Casualty Actuarial Society

Automated Vehicle Task Force (CAS AVTF)

Morgan Bugbee, FCAS, MAAA

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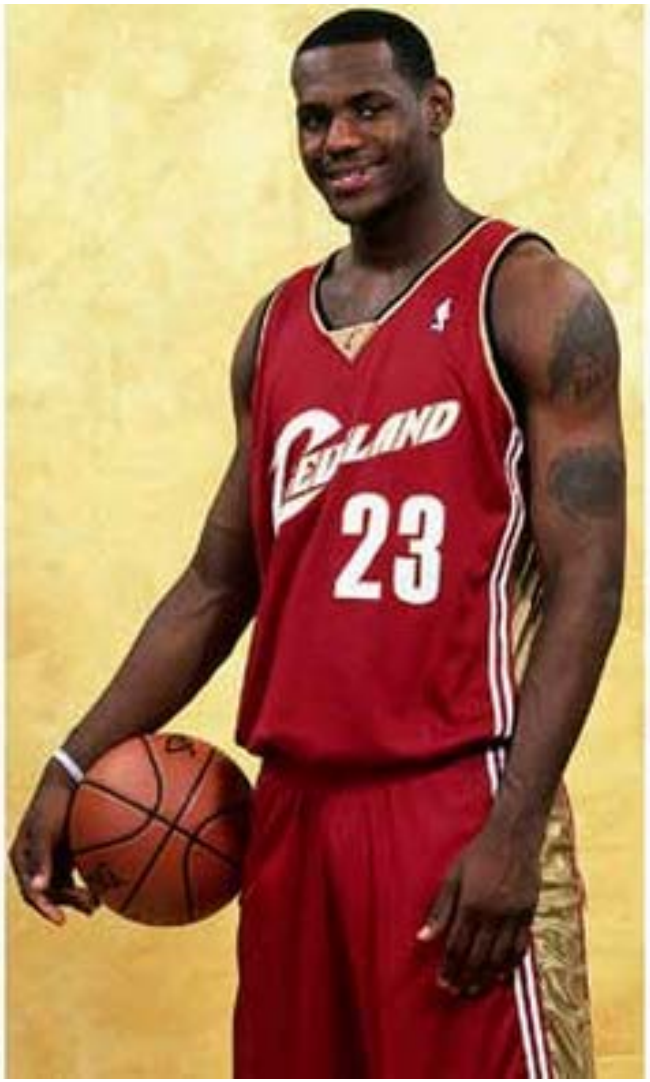
3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CAS AVTF

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: identify & quantify risks
- Post-market: accurately price the technology
- Post-claim: compensate claimants fairly & efficiently

Summary

- Automated Vehicles – Background
- Automated Vehicle Risk Profile
- Vehicle Symbol Analysis
- Regulatory Overview

