Three unanswered questions and one cautionary tale

Paul Atchley, Ph.D.
Associate Dean,
Academic Innovation &
Student Success
Professor,
Department of Psychology
University of Kansas

Three questions

Is "zero" a reasonable goal?

Is a fatality a good measure?

What is an "acceptable" level of distraction?

and one cautionary tale

There is a cost for science done and/or applied badly

Is “zero” a reasonable goal?


MISSION
zero
Your choices drive your safety!

Is 99.9% good enough?

A 99.9% standard in safety produces

- About 1-hour of unsafe drinking water every month.
- 881-unsafe landings at Chicago O'Hare this year putting about 132,000 passengers in jeopardy.
- 500-improper surgical procedures each day.
- 268,500-tires produced per year with serious defects.

Mission Zero is the only acceptable goal

Jim Schultz, "Leading People Safely"

FIGURE. Motor vehicle crash deaths per 100,000 population — 20 high-income countries, 2000 and 2013

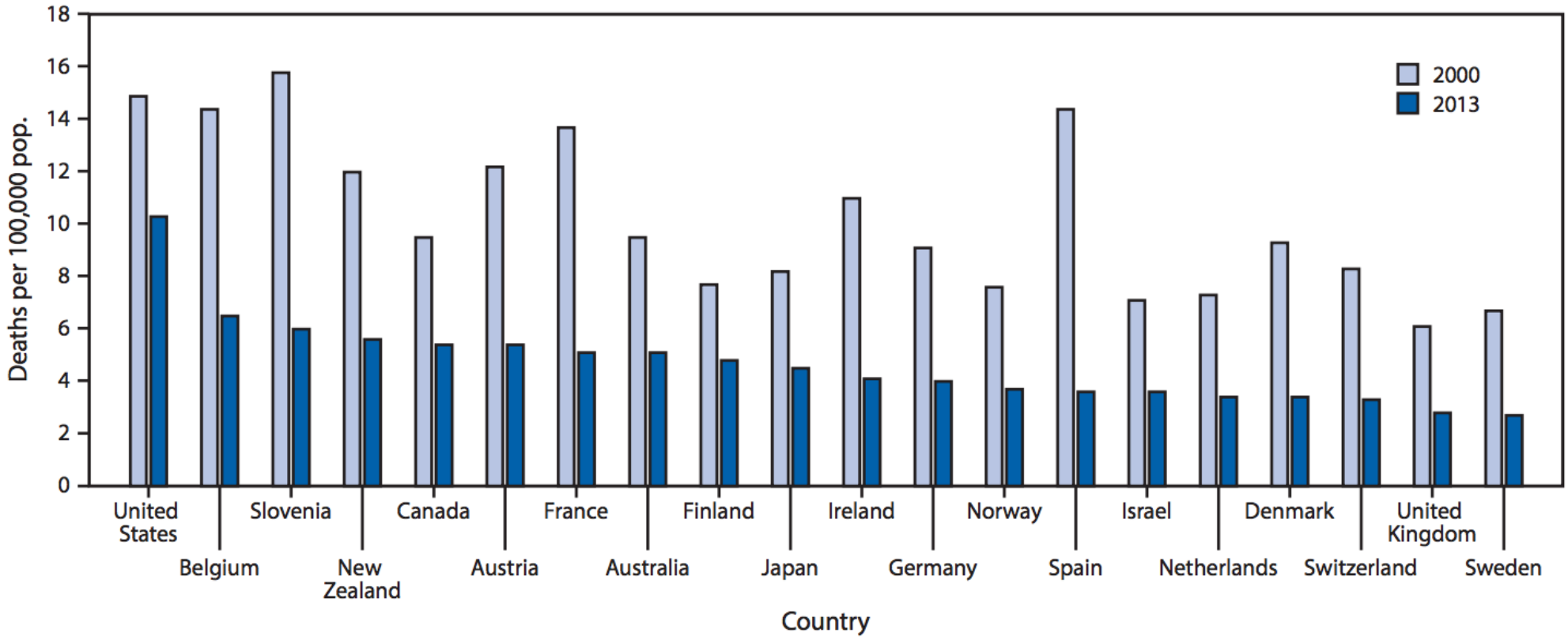


TABLE 1. Motor vehicle crash deaths per 100,000 population, per 100 million vehicle miles traveled, and per 10,000 registered vehicles, and percentage decreases from 2000 to 2013 — selected high-income countries, 2013*

CDC, Vital Signs: Motor Vehicle Injury Prevention, 2016

US: Safety improvement

- 31% decline in deaths
- 56% decline for 19 high income peers
- Lowest % decline among peers

