Casualty Actuarial Society

Automated Vehicle Task Force (CAS AVTF)

June 9, 2015

CAS AVTF: Overview

Goal	The CAS AVTF is researching the technology's risks to provide policymakers with the information needed to ensure **the product is brought to market as safely and efficiently as possible.**

Focus		
Pre market	**Post market**	**Post claim**
identify & quantify risks	accurately price the technology	compensate claimants fairly & efficiently

2015 Developments

January

- Audi partner with Nvidea to use Tegra X1 chips
- Nissan & NASA announce automated research project partnership

February

- Uber and Carnegie Mellon University announce strategic partnership
- Apple reported to be working on automated vehicles Sony's image sensors and ZMP's robotics

April

- Delphi 3,400 mile cross country trip with 99% of miles in autonomous mode
- Nevada licenses Mercedes' Freightliner truck with adaptive cruise control & steering assist
- Nokia's HERE: Mercedes, BMW, & Audi to make an offer greater than €2 billion in a consortium with Baidu. Uber reported to offer $3 billion

May

- Tesla adjusts adaptive cruise control to limit liability

Google

Vehicles

- 23 Lexus RX450h SUV's: on public streets
- 9 prototypes: on closed test tracks

Miles driven

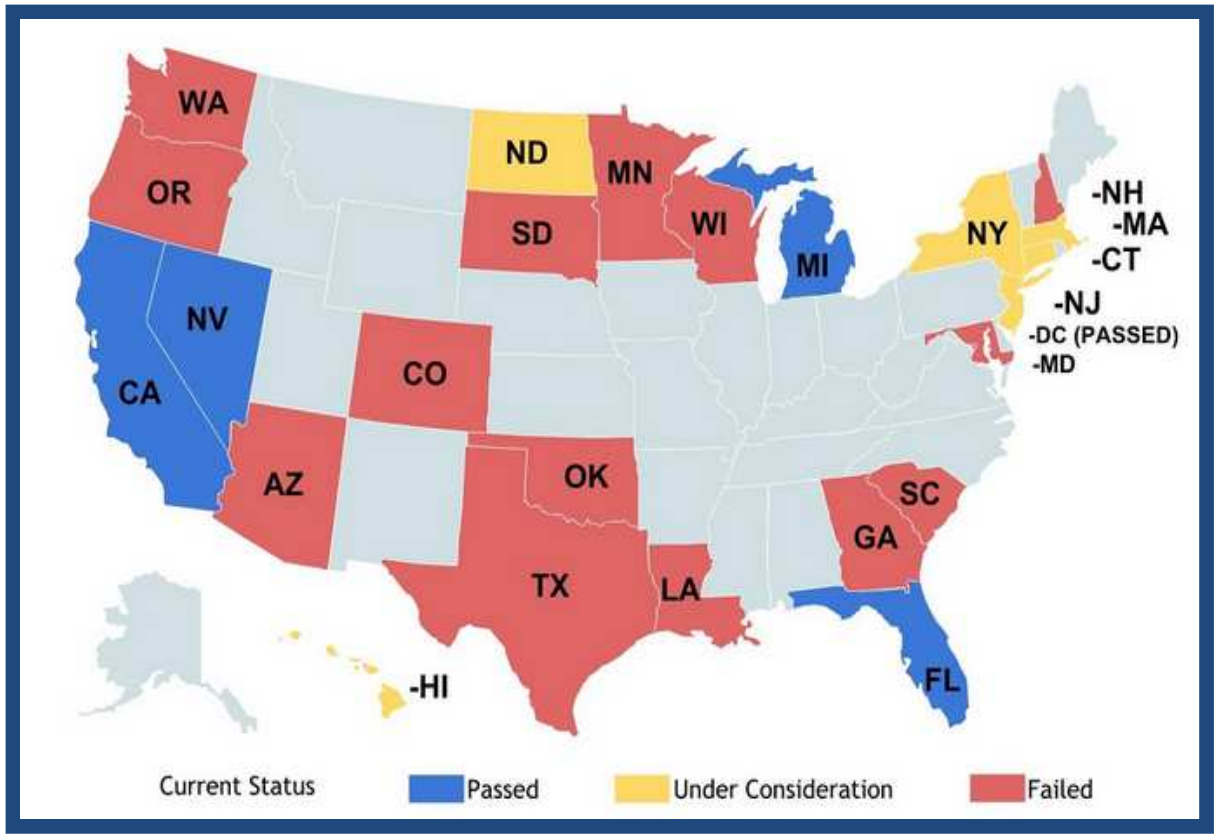
- Autonomous Mode: 1,011,338 miles
- Manually Mode: 796,250 miles
- Averaging 10,000 autonomous miles per week

