

A More Fuel Efficient Fleet - Will Physics Determine Safety Performance?

**Fuel Economy Effects on Vehicle Safety
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Yes

and

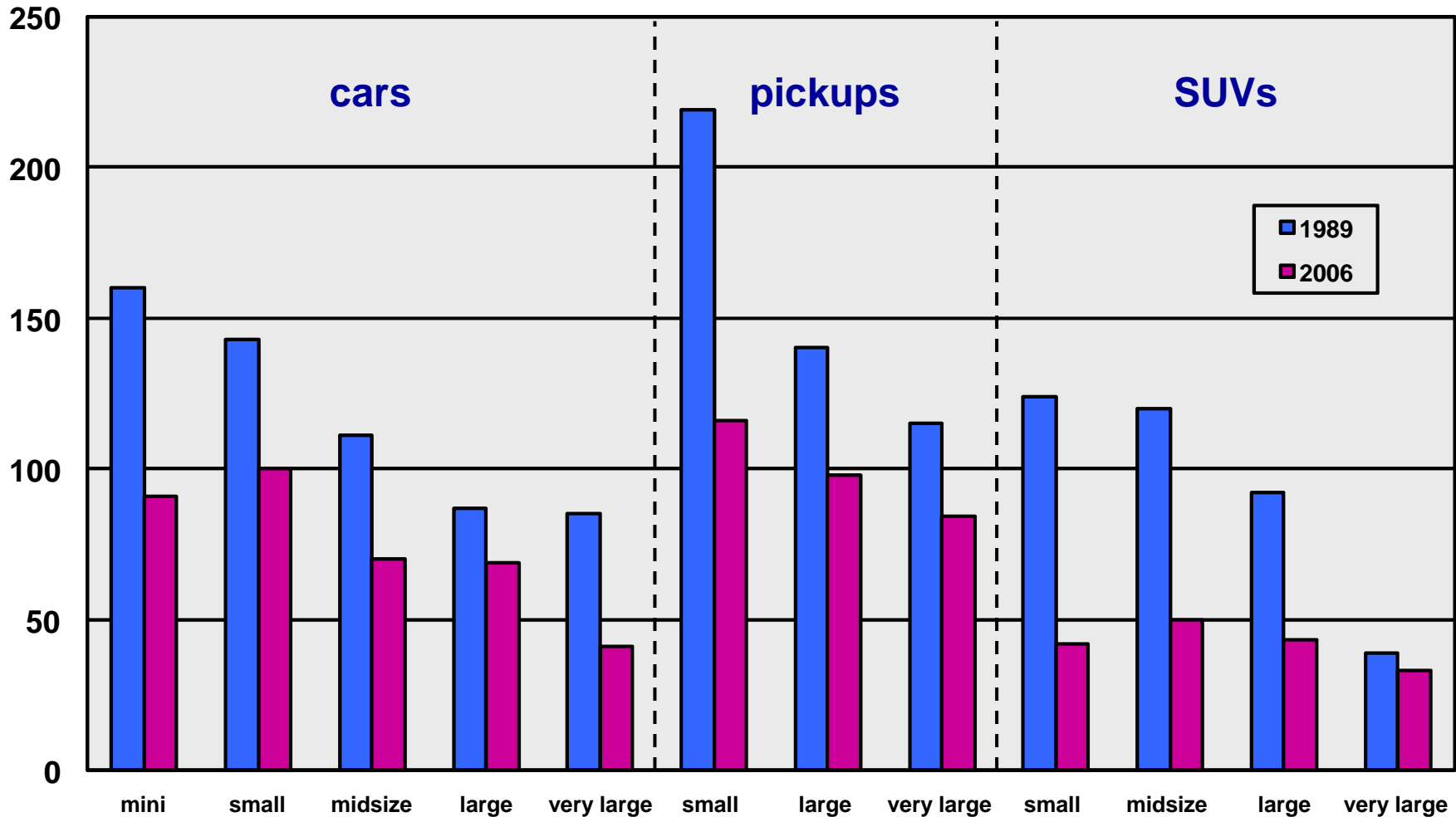
No

Yes

- The laws of physics have not been repealed
- Vehicle size and weight have separate effects on energy that must be absorbed by occupants in crashes
 - Larger size allows more crush space outside occupant compartment to reduce peak forces
 - Greater weight reduces momentum change for a vehicle's occupants in collisions with other vehicles and many objects

Safety advances, but size and weight still matter

Driver deaths per million vehicles, 1989 and 2006



If you buy a small car

- Buy one with good test results
- Get all the safety features
- Everything is more important, because you've given up the inherent protection of greater size and weight

So ...