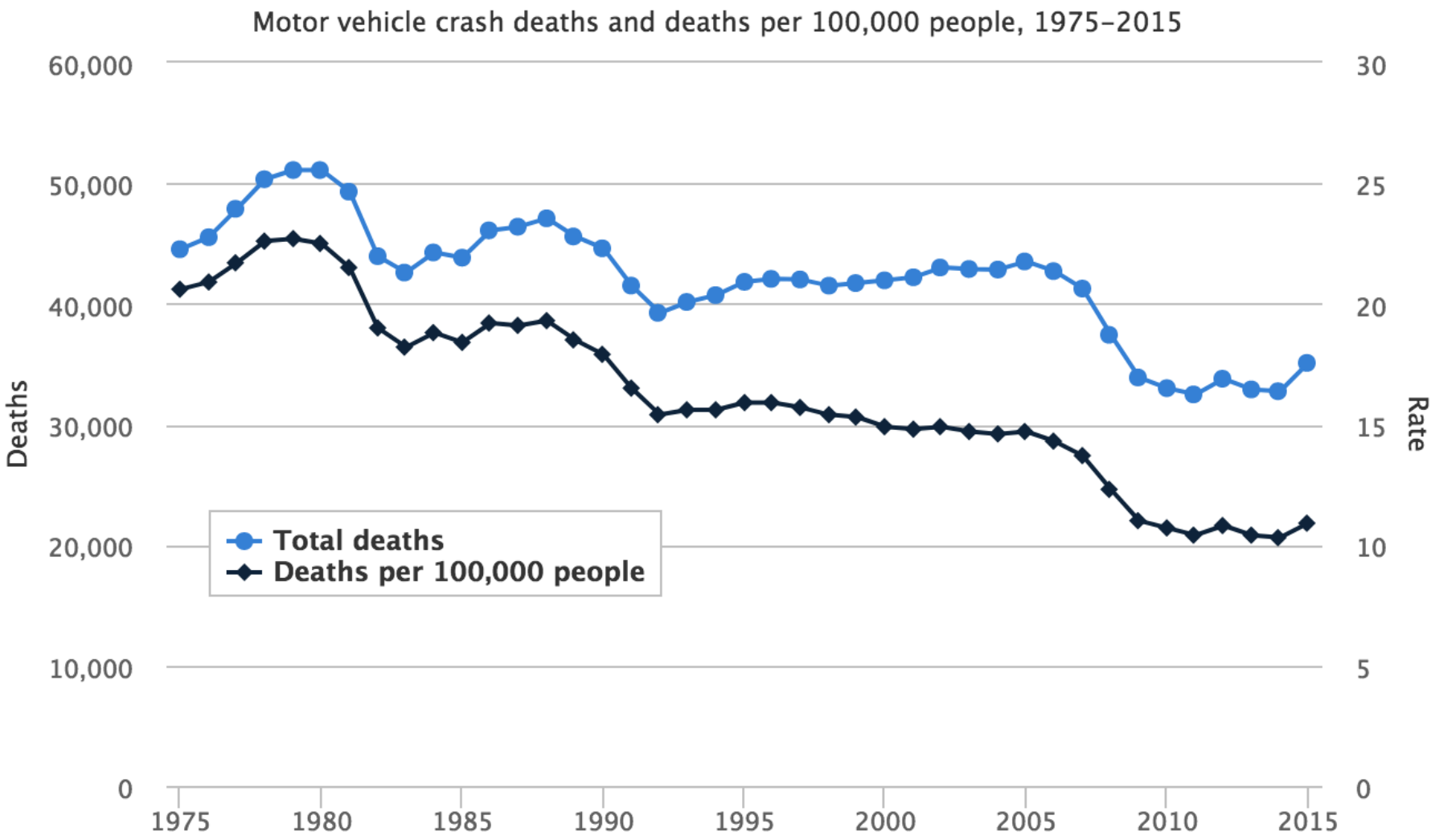
US: Crash deaths

- Most crash deaths per 100,000 population and per 10,000 registered vehicles

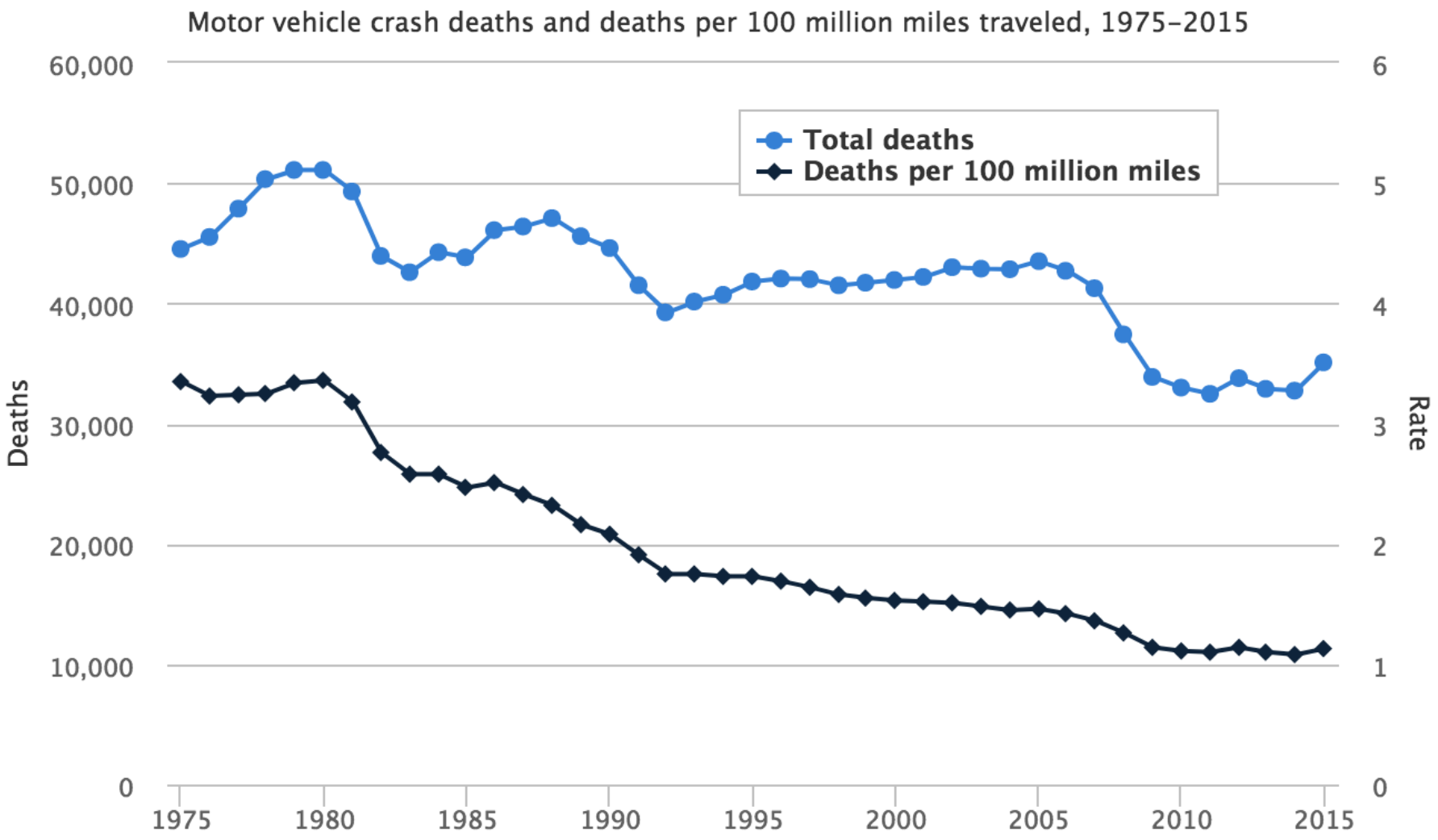
If we performed like peers

- As good as Belgium (2nd worst): 12,000 lives saved
- As good as average: 18,000 lives saved
- As good as Sweden (Best): 24,000 lives saved

Is a fatality a good measure?


Motor vehicle crash deaths and deaths per 100,000 people, 1975–2015
60,000
50,000
40,000
30,000
20,000
10,000
0
Deaths
30
25
20
15
10
5
0
Rate
1975
1980
1985
1990
1995
2000
2005
2010
2015
Total deaths
Deaths per 100,000 people

Source, *IIHS*


Motor vehicle crash deaths and deaths per 100 million miles traveled, 1975–2015
Total deaths
Deaths per 100 million miles
Deaths
Rate
60,000
50,000
40,000
30,000
20,000
10,000
0
6
5
4
3
2
1
0
1975
1980
1985
1990
1995
2000
2005
2010
2015

Source, *IIHS*

If we performed like peers

- As good as Belgium (2nd worst):
  12,000 lives saved; $140M direct medical
- As good as average:
  18,000 lives saved; $210 direct medical
- As good as Sweden (Best):
  24,000 lives saved; $281 direct medical

If a fatal crash costs $6.5M (2011 AAA estimate plus inflation)

- We could save $78B, $118B, and $157B, respectively

Is 40K+ deaths now the same as 40K+ deaths a decade ago?

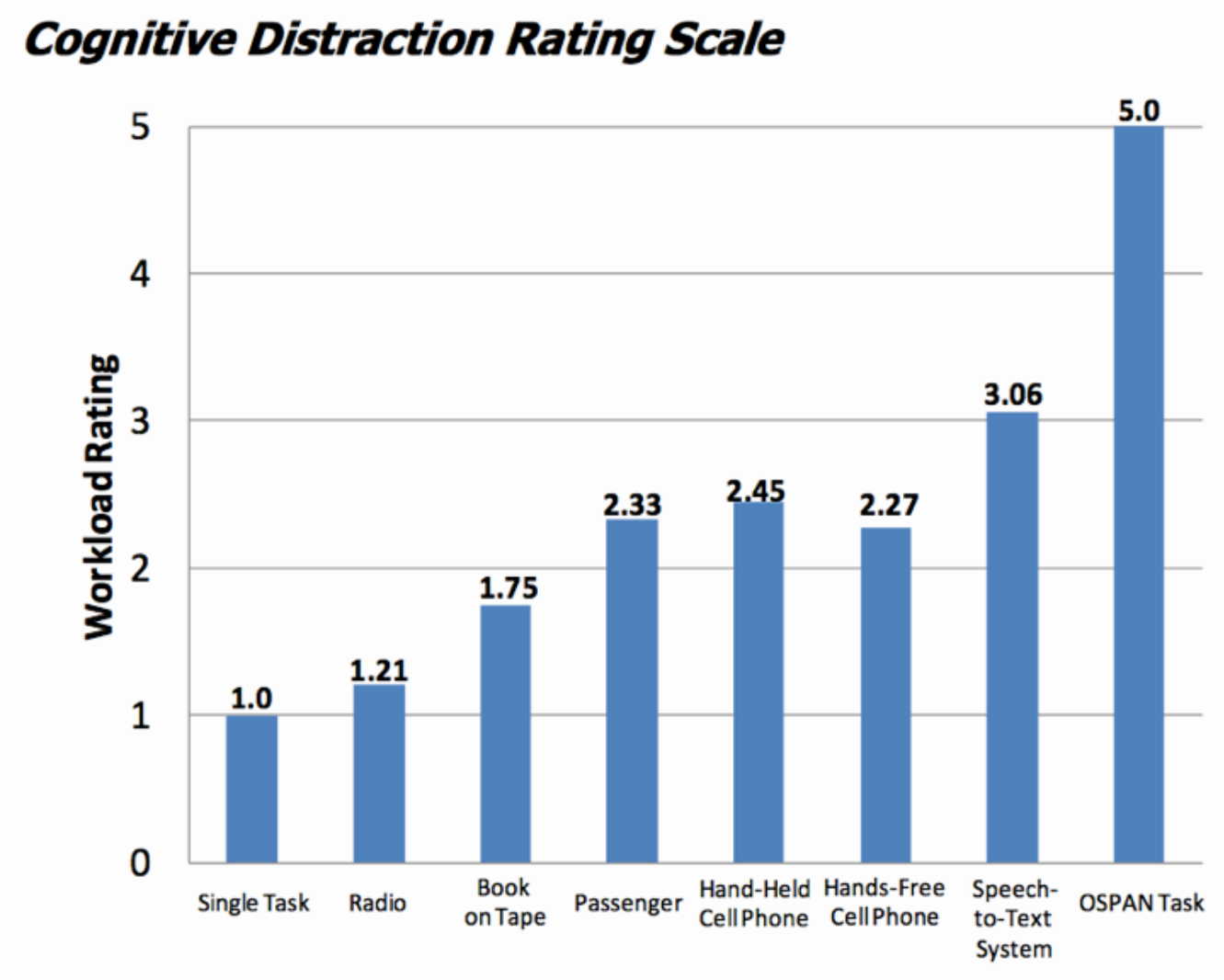
- Better cars
- Better roads
- Better emergency services
- Better medical care

If a fatal crash costs change over time, shouldn't the relative "value" of a fatality change too?

- A death in 2017 is much less likely than a death under the same conditions in 1967

What is an “acceptable” level of distraction?

