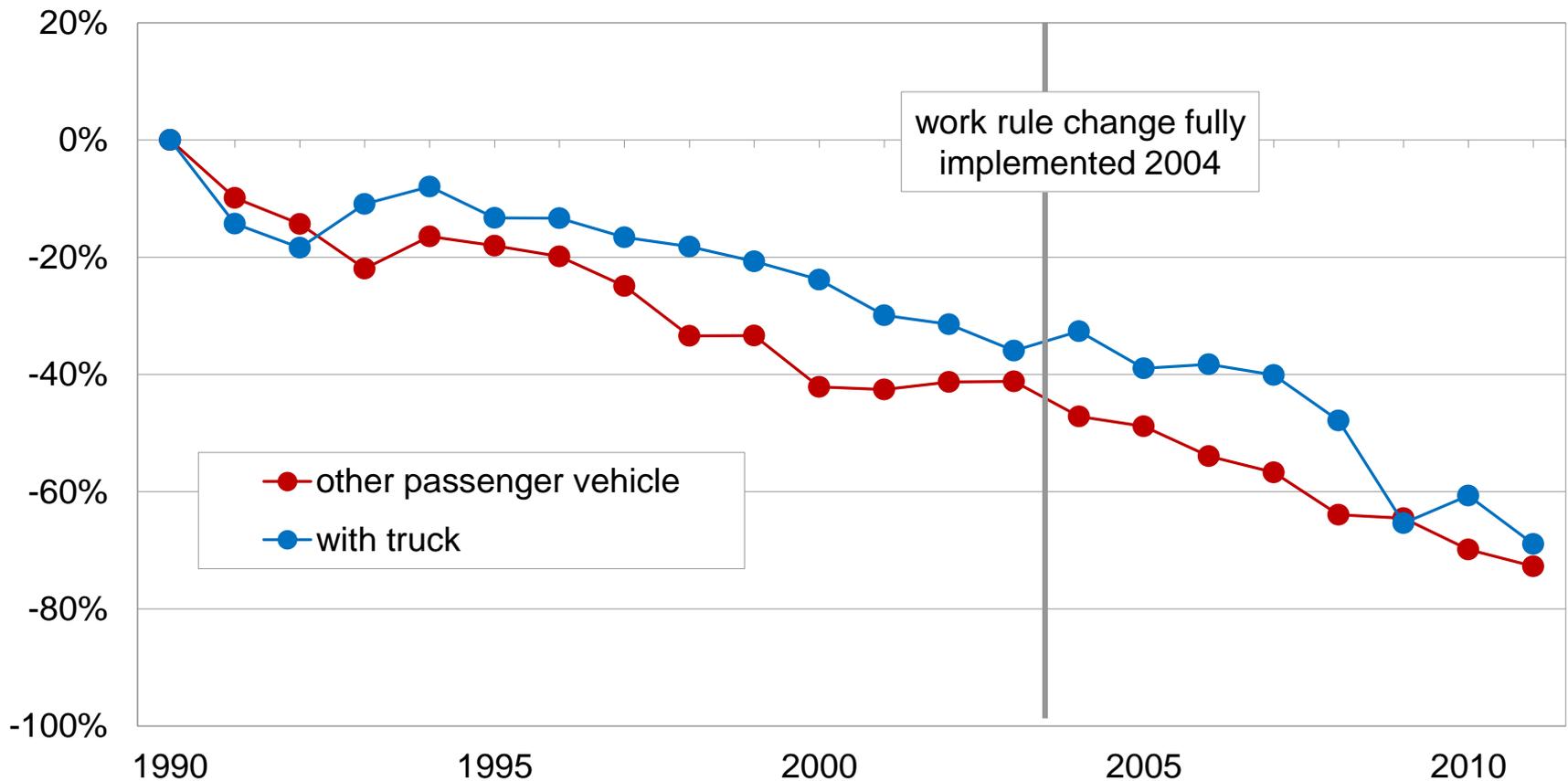
Per 100 million truck miles, 1982-2012



Passenger vehicle occupant deaths per million registered vehicles, 1-3 year old vehicles by vehicle contacted, 1990-2007



Percent change in passenger vehicle occupant deaths per million registered vehicles, 1-3 year old vehicles by vehicle contacted, 1990-2011, relative to 1990