- To the extent that a more fuel-efficient fleet means smaller, lighter-weight passenger vehicles, then that fleet will be less protective of occupants
- That's true, even if you take into account the greater aggressivity of heavier vehicles – because the likelihood of injuring other road users doesn't offset the self-protection of greater mass until vehicles reach weights of 4,500 – 5,000 lbs.

But, NO, physics will not by itself “determine” fleet safety

Injuries result from concatenation of factors

	crash phases		
changes in...	before	during	after
people	<ul style="list-style-type: none"> ◆ licensing laws (young & old) ◆ impaired driving laws ◆ speed limits & enforcement ◆ red light enforcement 	<ul style="list-style-type: none"> ◆ belt use ◆ helmets ◆ speed limits 	<ul style="list-style-type: none"> ◆ alcohol
vehicles	<ul style="list-style-type: none"> ◆ lane departure warning ◆ daytime running lights ◆ electronic stability control 	<ul style="list-style-type: none"> ◆ airbags ◆ vehicle structure ◆ bumpers 	<ul style="list-style-type: none"> ◆ OnStar ◆ fuel system integrity
environment	<ul style="list-style-type: none"> ◆ roundabouts ◆ pedestrian crossings ◆ rumble strips ◆ trouble spot treatment 	<ul style="list-style-type: none"> ◆ roundabouts ◆ breakaway poles ◆ jersey barriers 	<ul style="list-style-type: none"> ◆ emergency

With a fleet of smaller vehicles,

- Fatality rates may increase, decrease, or stay the same
- Other actions can, more or less, compensate for smaller vehicles
 - Improved crashworthiness
 - Crash avoidance technology
 - Advanced traffic control
 - Improved enforcement of traffic laws

Two important generalizations for fuel economy debate

- Whether injury stats increase or decrease with a smaller fleet, people will sustain injuries that would not have occurred had the fleet not downsized
 - Laws of physics are not repealed
 - Other actions can mask (compensate for) the effect
- Fuel economy, like safety, depends on multiple factors
 - The way people drive, the design of vehicles, and road design
 - Fuel conservation measures may exist that don't increase the risk of motor vehicle crash injuries

Lessons of 1st fuel crisis: Two major interventions with different safety effects

- Speed limit lowered to 55 mi/h
 - Dramatic reduction in fuel consumption
 - 3-5,000 fewer motor vehicle crash deaths annually
- Corporate average fuel economy regulations
 - Dramatic reductions in fuel consumption
 - 1,300-2,600 additional motor vehicle crash deaths in 1993 – because weight reduction was principal method of improved fuel economy