All technology requires attention



AAAFTS, 2013

The big picture

We looked at

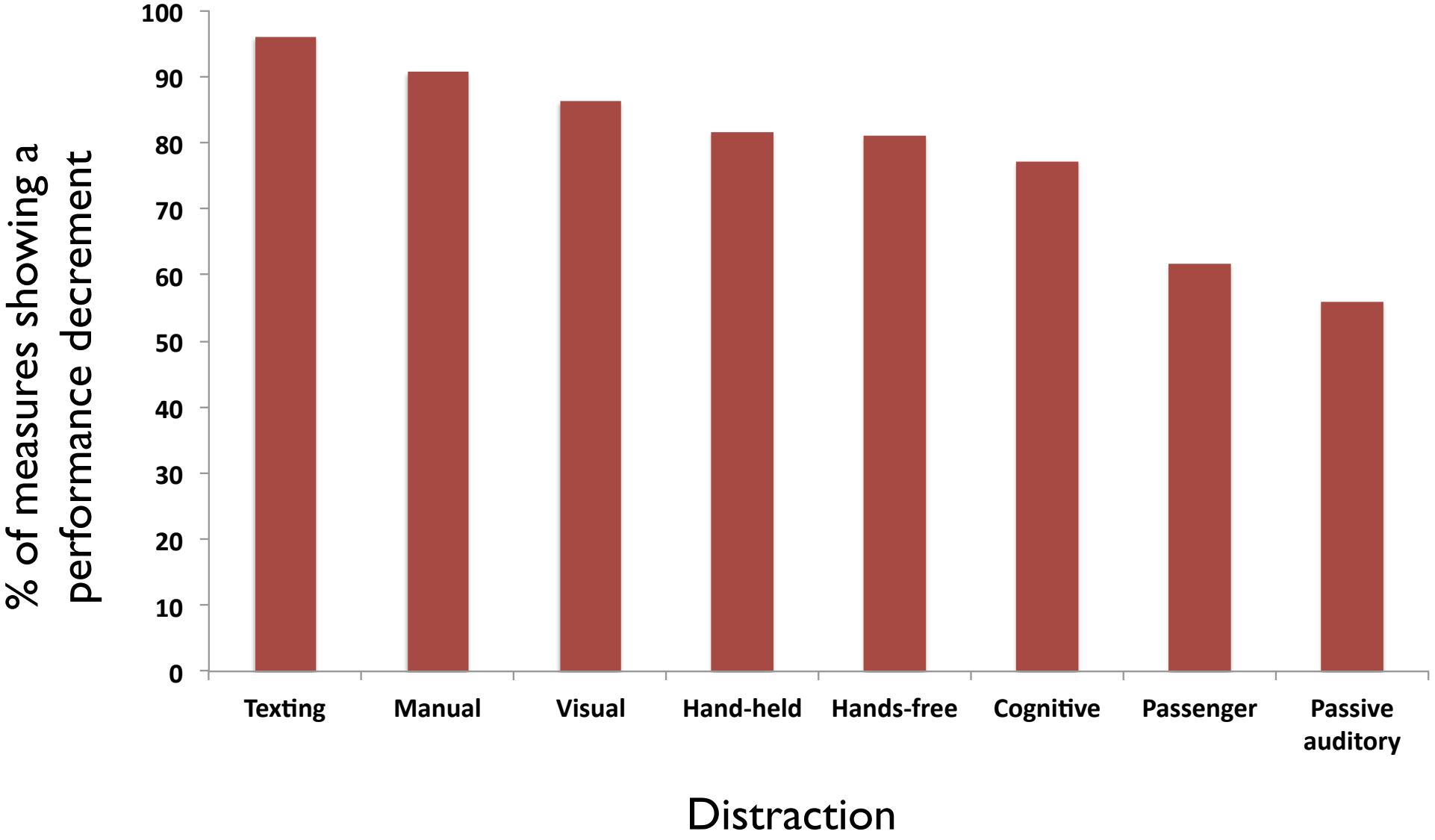
342 studies examining

1608 measurements

with **19370 subjects**

on the effects of distraction on driving performance

Atchley, Tran, & Salehinejad, 2017



Atchley, Tran, & Salehinejad, 2017

There is a cost for science done and/or applied badly

Then

100-car study: Crash odds ratio for using a phone using SCEs show **you are safer** if you use a phone

Now

SHRP-2: Well, maybe it's a **little more than double** the risk…

Dingus, T. A., at al. (2016). Driver crash risk factors and prevalence evaluation using naturalistic driving data. *Proceedings of the National Academy of Sciences, p. 2640*

FMCSA
Federal Motor Carrier Safety Administration

About Us | Regulations | Registration | Safety | News | FAST Act

- Distracted Driving
- No Texting Rule
- **Mobile Phone Restrictions**

What is the definition of using a mobile telephone?

The use of a hand-held mobile telephone means:

- Using at least one hand to hold a mobile phone to make a call;
- Dialing a mobile phone by pressing more than a single button; or
- Reaching for a mobile phone in a manner that requires a driver to maneuver so that he or she is no longer in a seated driving position, restrained by a seat belt.

What about “naturalistic” data?


U.S. Department of Transportation
National Highway Traffic Safety Administration

NHTSA
www.nhtsa.gov

DOT HS 811 757

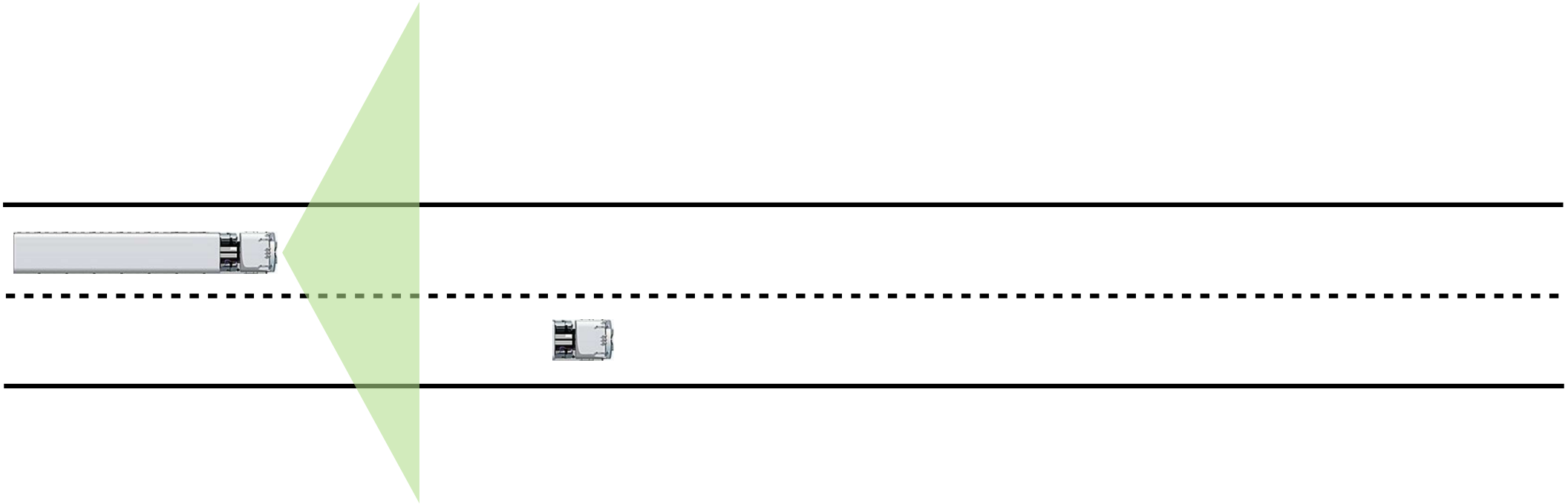
April 2013

The Impact of Hand-Held And Hands-Free Cell Phone Use on Driving Performance and Safety-Critical Event Risk