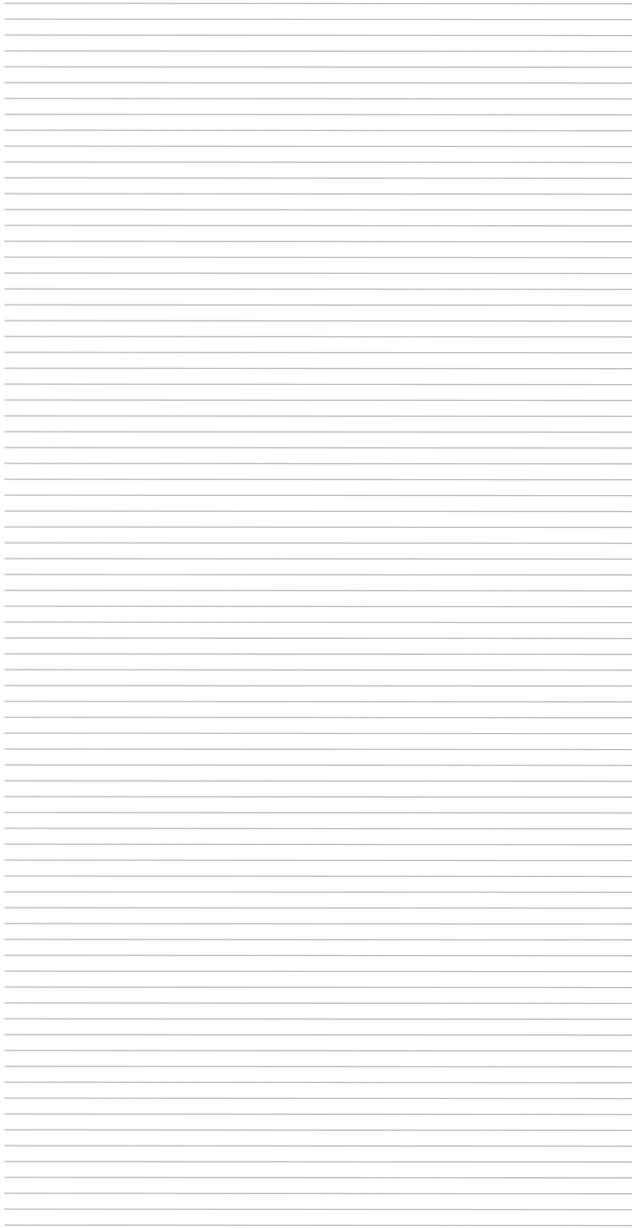


2012 HOS revision reduces
the extra driving hours
allowed by 2003 rule.

Too early to see what effect
this has.