Accidents

- 13 Accidents

Regulation & Testing

Current U.S. regulatory approach varies by state



Comments

- CA, DC, FL, MI, NV have regulations that permit operation/testing of AVs
- May 2013 NHTSA publication
- Statement with guidance to states on AV regulations
- Statement outlined NHTSA plans for testing AV technology

- May 2015: NHTSA fast tracks V2X legislation

http://cyberlaw.stanford.edu/wiki/index.php/Automated_Driving:_Legislative_and_Regulatory_Action

London had 3 trials underway

UK Autodrive Programme: 3 years to pave way for introduction of AVs

Dept. of Transportation put ~$29M USD for trials

Explore both legal and technical changes required for Autonomous Vehicles

Milton Keyes and Coventry

- Lutz Pods that drive in pedestrian zones
- Max speed 15 mph
- Electronic AV

Greenwich

- GATEway shuttles
- Electronic AV
- Local tour with drop off points: input destination on CPU

Bristol

- Venturer consortium will investigate congestion and safety
- BAE Wildcat

Every year brings new research opportunities

University of Michigan
July 2015

- 32 acre testing facility for V2V, V2I, and AV.
- Support 2,800 connected vehicles in Ann Arbor in pilot and 9,000 within 3 years

Volvo: Gothenburg
2017

- 100 self driving cars on the road by 2017
- Array of sensors for AV on highways
- No AV in inclement weather

Virginia Automated Corridor
2015

- More than 70 miles or rural & urban roadways
- High Def mapping supported through HERE
- No bond or insurance requirement

A9 Autobahn:
2016 or later

- V2V and V2I for AV, similar to Michigan facility
- A9 Connects Munich to Berlin

Singapore
March 2015

- 6km test route in real traffic
- Approved vehicles get one year license for testing
- Located in One North Business Park