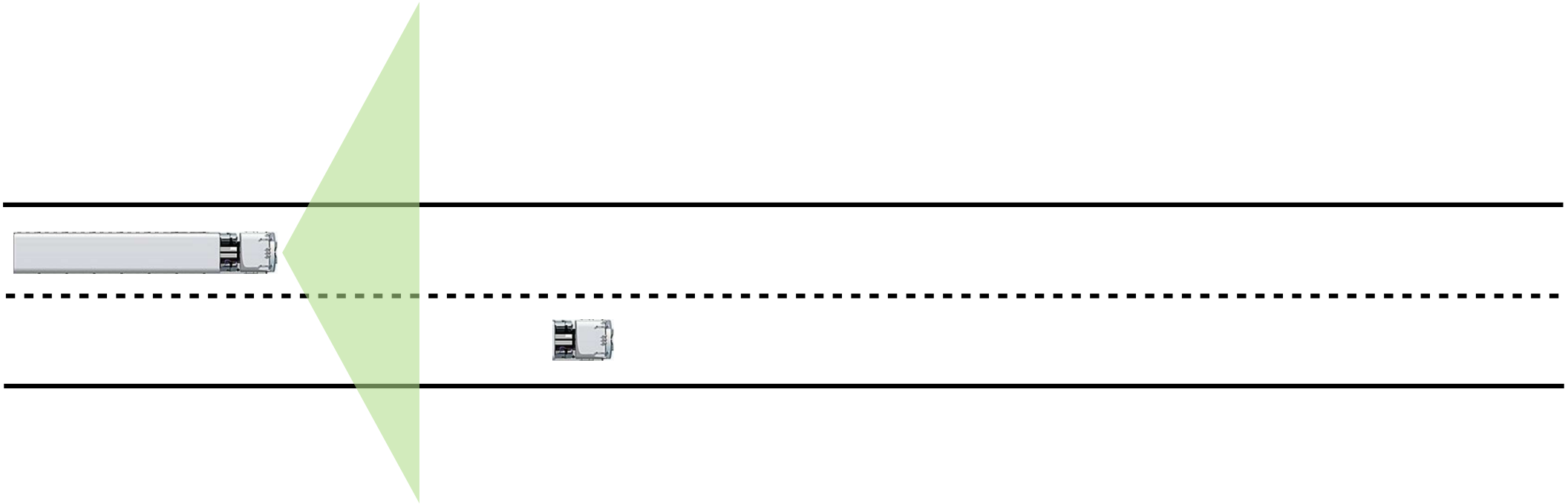
Final Report

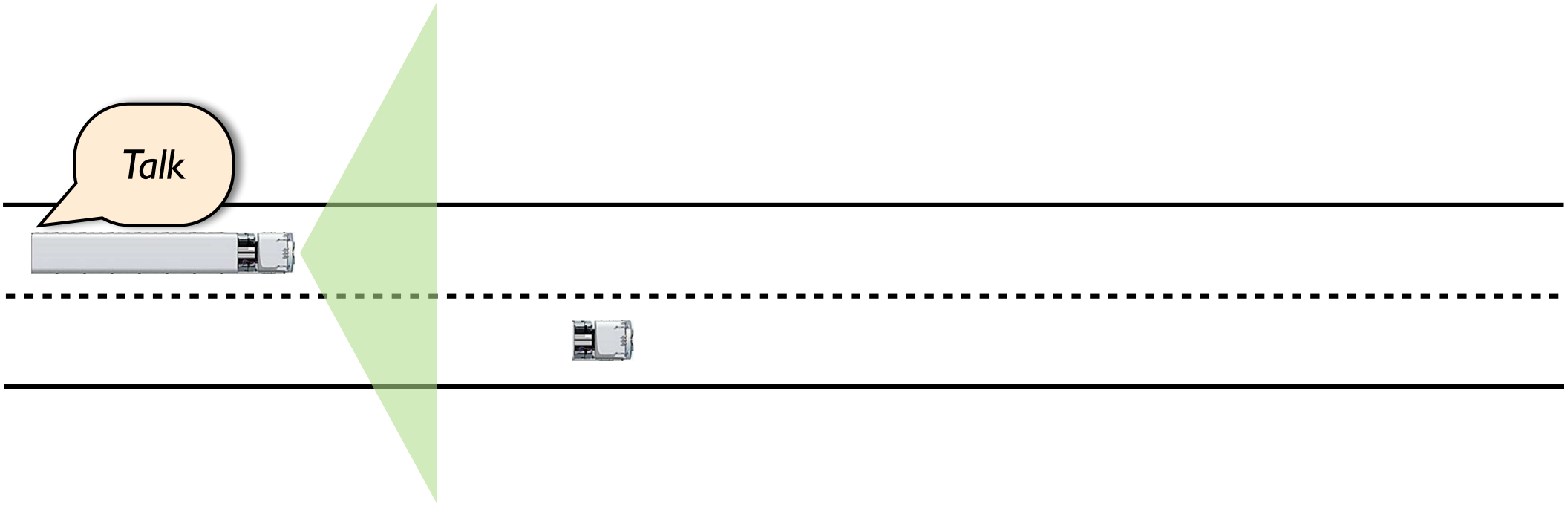
- Very few crashes
  - 2 in this study
- Data analyzed only if “triggers” occur
  - Triggers flawed
- Drivers know they are being recorded
- Miscoding
  - Fail to see phone