Work rule change effective 2012, fully implemented July 1, 2013

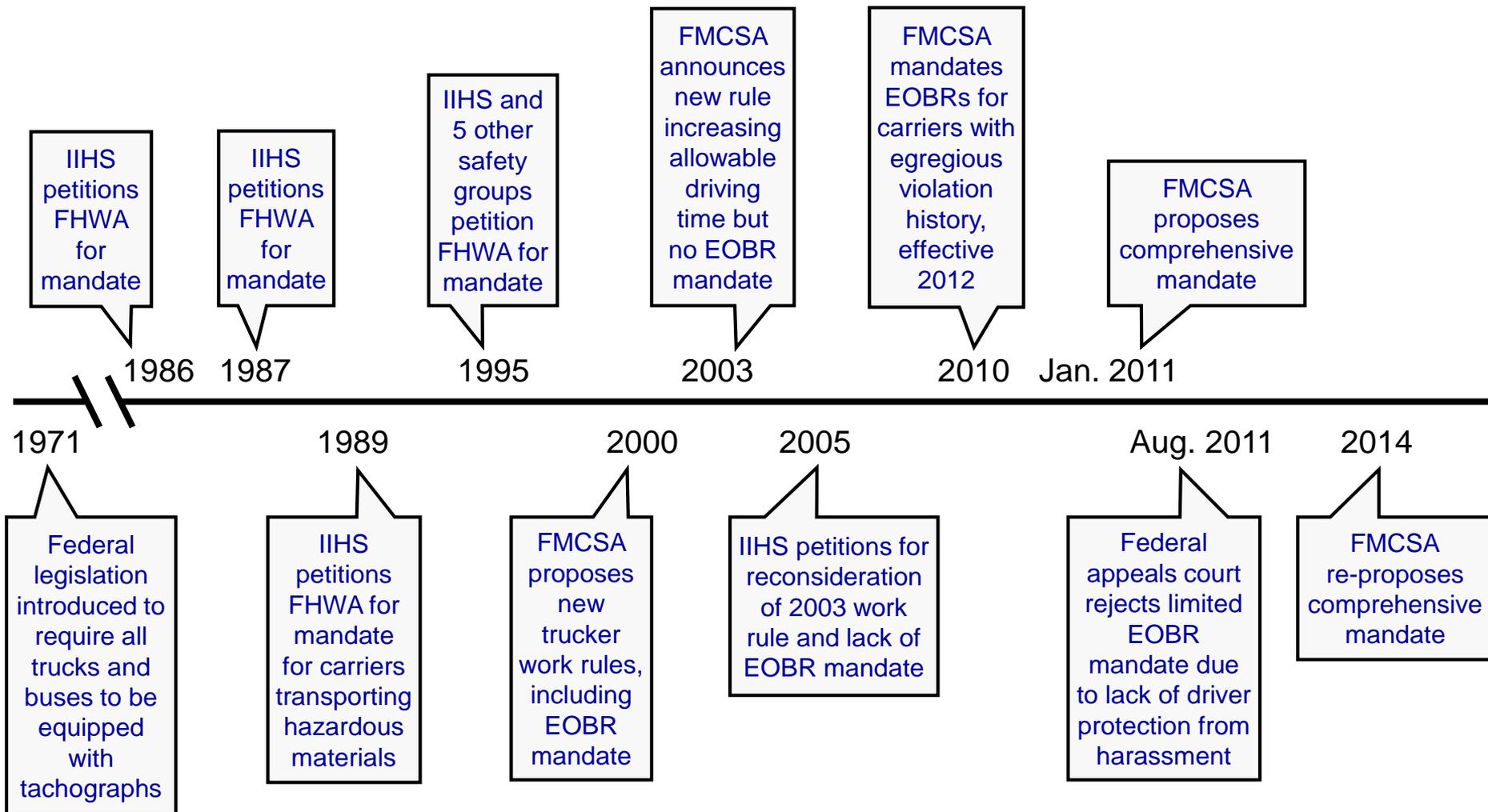
	2003 rule	2012 rule
daily off-duty requirement	10 hours	10 hours
no driving after ...	14 hours since starting duty shift	14 hours since starting duty shift
limit on consecutive driving	11 hours	11 hours
rest breaks	N/A	may drive only if ≤ 8 hours have passed since last off-duty period of ≥ 30 minutes
nominal limit on weekly driving	60/70 hours in 7/8 day workweek	60/70 hours in 7/8 day workweek
restart provision	weekly clock restarts after 34 hours off duty; 2 restarts per 7 days	weekly clock restarts after 34 hours off duty; 1 restart per 7 days; restart must include 2 periods of 1 a.m.-5 a.m.
maximum 7-day driving (average over time)	72/74 hours using 7/8 day workweek	64/70 hours using 7/8 day workweek



Electronic on-board recorders
(electronic logging devices)

Devices that could improve
compliance with and
effectiveness of HOS rules

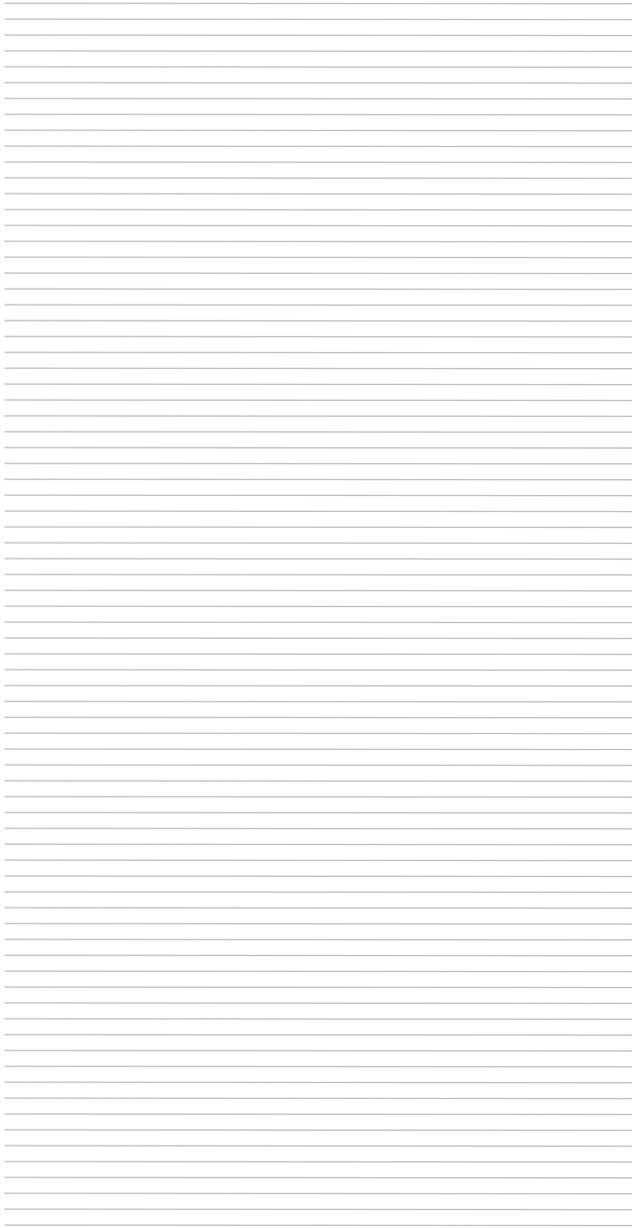
History of electronic onboard recorder (EOBR) mandate for truckers