Future development may create two models for AVs

All driving, limited location

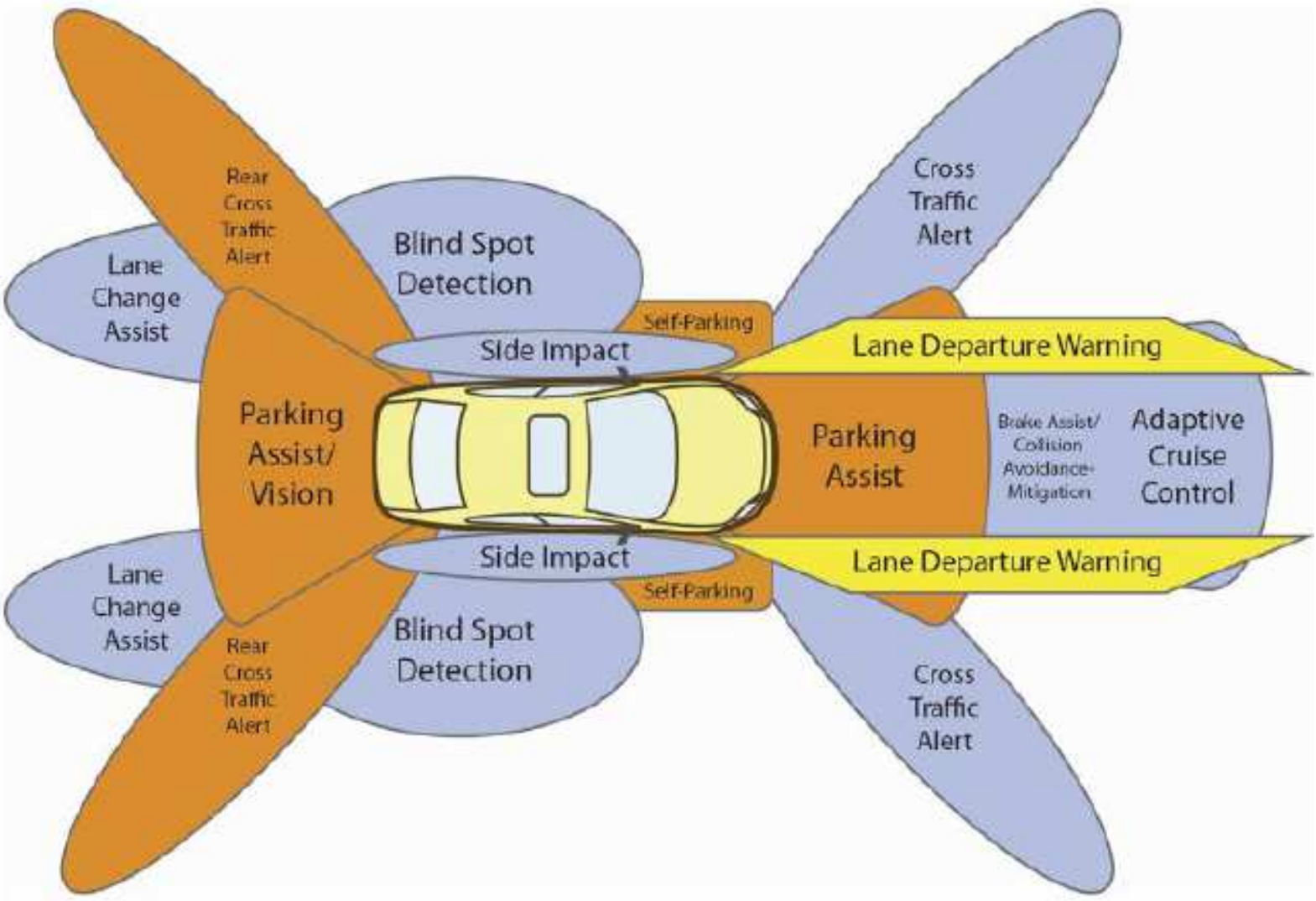
- End to end service
- Only operates in specified area
- “Taxi” service
- Google & Uber