Other measures to reduce fuel consumption with positive safety effects

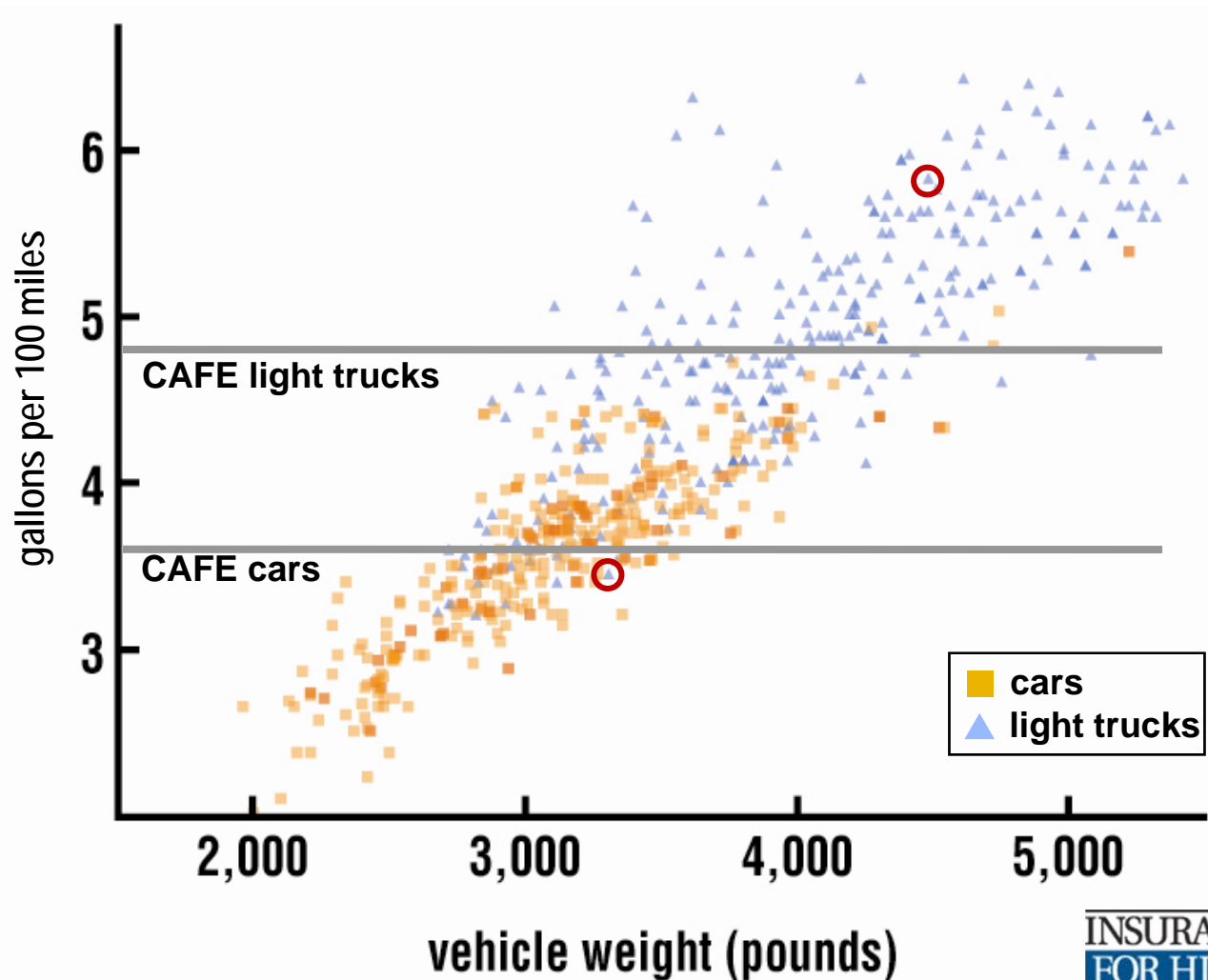
- Return to lower speed limit
 - Automated enforcement to make limits “real”
- Limit on horsepower
 - Lower acceleration = less time at high speed
- Increase use of roundabouts
 - Less congestion, fewer crashes
- Remove high school parking lots
 - Fewer teen driver miles, more green space
- Reduce damageability in low speed crashes
 - Bumpers that “bump” could reduce congestion

Even CAFE could have safety benefits

- The increased injury risk of old CAFE regulations came from insensitivity to vehicle attributes
- NHTSA's size-indexed fuel economy requirements are safety neutral
 - It focuses automakers on fuel efficient technology rather than weight reduction
 - NRC report found large increases in fuel economy possible without giving up any power or other vehicle attributes -- \$\$
- Making requirements more stringent could make them safety positive by requiring more technology go to fuel economy rather than enhanced power
- NRC report noted that indexing can be targeted to increase societal safety