Percent of truck drivers who said they use electronic onboard recorders

IIHS interviews of truck drivers, 2003 and 2005

	2003	2005
use recorders/computers to track driving time	18	46
of these, percent who also keep paper logbook	91	98



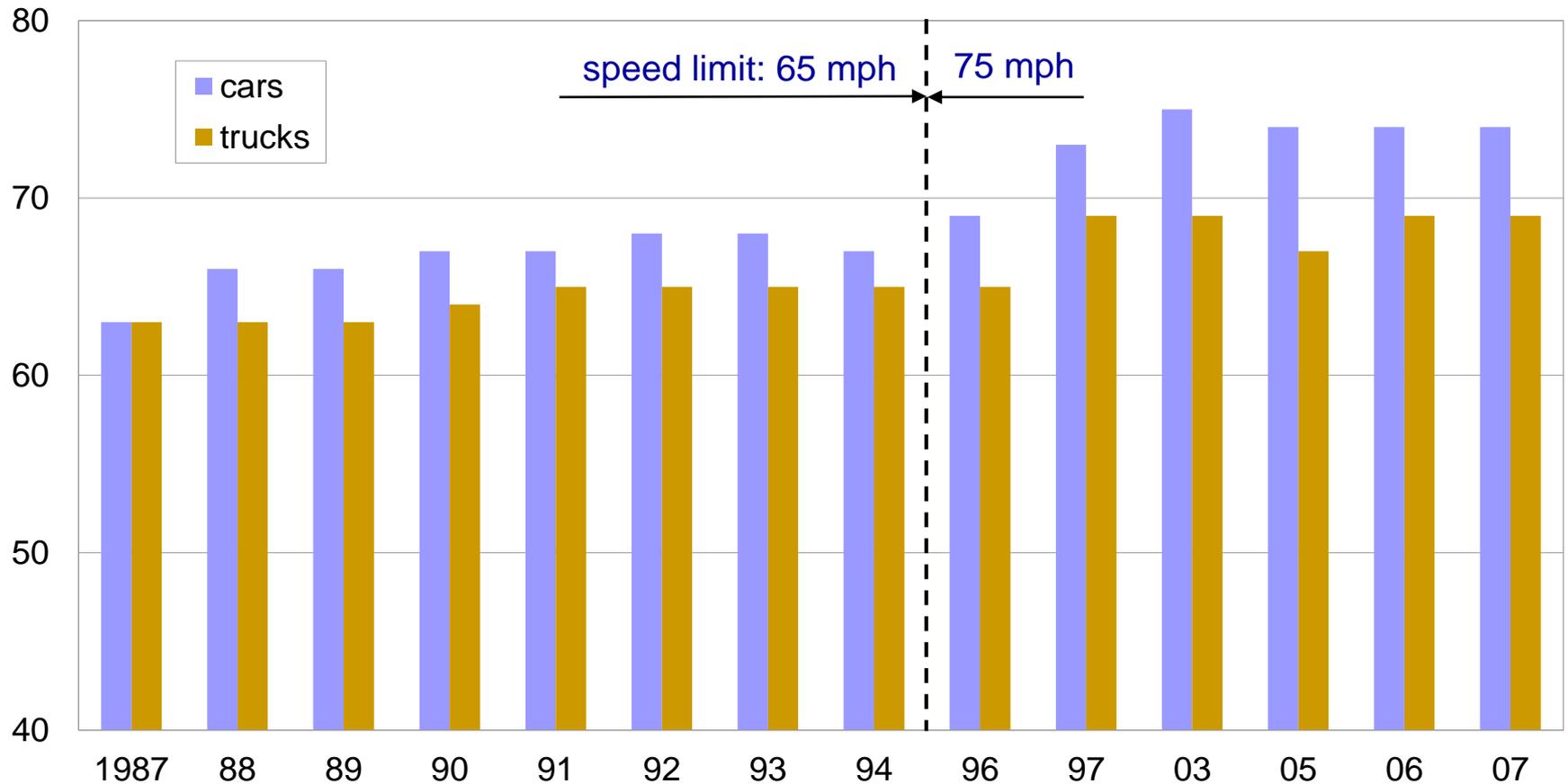
Truck speeds

Effects of high truck speeds can be deadly

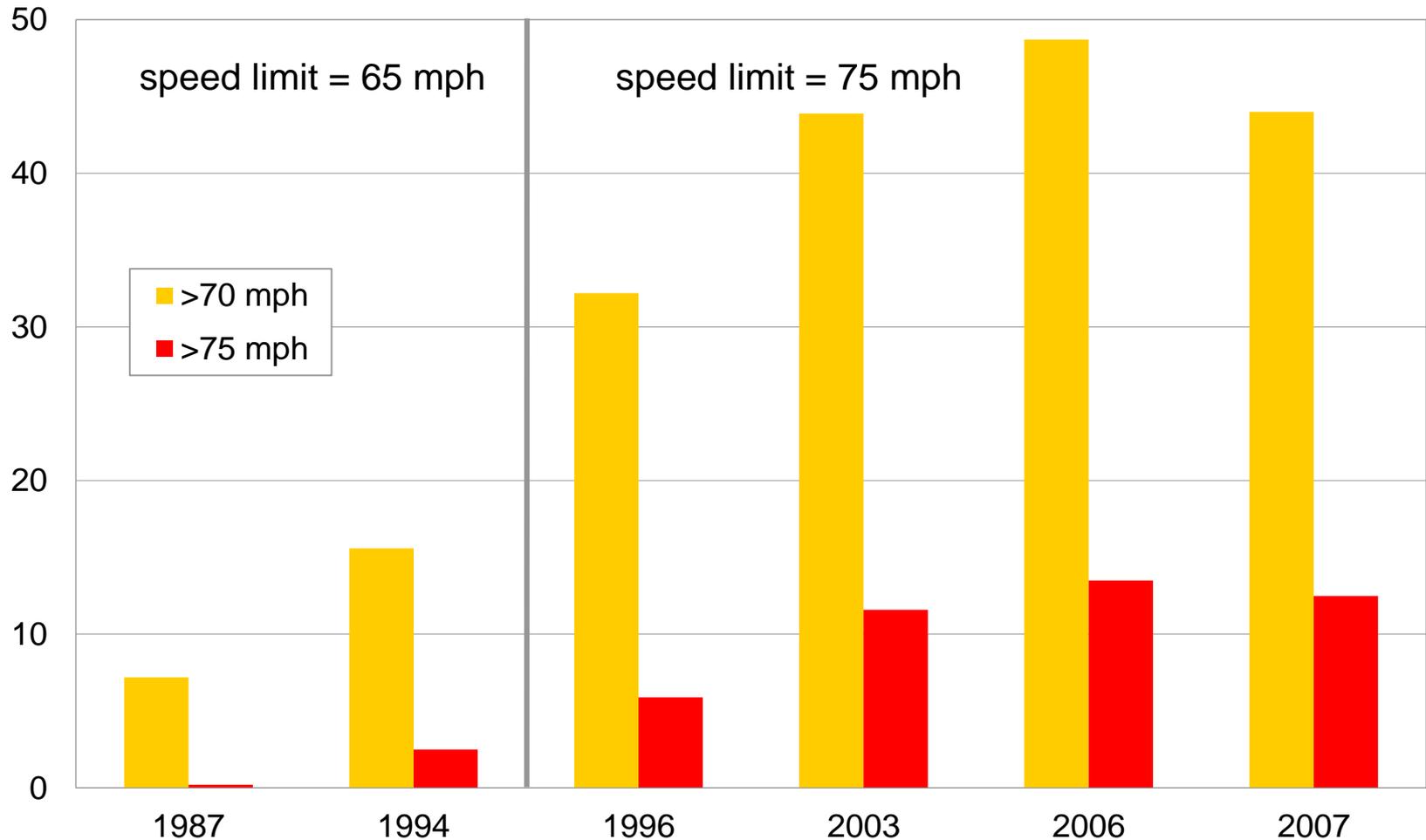
- Speed increases stopping distance as well as crash severity
- A large truck takes about one-third longer to stop from 75 mph compared with 65 mph
- Large trucks often weigh 15-40 times more than cars; stopping distances are about 20-40 percent longer
- Out-of-adjustment brakes and other brake violations are the most common reason for inspectors to order trucks out of service

Traffic speeds have increased

Average speed in mph on New Mexico rural interstates, 1987-2007



Percent of tractor-trailers exceeding 70 mph and 75 mph on New Mexico rural interstates