Some driving, all locations

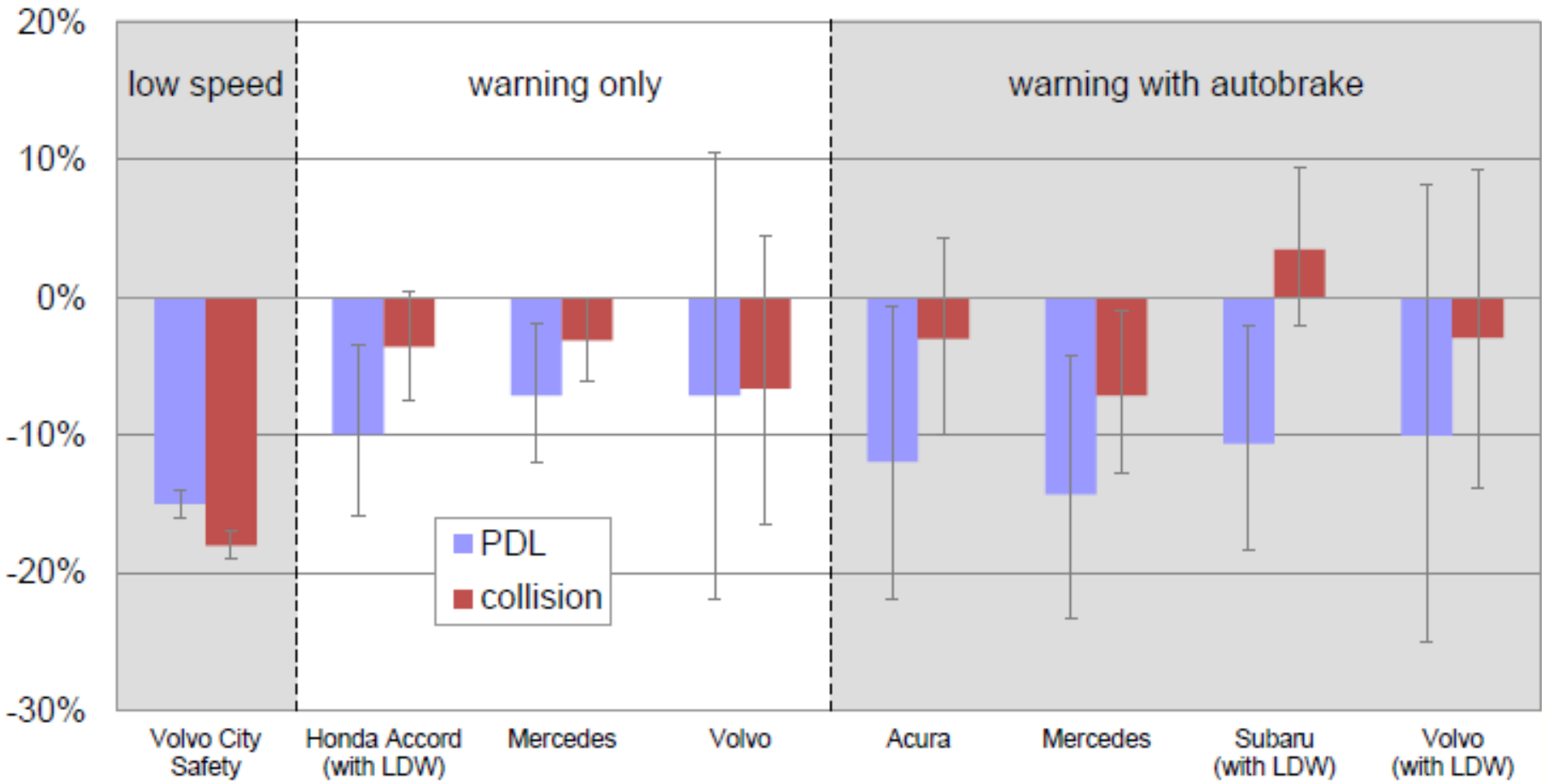
- Takes over some of the driving
- E.g. Supercruise, parallel parking
- Only operates in specified area
- Driver owns and operates
- Mercedes, BMW, Volvo, Cadillac, Telsa

Current Vehicle Technology

Driver Assistance Features



Front Crash Prevention
- Chg in Phys Dam Freq



Insurers' responses

Pricing Adjustments

- Proprietary coverage level vehicle symbols

Forming Partnerships

- Ford, State Farm & University of Michigan – Ford Hybrid automated research vehicle (December 2013)
- Honda & major insurance company sign agreement to use self-driving automobile test track at former Concord Naval Weapons Station (March 2015)

Testifying at hearings

- CA DOI: State Farm & Nationwide & CAS AVTF
- NJ Senate: Munich Re America

Industry Groups are performing research

- HLDI-IIHS studies
- Casualty Actuarial Society
- RAND Corporation
- Brookings Institute

Hurdles

Accurately Pricing Issues

Difficult to quantify impact of current technology

- Lower frequency can be offset by higher severity
- Not all systems are created equal
- Optional features are hidden in our data