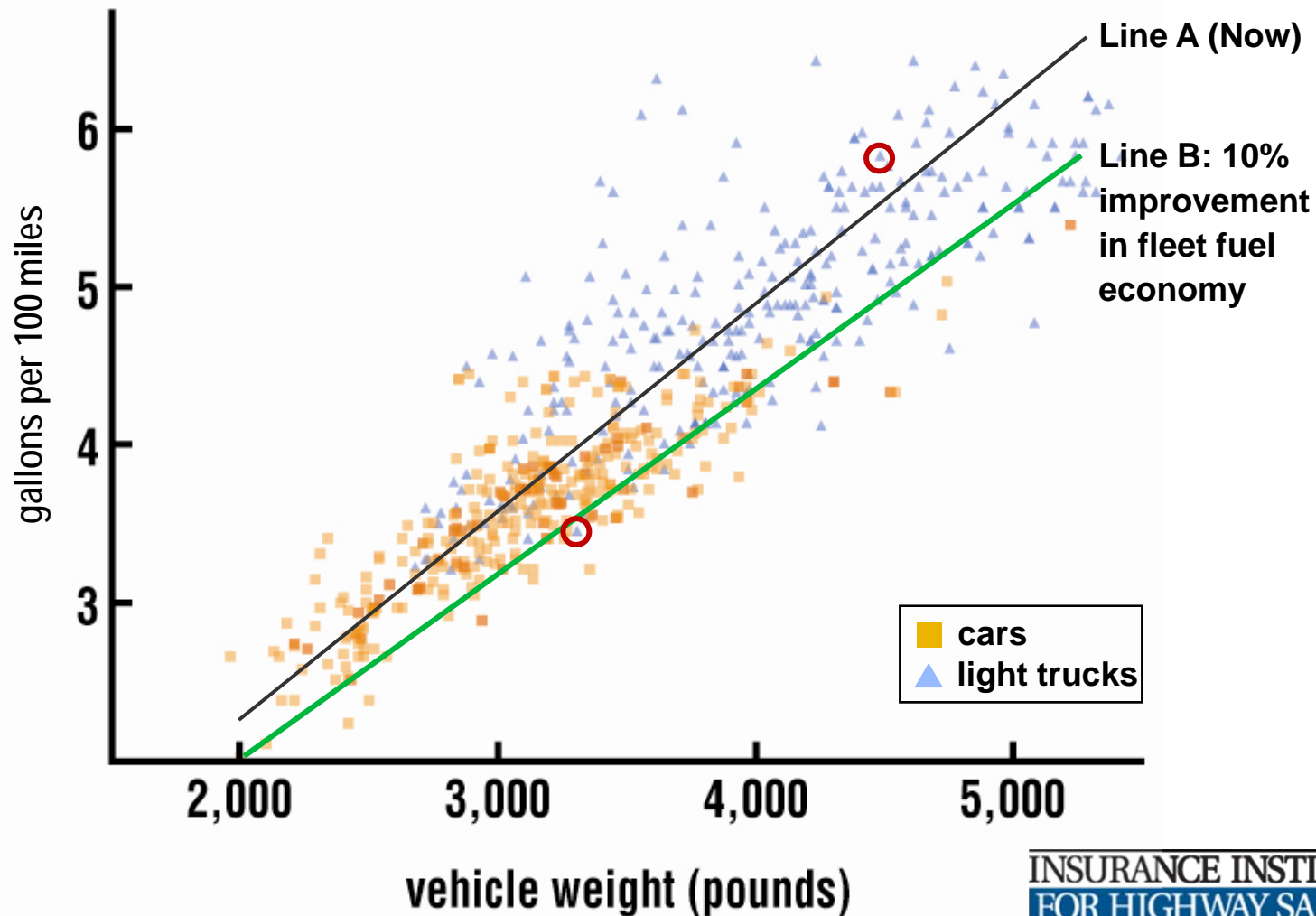
Fuel economy targets under old CAFE structure

By vehicle weight (circa 1999)