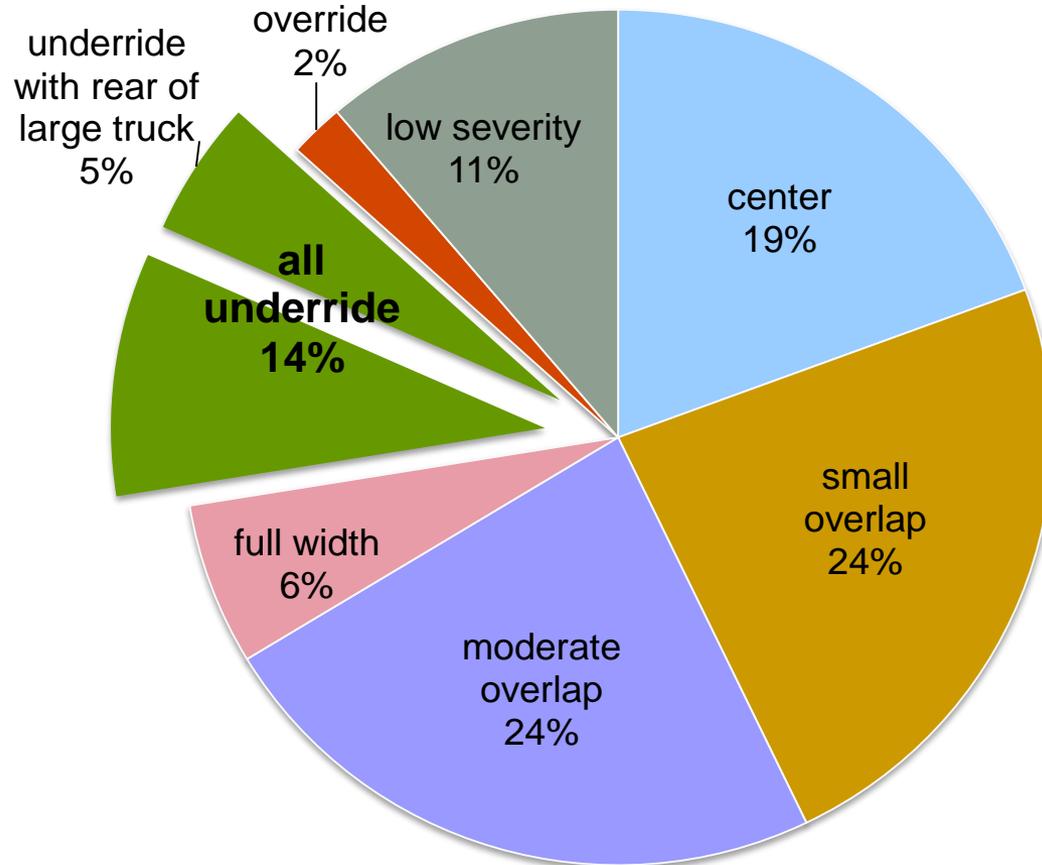
Petitions to federal government to require speed governors on large trucks

- Petitions by American Trucking Associations, Road Safe America, and individual carriers
 - Trucks weighing 26,000 pounds or more
 - 68 mph maximum speed
 - Speed governors should be tamper resistant; penalties for tampering
- DOT plans to have governor requirement in place by end of 2014
- Rulemaking should be expedited
 - Limit below 68 mph would be safer, but 68 mph is a place to start
 - Widespread voluntary use by many truck fleets
- National speed limit of 65 mph would save fuel and lives, but may not be politically viable



Many deaths occur when
passenger vehicles underide
large trucks

116 real-world frontal crashes with fatal or serious injuries of belted occupants in IIHS good-rated vehicles



Examples of real-world underride guard failures



Crash testing shows guard performance differences

35 mi/h center impact with 2010 Chevrolet Malibu



In 2011, IIHS petitioned for upgrades to federal rear underride guard standard

- Increase force requirements
- Attachments should remain intact during quasi-static testing
- Extend guard protection to full width of trailer
- Test guards while attached to trailers
- Re-evaluate practicality of lower ground clearance requirement
- Determine which current exemptions can be dropped, e.g., single unit trucks – many already have some type of guard
- In the absence of an upgraded standard, IIHS has continued conducting crash tests to encourage improved guard designs by the major trailer manufacturers.