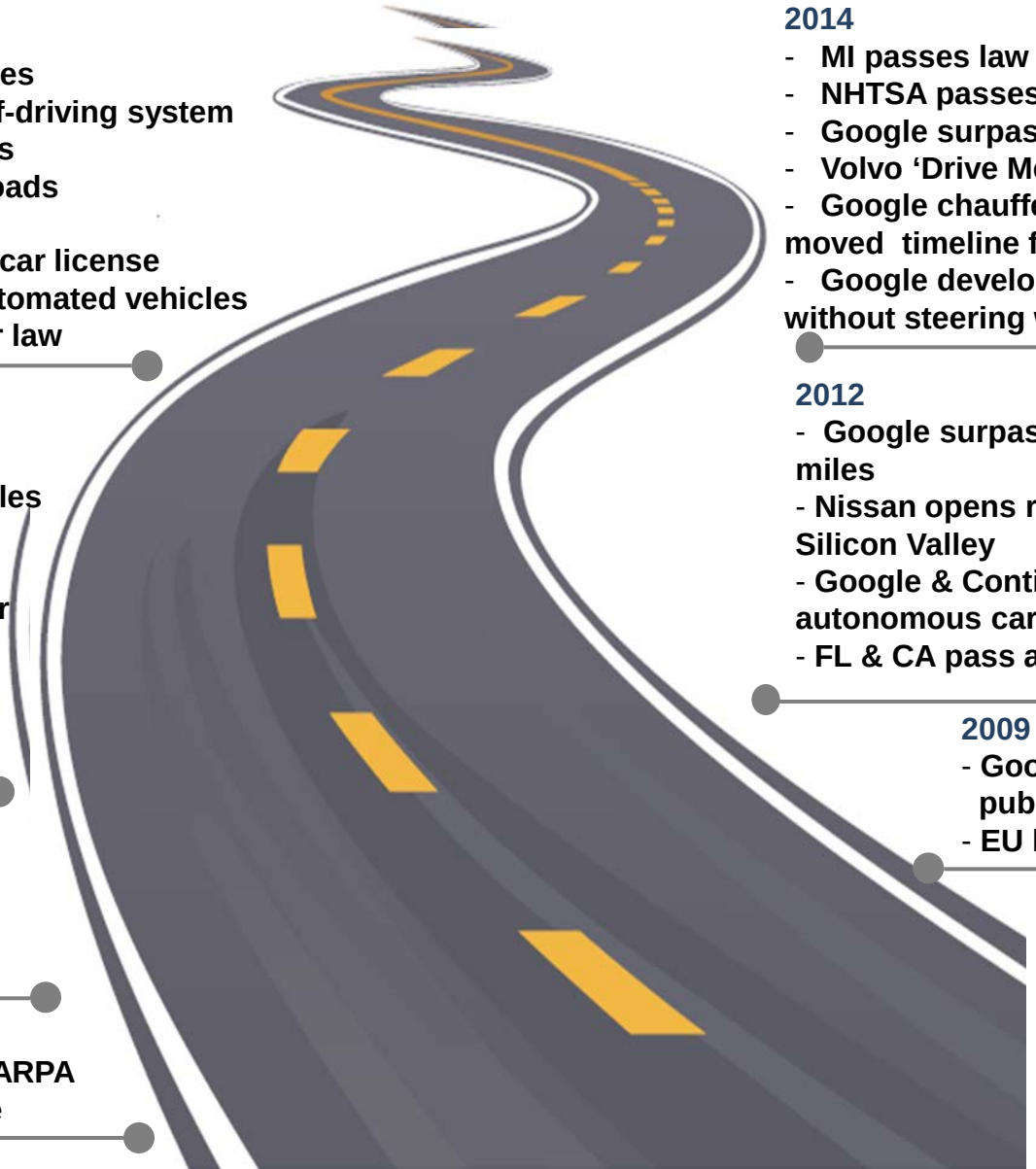
Automated Vehicles
- Background -

Enabling Technology

V2V/V2I: Stands for Vehicle to Vehicle or Vehicle to Infrastructure. Uses Dedicated Short Range Communications (DSRC), similar to wifi, to allow a vehicle to communicate to other vehicles or infrastructure (traffic signals, toll booths, etc).

LIDAR: combination of light and radar, and uses laser light to create 3D images of the surrounding environment.

Historic Developments



2013
- Google surpasses 500K miles
- Oxford creates a $7,750 self-driving system
- Britain tests on public roads
- Mercedes tests on public roads
- CMU tests on public roads
- Audi receives autonomous car license
- NHTSA issues policy on automated vehicles
- DC passes autonomous car law

2014
- MI passes law
- NHTSA passes V2V
- Google surpassed 700k miles
- Volvo 'Drive Me' tests in Gothenburg
- Google chauffeured 30 journalists; moved timeline for 2020 release
- Google developing driverless car without steering wheel or brakes

2012
- Google surpasses 300K accident free miles
- Nissan opens research facility in Silicon Valley
- Google & Continental receive autonomous car licenses
- FL & CA pass autonomous car laws