Current calculation approaches are inadequate

- Vehicle symbol calculation will not recognize benefits fast enough

Vehicle symbol analysis approach

Vehicle experience groups

- Each group's experience is weighted and combined with similar vehicles

Complements to credibility

- Vehicle's body style factor
- Prior year factor

Automated vehicle symbol: option 1

- Assume a brand new vehicle
  - e.g. Mercedes introduces a new fully automated vehicle
  - No initial prior year factor, growth trend impacts credibility

Automated vehicle symbol: option 2

- Assume update to a current vehicle
  - e.g. all new Lexus RX 350 sold with AV equipment

Vehicle Symbol Calculation

Automated vehicle symbol: option 2

Assume all new Lexus RX 350 sold with AV equipment

Vehicle Symbol Discount					
	Loss Attenuation				
Year	0%	25%	50%	75%	100%
1	0.0%	4.3%	7.4%	10.5%	13.6%
2	0.0%	7.1%	13.7%	20.0%	26.3%
3	0.0%	9.7%	18.2%	25.7%	35.4%
4	0.0%	11.1%	21.0%	31.0%	41.2%

The business case for full automation

Demand

Assume: *Automated vehicles can decrease the risk for automobile accidents such that:*

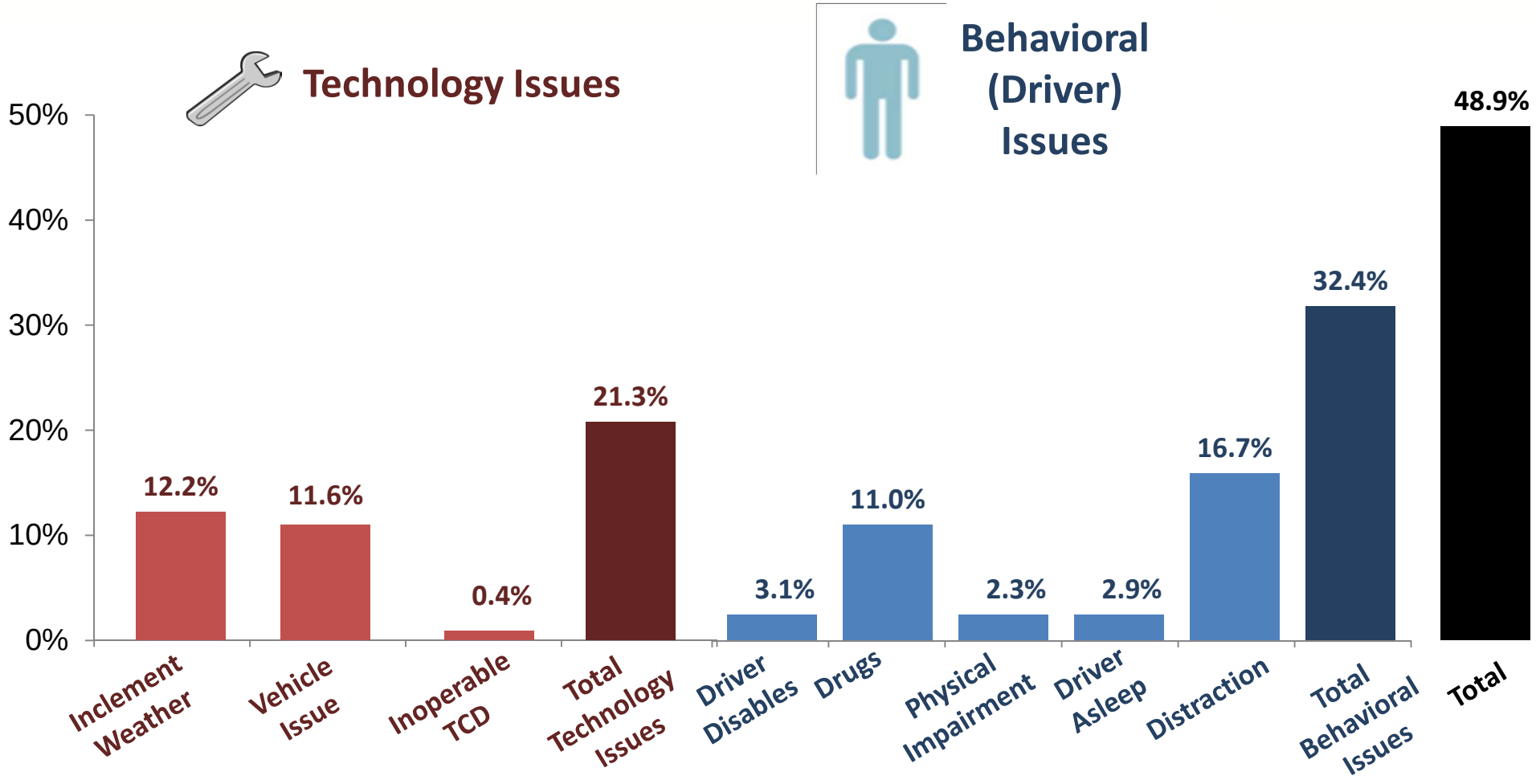
- **Vehicles can operate without an attentive driver**
- **Vehicles can be lighter**
- **Vehicles can travel closer together**