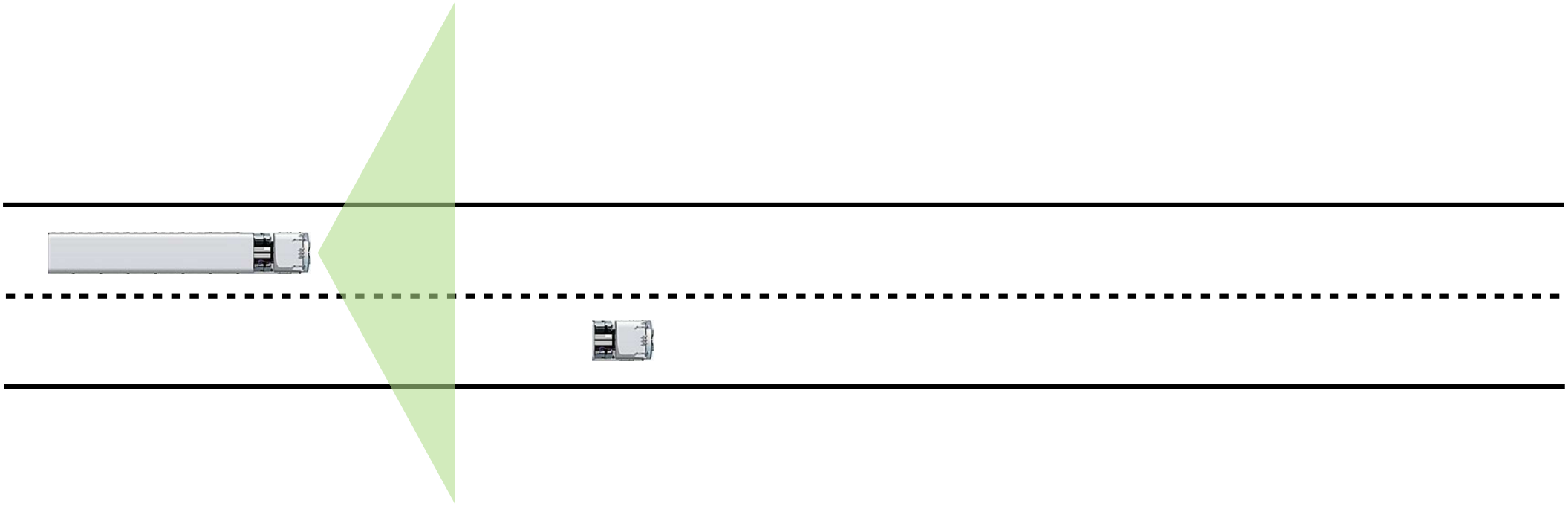
“Oh *&^#” minus 21 seconds

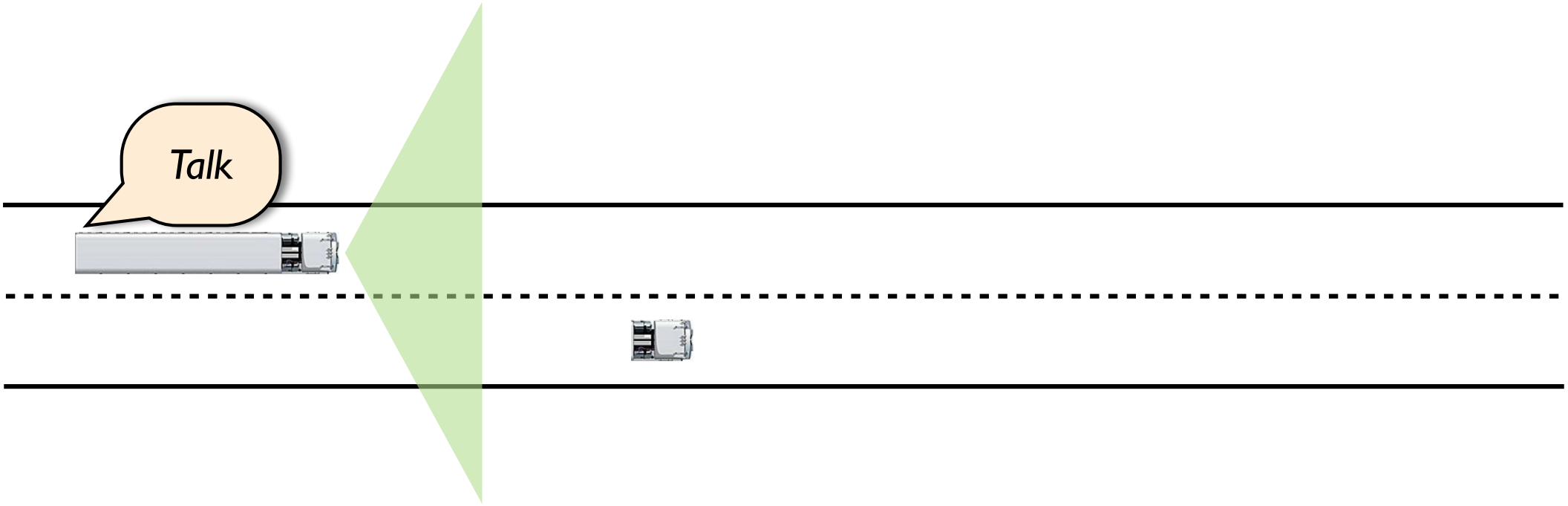


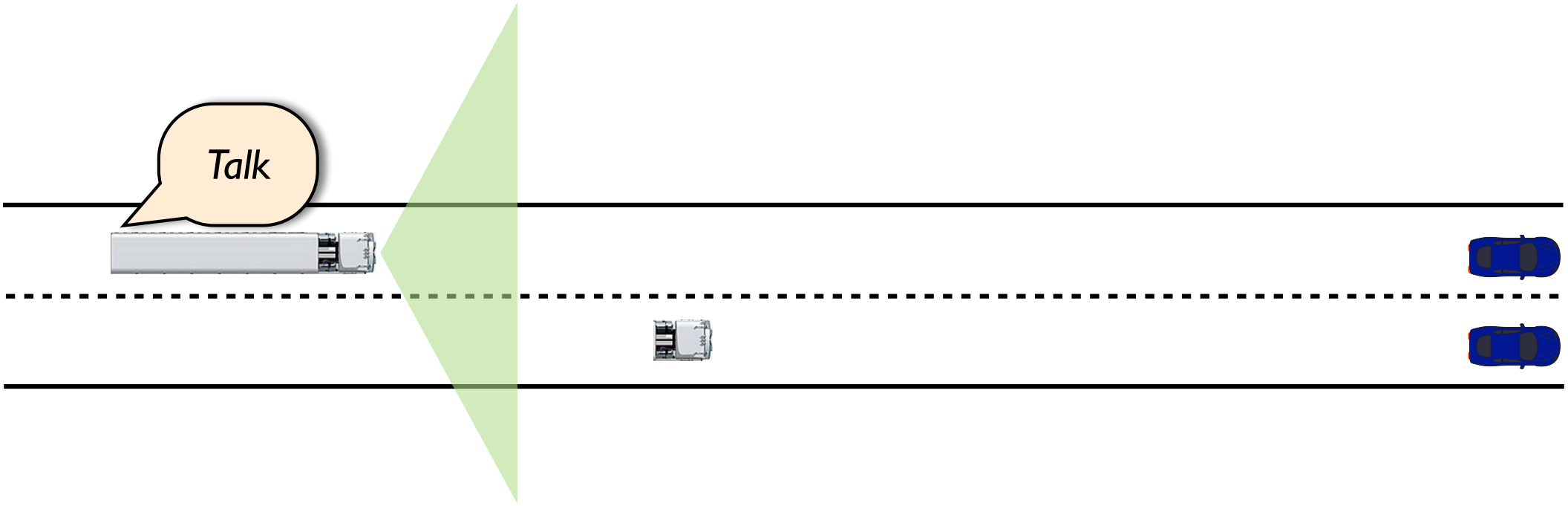
“Oh *&^#” minus 21 seconds



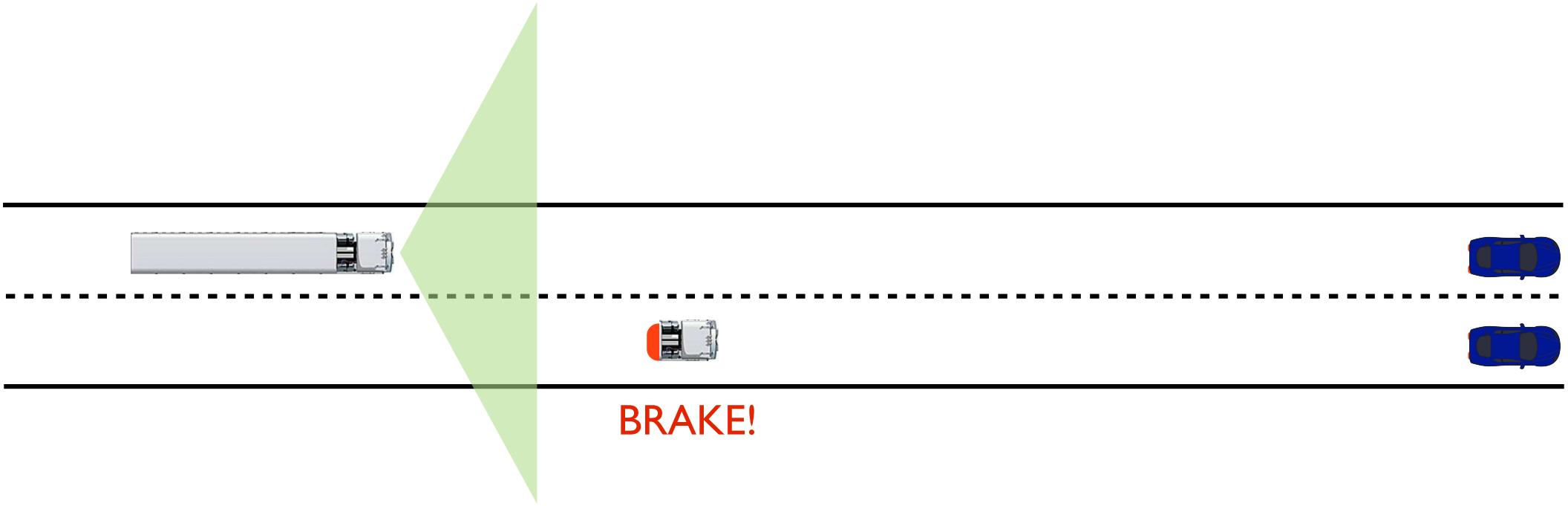

Talk



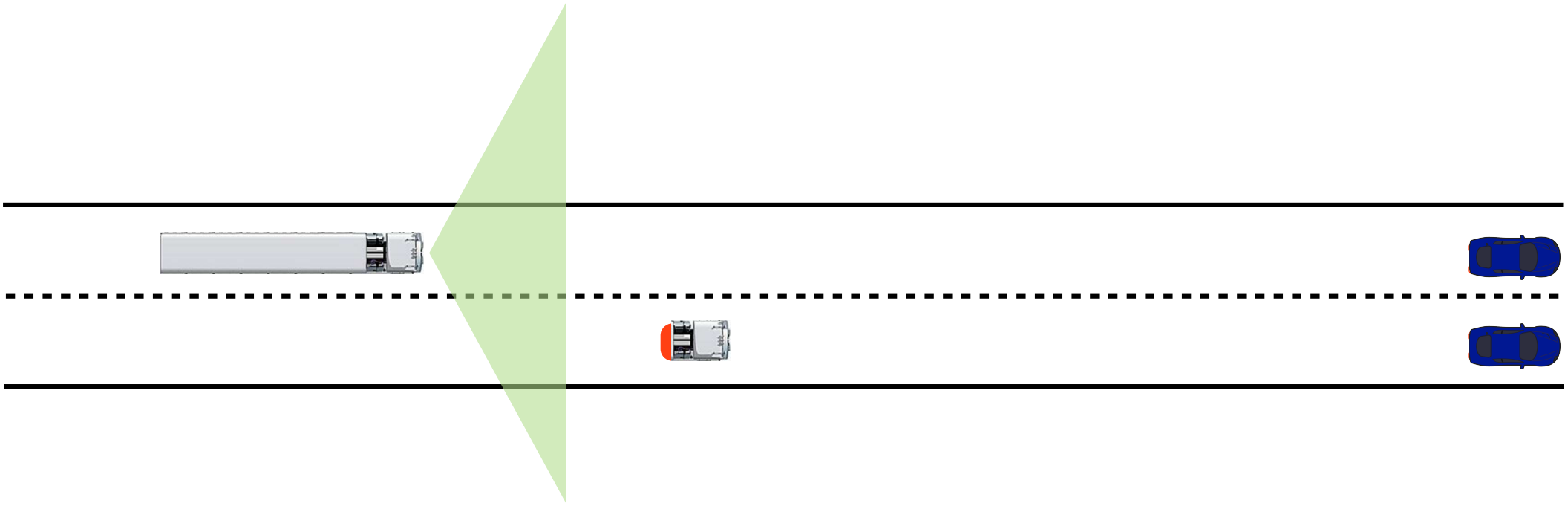

Talk


Talk

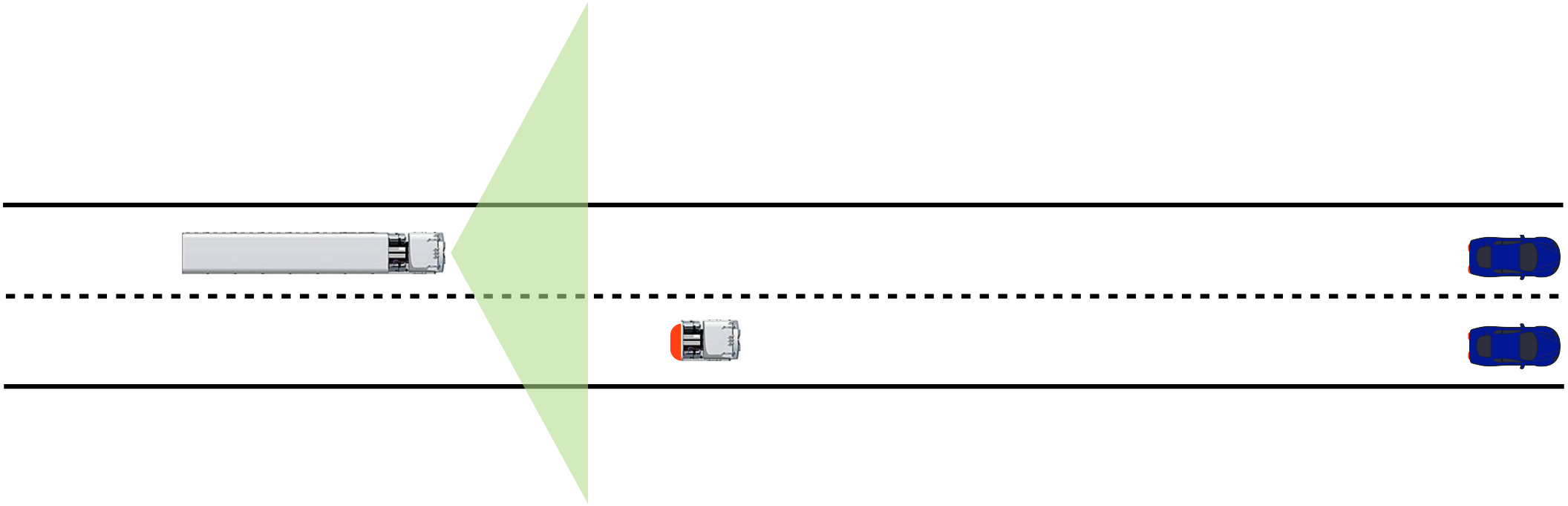
Minus 10 seconds