Truck crash avoidance technology

Potential crash reductions with crash avoidance features for large trucks

- Crashes during 2004-08 involving straight trucks and tractor-trailers
- 4 technologies: forward collision warning, lane departure warning, side view assist, stability control
- Estimates account for current system limitations
 - Speed thresholds
 - Sensor limitations in inclement weather
 - Requirements for visible lane markings, reflective surfaces

Annual large truck crashes potentially prevented or mitigated, by type of system, 2004-08

	all	injury	fatal
lane departure warning	10,000	1,000	247
electronic stability control	30,000	7,000	439
forward collision warning	31,000	3,000	115
side view assist	39,000	2,000	79
total unique crashes addressed	107,000	12,000	835

Percent of large truck crashes that potentially could be prevented or mitigated, 2004-08

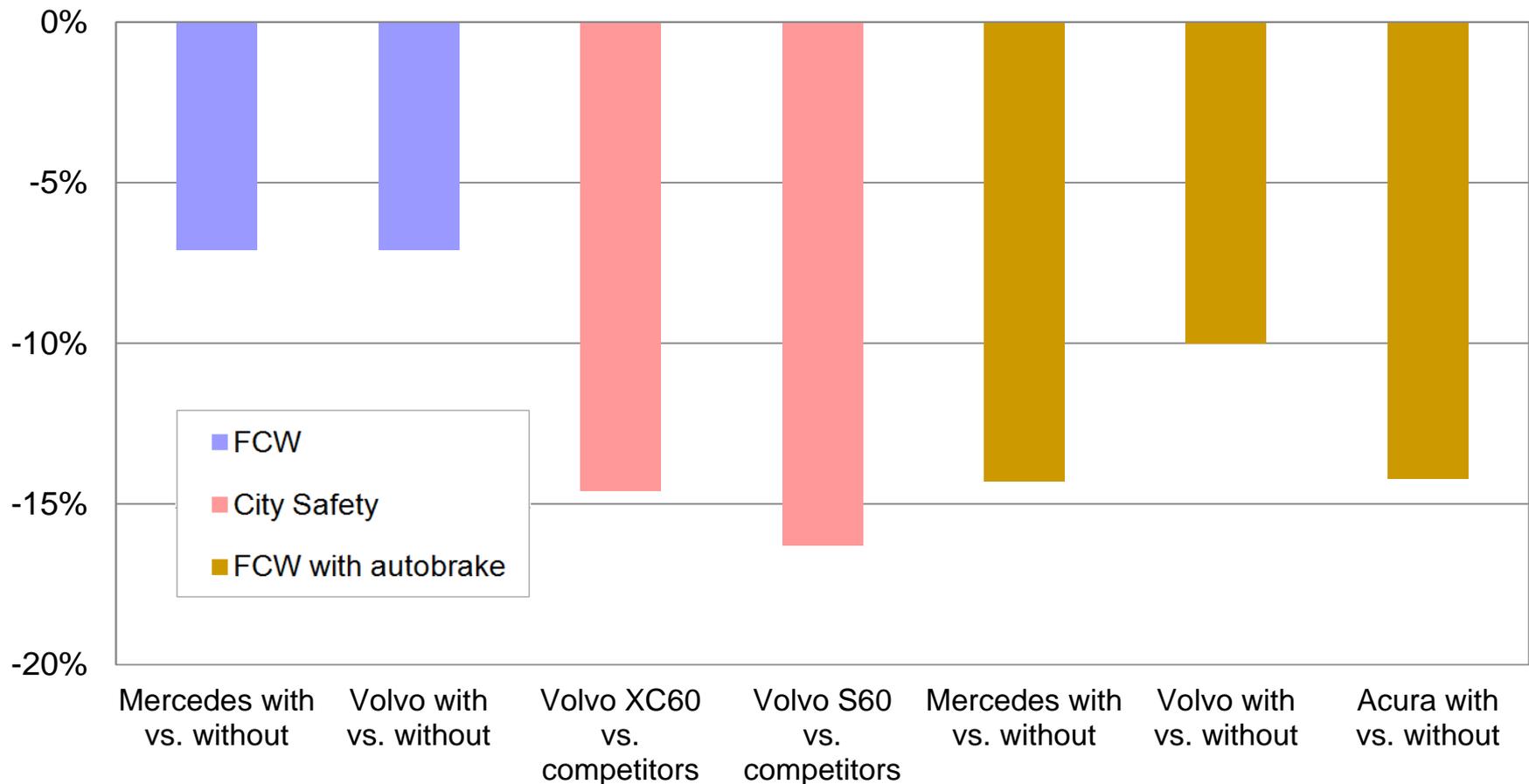
	all	injury	fatal
all crashes	384,000	37,000	4,151
total unique crashes addressed	107,000	12,000	835
percent of crashes	28%	34%	20%

No empirical data on actual effect of crash avoidance technology in large trucks, but

- 1.** A study is underway with one fleet to evaluate roll stability control and automatic emergency braking
- 2.** Data on passenger vehicle technology is promising, at least for some features

Front crash prevention systems are helping drivers of passenger vehicles avoid crashes reported to insurers