➢ **Will be brought to market by three constituencies: businesses, politicians, consumers**

Benefits – Govt' & Customers

- Reduce accidents
- Congestion costs
- Increase mobility (elderly, disabled & poor)
- Infrastructure funding
- Environmental
- Parking Costs
- International Competition

Manufacturers – Limiting Risk



Recommended Actions

Risks

- Complete & immediate saturation of local market
- Data reporting requirements defined by manufacturers
  - Delphi trip 30 terabytes: too much data to analyze
- Auto Liab -> Products Liability
  - Market prices long-term future into company's capital
  - 190 billion of premium flight

Response to Revolutionary Change

- We need to gain knowledge & influence
- Integrate ourselves into the discussion to control our own destiny
- Form partnerships
- Perform/sponsor research

CAS AVTF
- Projects -

Average Accident Rate

"One of the most important things we need to understand in order to judge our cars' safety performance is 'baseline' accident activity on typical suburban streets.

Quite simply, because many incidents never make it into official statistics, we need to find out how often we can expect to get hit by other drivers."

– Chris Urmson, Director of Google's Self-Driving Car Project

- **What's the expected frequency of a comparable driver?**

Average Accident Rate

Comparable Driver

- Match location & type
- Match driver characteristics

Issues with NHTSA Data

- Only include police reported accidents
- Cannot segment by driver type

Insurance Data

- Calculate frequencies for different driving segments
- Can more accurately define “good driver”
- GLM’s lead to a more stable & accurate calculations

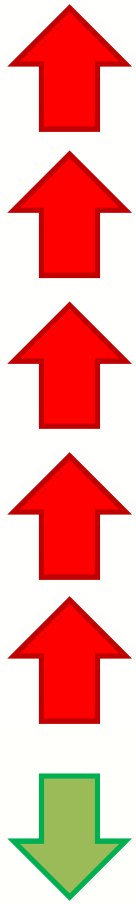
Auto Liab vs. Products Liab

Quantify the change in costs from liability systems

- Scenario #1: Assume no change in accidents
- Scenario #2: Accident frequency is reduced by X%
  - Determine what X needs to equal for Scenario 1 = Scenario 2
- Scenario #3: Cap liability to $Z
  - Determine what Z needs to be for Scenario 1 = Scenario 3
- Scenario #4: Combination of Scenario #2 & #3

Auto Liab vs. Products Liab

- ALAE Factor
- Permissible Loss Ratio
- Accident classification
- Liability limits
- Settlement lag
- Unnecessary coverages



Questions and Discussion