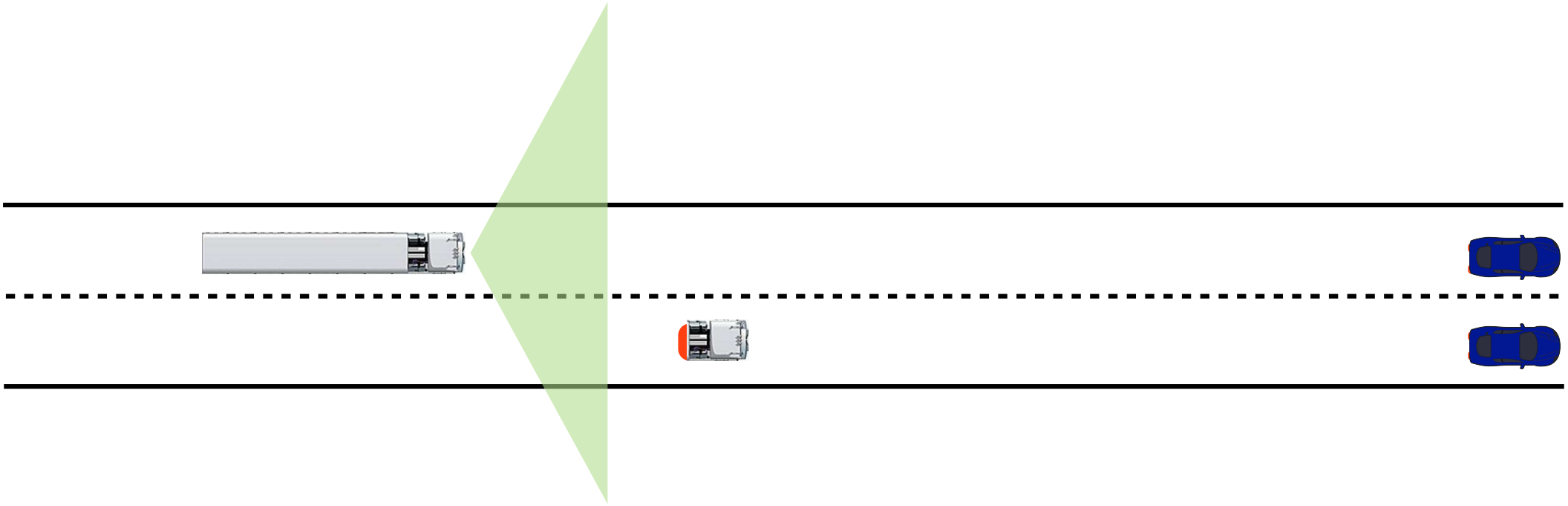
Minus 9 seconds



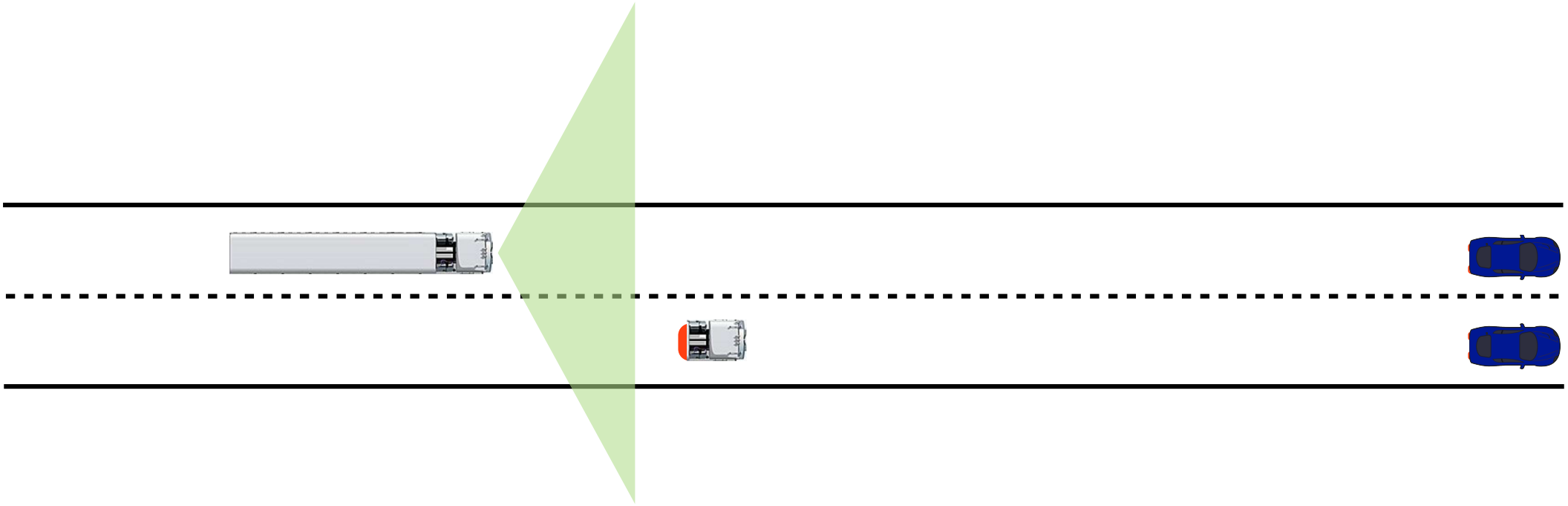
Minus 8 seconds



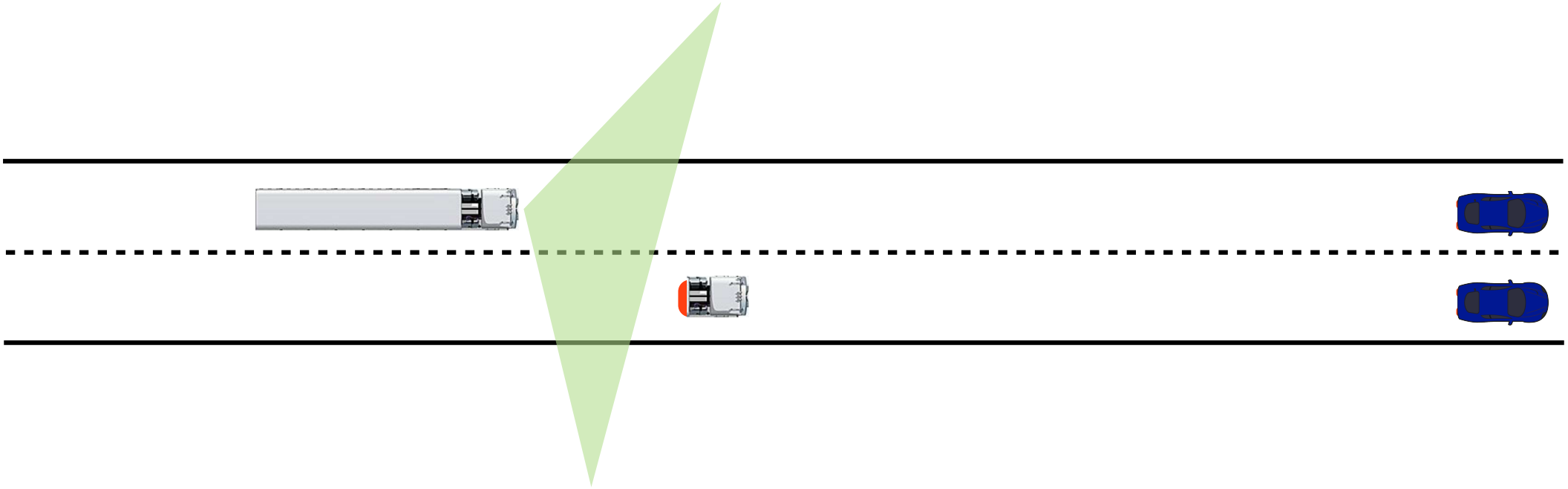
Minus 7 seconds



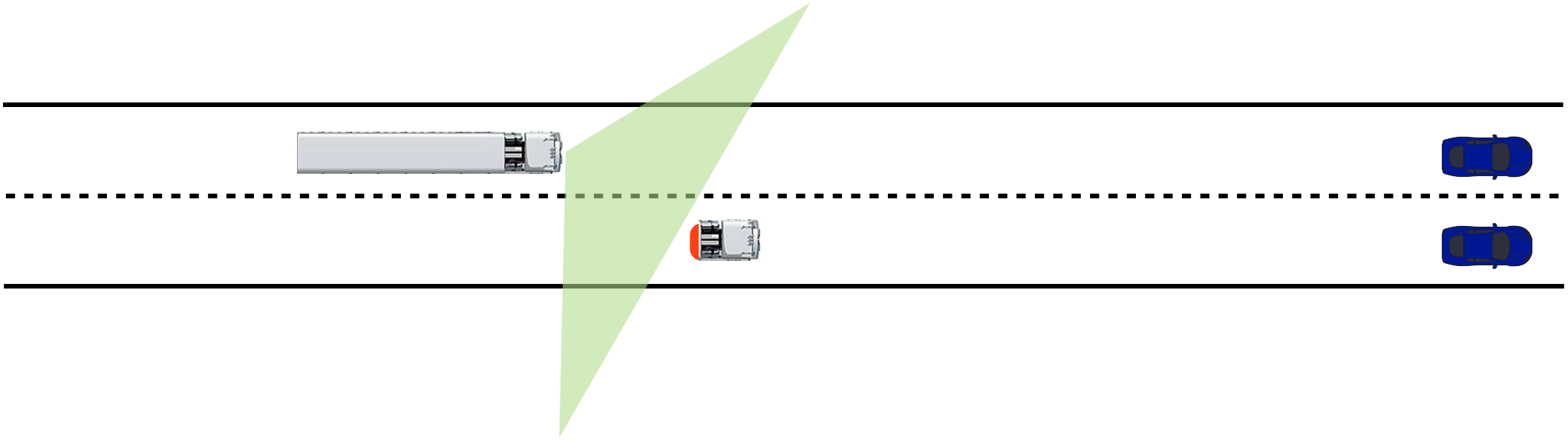
Minus 6 seconds



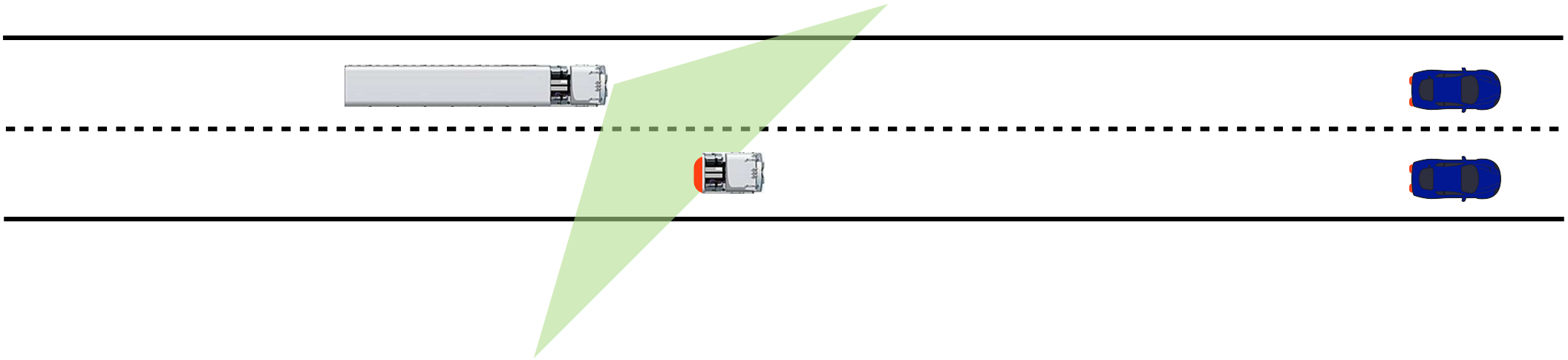
Minus 5 seconds



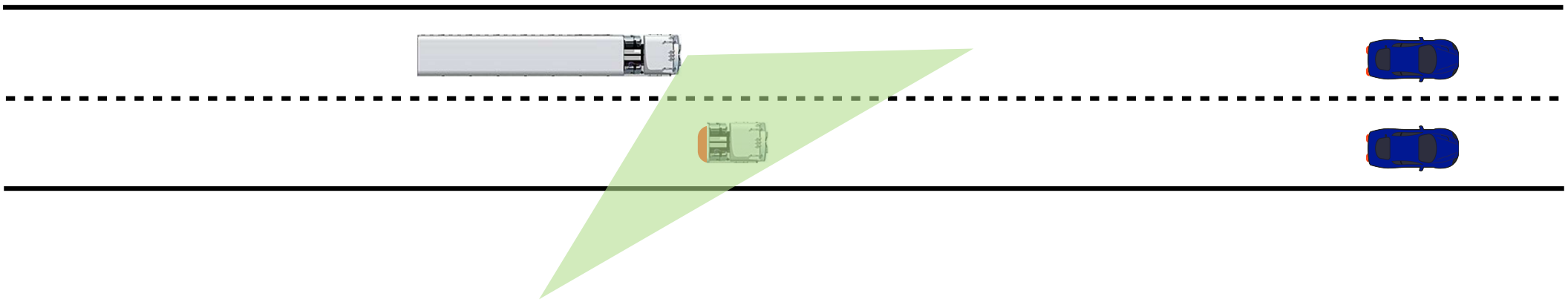
Minus 4 seconds