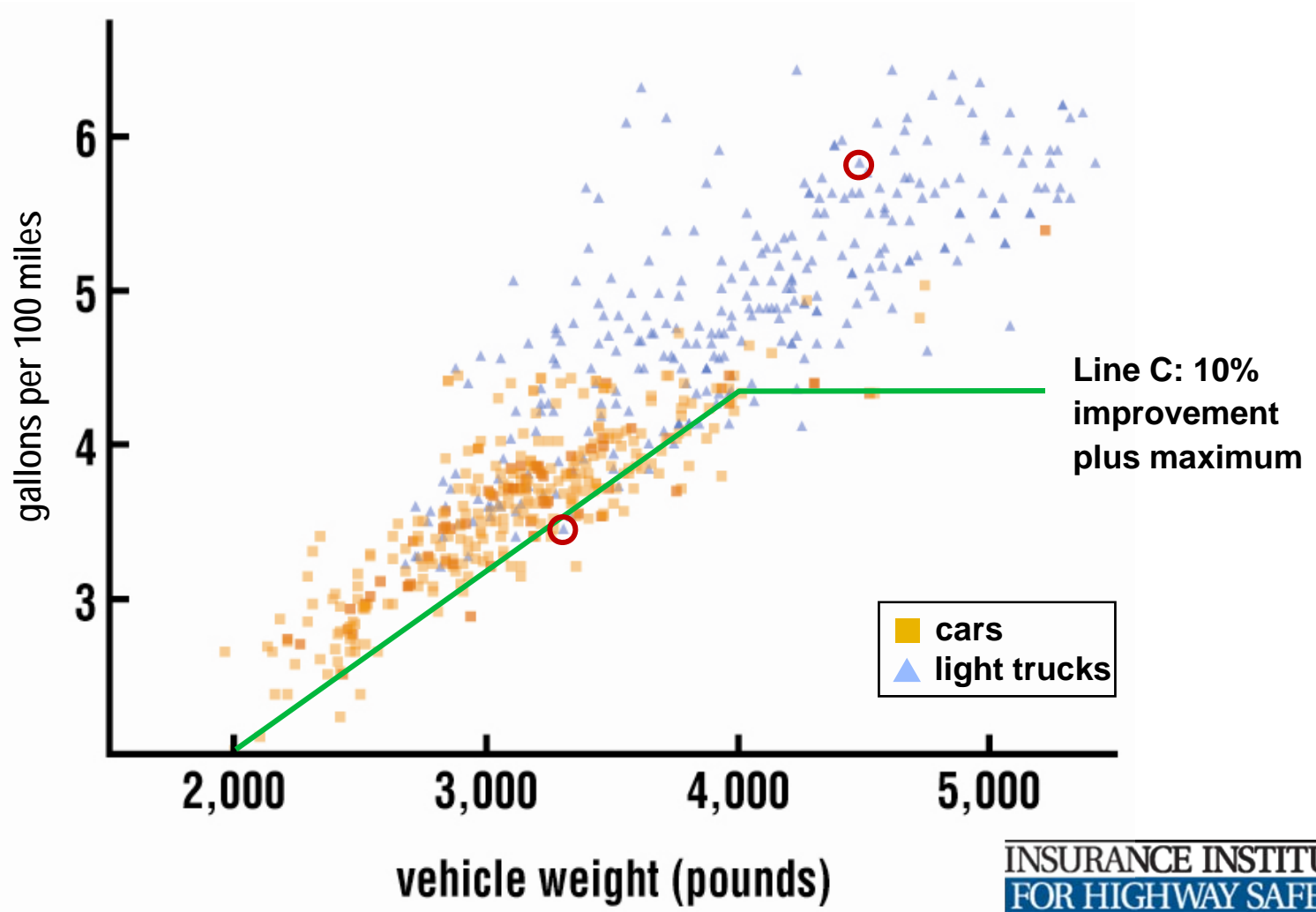
Fuel economy targets under a weight-based structure

By vehicle weight (circa 1999)



Fuel economy targets under a modified weight-based system to reduce aggressivity

By vehicle weight (circa 1999)



Implications for proposal to allow states to regulate carbon emissions

- Allowing states to regulate carbon emissions should include requirement for weight/size indexing
- White House directive to establish fuel economy target for 2011 only
 - Suggests administration may be rethinking index CAFE
 - Abdicates responsibility for safety of motor vehicle fleet
 - Green environment should not be paid for with the tragedy of motor vehicle crash injuries and deaths

Indexed CAFE does more than assure government does no harm

- Fuel is likely to become increasingly expensive in near term
- More expensive fuel forces people to look for more fuel efficient transportation
- If larger cars are not required to become more fuel efficient, the least wealthy among our population will necessarily choose small cars to transport their families
 - Why not assure them the choice of a safer, larger car that gets better mileage with some loss of acceleration?
- Increased gas taxes, no substitute for indexed CAFE

Where is fuel economy or safety?