Reductions in property damage liability claim frequency

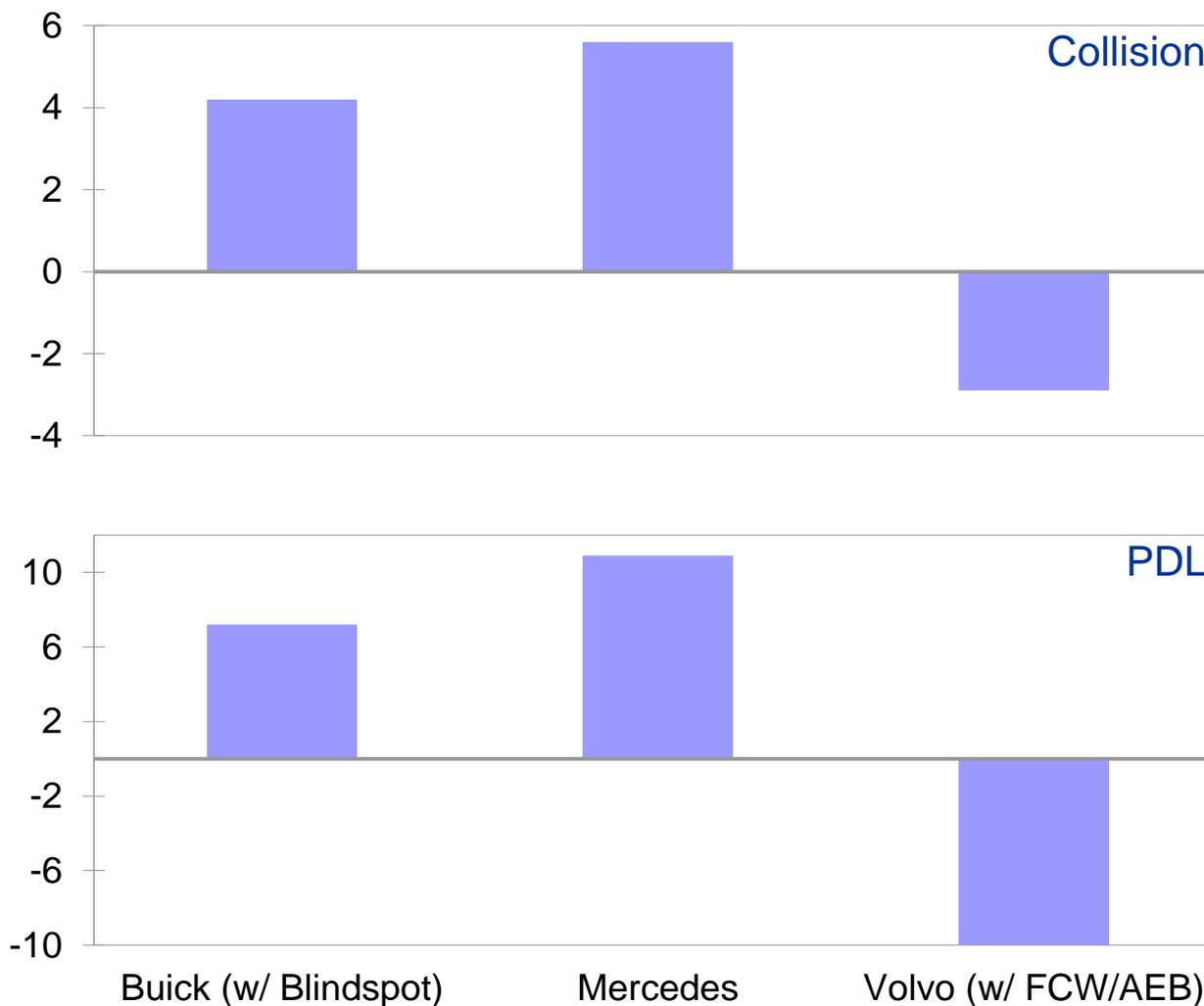


Some crash avoidance systems
are showing no effectiveness

Lane departure warning
(LDW, without active lane
keep assistance) may be increasing
crashes claimed with insurers

LDW is not reducing crash incidence

Percent change in vehicle damage claims per insured vehicle year



Final thoughts

- Hours of service is a proxy for fatigue-impaired driving
 - Just as BAC is a good proxy for alcohol-impaired driving
 - Reductions in alcohol-related crashes occurred only after BAC was substituted for estimates of impairment
- Recent change in hours of service regulation (2012) is an improvement over 2003 regulation, but might still allow more driving than the regulation before 2003
 - No evidence that 2003 regulation reduced truck crash risk
 - An onboard recorder requirement will make regulation more effective and reduce truck driver fatigue
- Limits on hours of service are only one means to reduce large truck crashes or the injuries resulting from them
 - Crash avoidance technology
 - Reducing underride potential
 - Reducing truck speeds



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