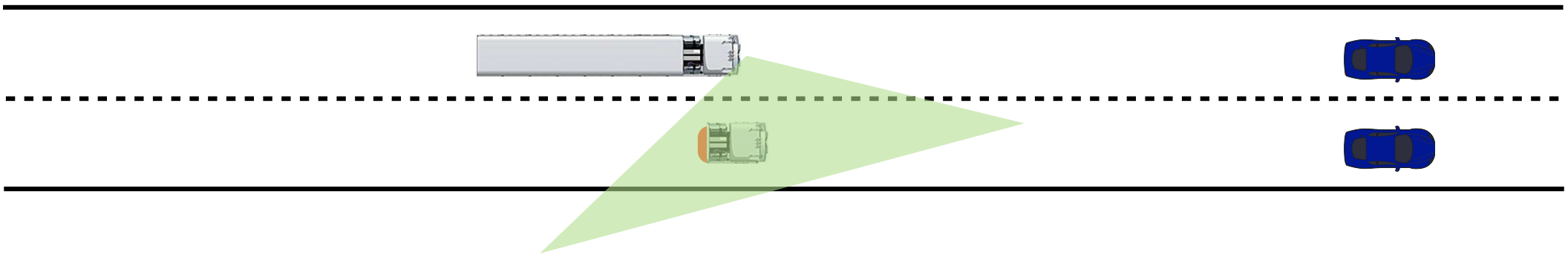
Minus 3 seconds

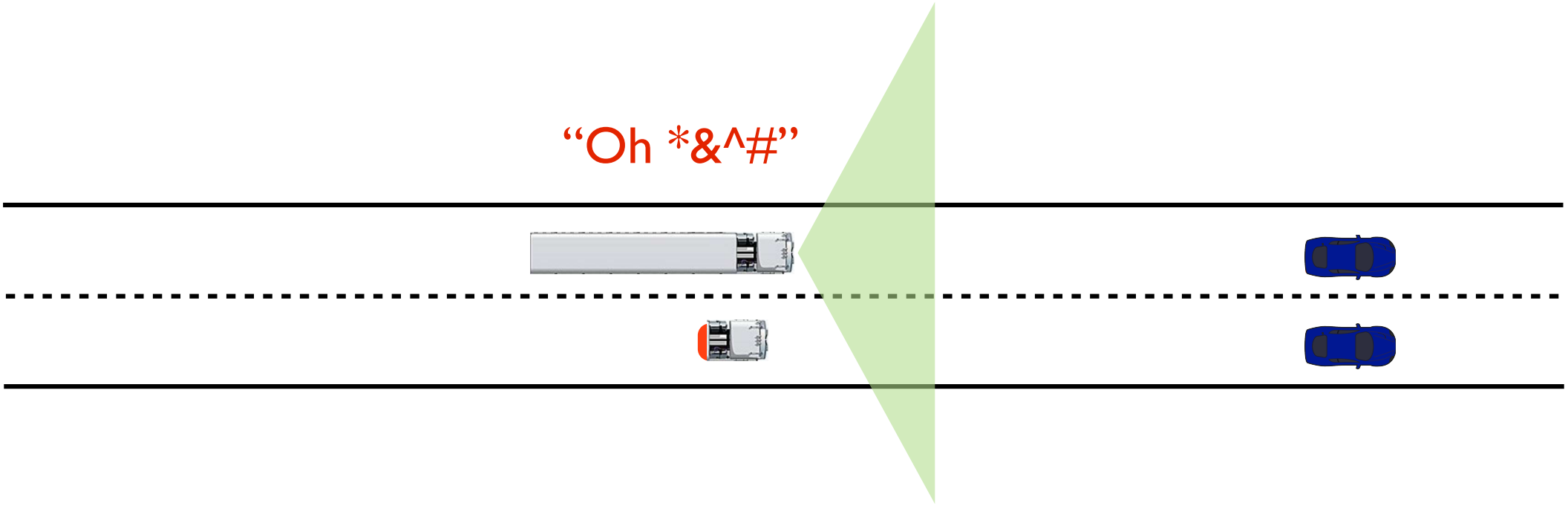


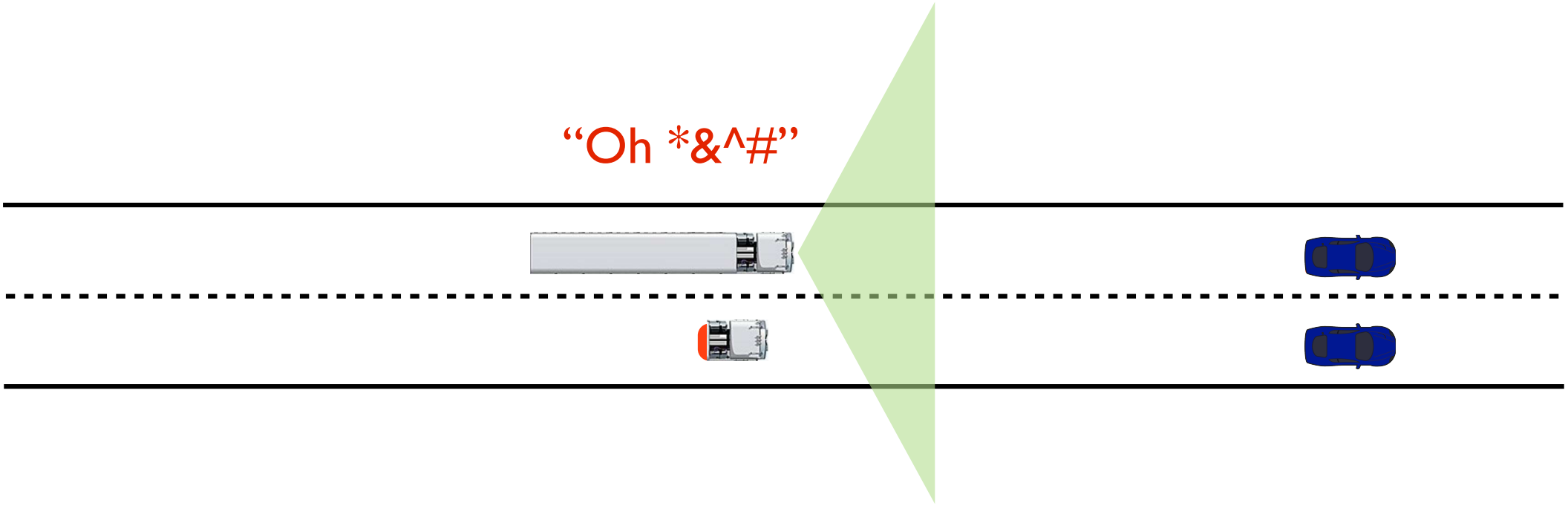
Minus 2 seconds



Minus 1 seconds




“Oh *&^#”


“Oh *&^#”

TRANSPORT TOPICS June 29, 2015 — 9

Naturalistic Driving, Unnaturalistic Science

Opinion

Ronald R. Knipling, Ph.D.
President
Safety for the Long Haul Inc.