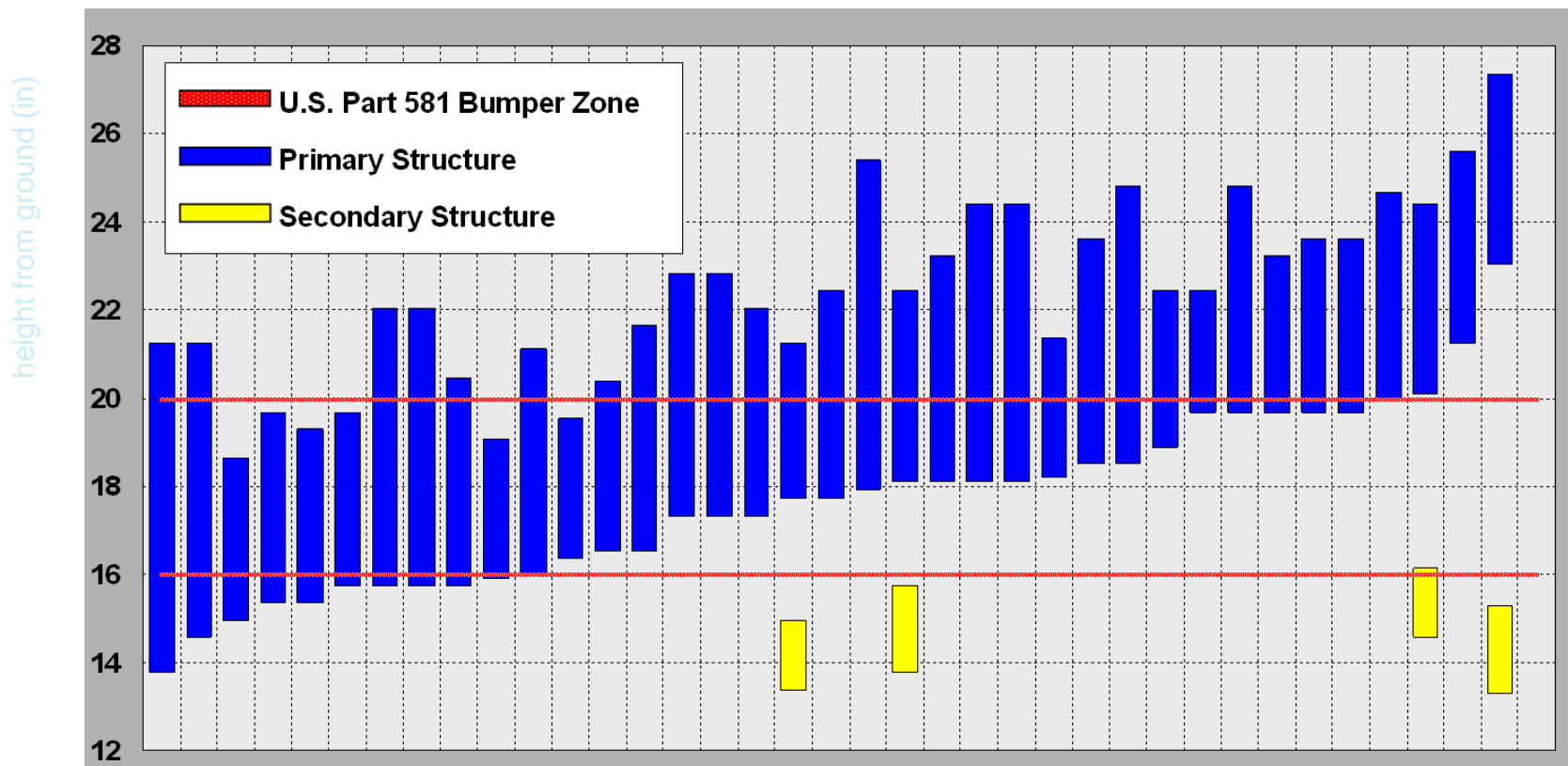
Front crash incompatibility


Voluntary commitment to improve compatibility

Cooperative efforts since 2003 by IIHS, automakers, and others

- ⑩ Frontal crashes: structure of SUVs and pickups will be lowered or increased in size to engage passenger car structure
 - ⌘ Minimize override of cars
- ⑩ Side crashes: cars will be fitted with side airbags with head protection as standard equipment
 - ⌘ Reduce head injury associated with light truck hoods striking car occupants' heads
- ⑩ All new cars, SUVs, and pickups built after September 1, 2009 will comply

Light truck primary and secondary structure heights in relation to U.S. Part 581 Bumper Zone





Animation illustrating car bumper zone and required overlap

Voluntary commitment benefit

IIHS study of frontal structure-matching

- ⑩ Comparison of partner car fatality rates between complying and non-complying light trucks
 - ⌘ FARS 2001-04, 2000-03 MY light trucks
- ⑩ Benefits estimated for front-front and front-driver side crashes

Baker, B, et al, "Crash Compatibility between Cars and Light Trucks: Benefits of Lowering Front-End Energy-Absorbing Structure in SUVs and Pickups", Accident Analysis and Prevention 40 (2008) 116–125

Summary of estimated fatality risk reductions in struck cars when SUV and pickup structure matches car structure

crash type	vehicle type	percent	
		risk reduction	combined reduction
light truck front into car front	SUVs	16	19
	pickups	20	
light truck front into car side	SUVs	30	19
	pickups	10	

Voluntary commitment benefits

IIHS study of side airbag effectiveness - estimated percent reductions in driver fatality risk in vehicles struck on the driver side by type of side airbag, 2000-2004