The Federal Motor Carrier Safety Administration has spent millions of dollars on naturalistic driving studies of commercial driver fatigue. Instead of looking directly at crashes, these studies put devices on trucks to record videos and other data on driver maneuvers. However, the recorded incidents, called "safety-critical events," do not validly represent crashes, crash risk or crash causation.

Very few SCEs are crashes. Most are abrupt avoidance maneuvers such as hard braking or swerves. A 2011 Virginia Tech study on hours of service had just four crashes in 2,197 SCEs (0.2%). A crash was defined as any contact with objects or other vehicles — even if the damage was a scratch. Apparently, FMCSA and Virginia Tech believe that serious crashes, minor crashes, near-crashes and even less intense incidents are all so similar that combining them can pinpoint factors, including driver schedules, affecting crashes resulting in serious human harm.

The scientific advantages of NDS have been oversold. Yes, you can replay SCE videos to see and analyze driver actions, but how important are the events being analyzed? Yes, the large number of SCEs collected makes NDS statistically powerful. Statistical power is nice, but not if the data don't portray the actual problem.

Yet, NDS is now the "go-to" method for HOS studies. The method is so implanted that Congress mandated an SCE-based NDS of different restart periods. That study is under way. But no one seems to care whether SCEs accurately portray the genesis of serious crashes — those causing the vast majority of harm.

There are plenty of reasons to doubt SCE validity. We know that crashes themselves are extremely varied. Crashes of different types (rear-end, road departure, etc.) and severity levels (fatal, injury, property damage only, non-police reported) have very different causal profiles.

The 240,000 or so annual police-reported property-damage-only large truck crashes are not statistically representative of the 75,000 or so causing injuries and deaths. For example, we know that night and day crashes differ in many ways. In 2012, 36% of fatal truck crashes occurred at night, versus just 18% of property-damage-only crashes. Serious crashes are more likely to be caused by driver misbehavior (speeding, tailgating) or impairment (alcohol use, fatigue), while minor crashes are more likely to involve common mistakes ("looked but did not see").

Serious truck-car crashes usually are triggered by the car driver, while fault in minor crashes is split more equally. If minor crashes do not represent serious crashes, how can non-crashes represent them?

I'm a skeptic now, but in years past, I was an NDS insider and believer. I was FMCSA's research chief when the first large studies were funded and performed. At Virginia Tech, I managed data collection for the landmark 100-Car Naturalistic Driving Study. I designed and supervised data analysis for the first big truck study to look at SCE characteristics and causes. That's when I soured on the science.

SCE profiles simply did not match the objective profiles of crashes. For example, 43% of truck SCEs would have been rear-end hits into other vehicles, if the averted crash actually had occurred. In the Large Truck Crash Causation Study of serious crashes, the corresponding percentage was just 12%. Trucks were "at-fault" in 81% of their SCEs, versus 56% of LTCCS crash involvements. Imagine a national Gallup Poll with such disparities between the poll sample and the voter population. No one would accept it.

FMCSA's HOS studies treat the SCE rate as a surrogate measure of fatigue, yet SCEs and fatigue are near-opposites. Most SCEs involve active, abrupt driver maneuvers in traffic. In contrast, fatigued drivers have lowered responsiveness and are usually alone on empty highways. SCEs peak during daytime rush hours, reflective of traffic interactions. Fatigue peaks during predawn hours, reflective of circadian physiology.

Using two different, established drowsiness measures, a Virginia Tech review of NDS videos found drivers most alert when they were having SCEs and least alert in non-SCE control periods. One would expect the opposite if SCEs were valid fatigue surrogates.

Bad surrogate measures are not unique to traffic safety. In medicine, some congestive heart medications increase cardiac function without improving survival. Treatments for diabetes can lower blood sugar without reducing complications or death rates.

Moral: Any surrogate measure must be validated against the real problem.

Who should be concerned about SCE validity? Scientists? Industry? The government? Taxpayers? Answer: All of the above.

HOS rules affect millions and cost billions. Spurious science results in bad regulatory decisions with potentially adverse effects on national productivity and safety. To HOS researchers, I say: "Get real." Study real crashes or, if you must study surrogates, make sure they represent real risk.

Knipling is the author of "Safety for the Long Haul: Large Truck Crash Risk, Causation, & Prevention." Safety for the Long Haul Inc., based in Arlington, Virginia, provides safety research, training and management consultation.

"Moral: Any surrogate measure must be validated against the real problems."

- Dr.Ron Knipling
former FMCSA chief researcher and VTTI 100-car study researcher

Opinion

Naturalistic Driving, Unnaturalistic Science

Ronald R. Knipling, Ph.D.
President
Safety for the Long Haul Inc.

The Federal Motor Carrier Safety Administration has spent millions of dollars on naturalistic driving studies of commercial driver fatigue. Instead of looking directly at crashes, these studies put devices on trucks to record videos and other data on driver maneuvers. However, the recorded incidents, called "safety-critical events," do not validly represent crashes, crash risk or crash causation.

Very few SCEs are crashes. Most are abrupt avoidance maneuvers such as hard braking or swerves. A 2011 Virginia Tech study on hours of service had just four crashes in 2,197 SCEs (0.2%). A crash was defined as any contact with objects or other vehicles — even if the damage was a scratch. Apparently, FMCSA and Virginia Tech believe that serious crashes, minor crashes, near-crashes and even less intense incidents are all so similar that combining them can pinpoint factors, including driver schedules, affecting crashes resulting in serious human harm.

The scientific advantages of NDS have been oversold. Yes, you can replay SCE videos to see and analyze driver actions, but how important are the events being analyzed? Yes, the large number of SCEs collected makes NDS statistically powerful. Statistical power is nice, but not if the data don't portray the actual problem.

Yet, NDS is now the "go-to" method for HOS studies. The method is so implanted that Congress mandated an SCE-based NDS of different restart periods. That study is under way. But no one seems to care whether SCEs accurately portray the genesis of serious crashes — those causing the vast majority of harm.

There are plenty of reasons to doubt SCE validity. We know that crashes themselves are extremely varied. Crashes of different types (rear-end, road departure, etc.) and severity levels (fatal, injury, property damage only, non-police reported) have very different causal profiles.

The 240,000 or so annual police-reported property-damage-only large truck crashes are not statistically representative of the 75,000 or so causing injuries and deaths. For example, we know that night and day crashes differ in many ways. In 2012, 36% of fatal truck crashes occurred at night, versus just 18% of property-damage-only crashes. Serious crashes are more likely to be caused by driver misbehavior (speeding, tailgating) or impairment (alcohol use, fatigue), while minor crashes are more likely to involve common mistakes ("looked but did not see").

Serious truck-car crashes usually are triggered by the car driver, while fault in minor crashes is split more equally. If minor crashes do not represent serious crashes, how can non-crashes represent them?

I'm a skeptic now, but in years past, I was an NDS insider and believer. I was FMCSA's research chief when the first large studies were funded and performed. At Virginia Tech, I managed data collection for the landmark 100-Car Naturalistic Driving Study. I designed and supervised data analysis for the first big truck study to look at SCE characteristics and causes. That's when I soured on the science.

SCE profiles simply did not match the objective profiles of crashes. For example, 43% of truck SCEs would have been rear-end hits into other vehicles, if the averted crash actually had occurred. In the Large Truck Crash Causation Study of serious crashes, the corresponding percentage was just 12%. Trucks were "at-fault" in 81% of their SCEs, versus 56% of LTCCS crash involvements. Imagine a national Gallup Poll with such disparities between the poll sample and the voter population. No one would accept it.

FMCSA's HOS studies treat the SCE rate as a surrogate measure of fatigue, yet SCEs and fatigue are near-opposites. Most SCEs involve active, abrupt driver maneuvers in traffic. In contrast, fatigued drivers have lowered responsiveness and are usually alone on empty highways. SCEs peak during daytime rush hours, reflective of traffic interactions. Fatigue peaks during predawn hours, reflective of circadian physiology.

Using two different, established drowsiness measures, a Virginia Tech review of NDS videos found drivers most alert when they were having SCEs and least alert in non-SCE control periods. One would expect the opposite if SCEs were valid fatigue surrogates.

Bad surrogate measures are not unique to traffic safety. In medicine, some congestive heart medications increase cardiac function without improving survival. Treatments for diabetes can lower blood sugar without reducing complications or death rates.

Moral: Any surrogate measure must be validated against the real problem.

Who should be concerned about SCE validity? Scientists? Industry? The government? Taxpayers? Answer: All of the above.

HOS rules affect millions and cost billions. Spurious science results in bad regulatory decisions with potentially adverse effects on national productivity and safety. To HOS researchers, I say: "Get real." Study real crashes or, if you must study surrogates, make sure they represent real risk.

Knipling is the author of "Safety for the Long Haul: Large Truck Crash Risk, Causation, & Prevention." Safety for the Long Haul Inc., based in Arlington, Virginia, provides safety research, training and management consultation.

"Spurious science results in bad regulatory decisions and potentially adverse effects on national productivity and safety."

Thank you for your work and your attention