2011
- Google surpasses 150K miles
- BMW begins testing self driving car on public roads
- NV passes autonomous car law

2010
Volvo CitySafe standard

2009
- Google begins testing on public roads
- EU launches Project SARTRE

2007
CMU wins DARPA Urban Challenge

2005
Stanford wins DARPA Grand Challenge

Timeline

"An autonomous package might only add $5K - $7K to the sticker price."
– Raj Rajkumar, director of CMU's program

2020

2016

2014 *LIDAR cost ~ $8K or a few hundred dollars*

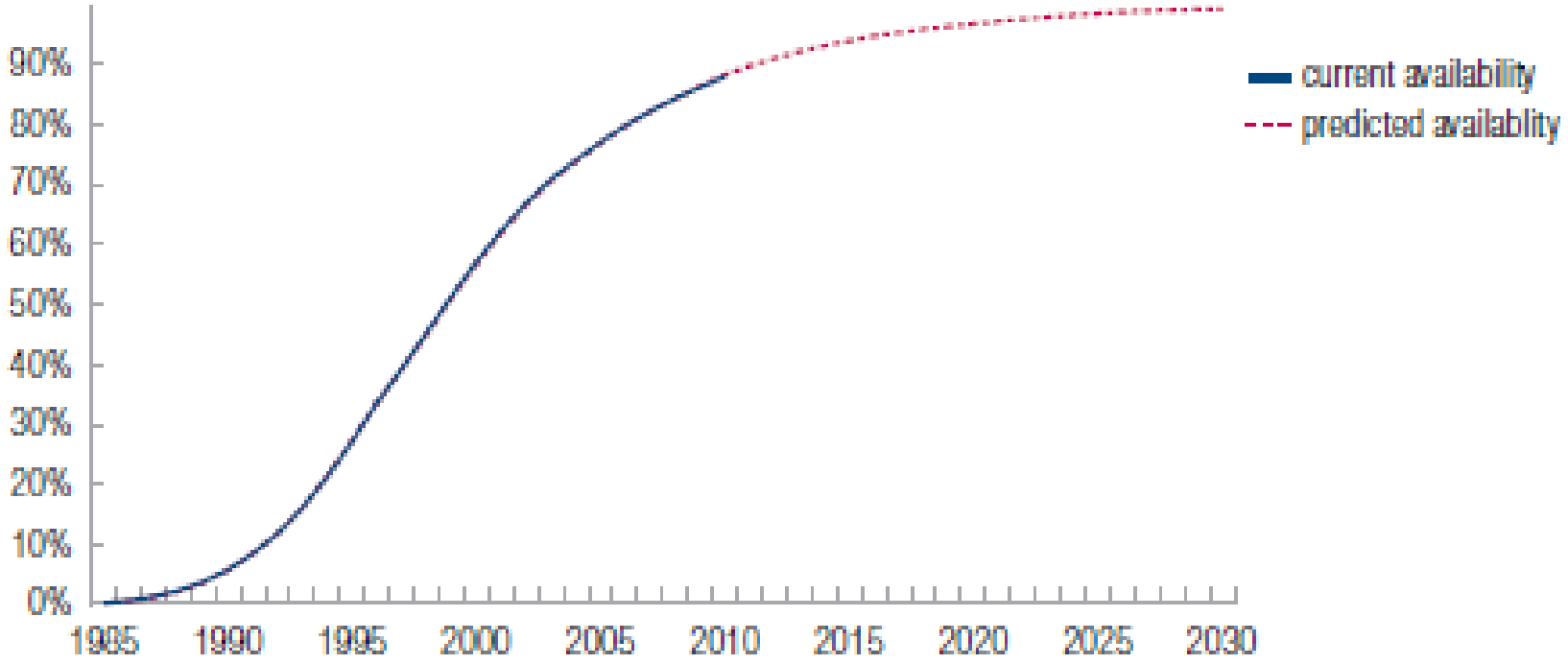
2013

"The autonomous system package will only cost around $2,500." - Audi

2005

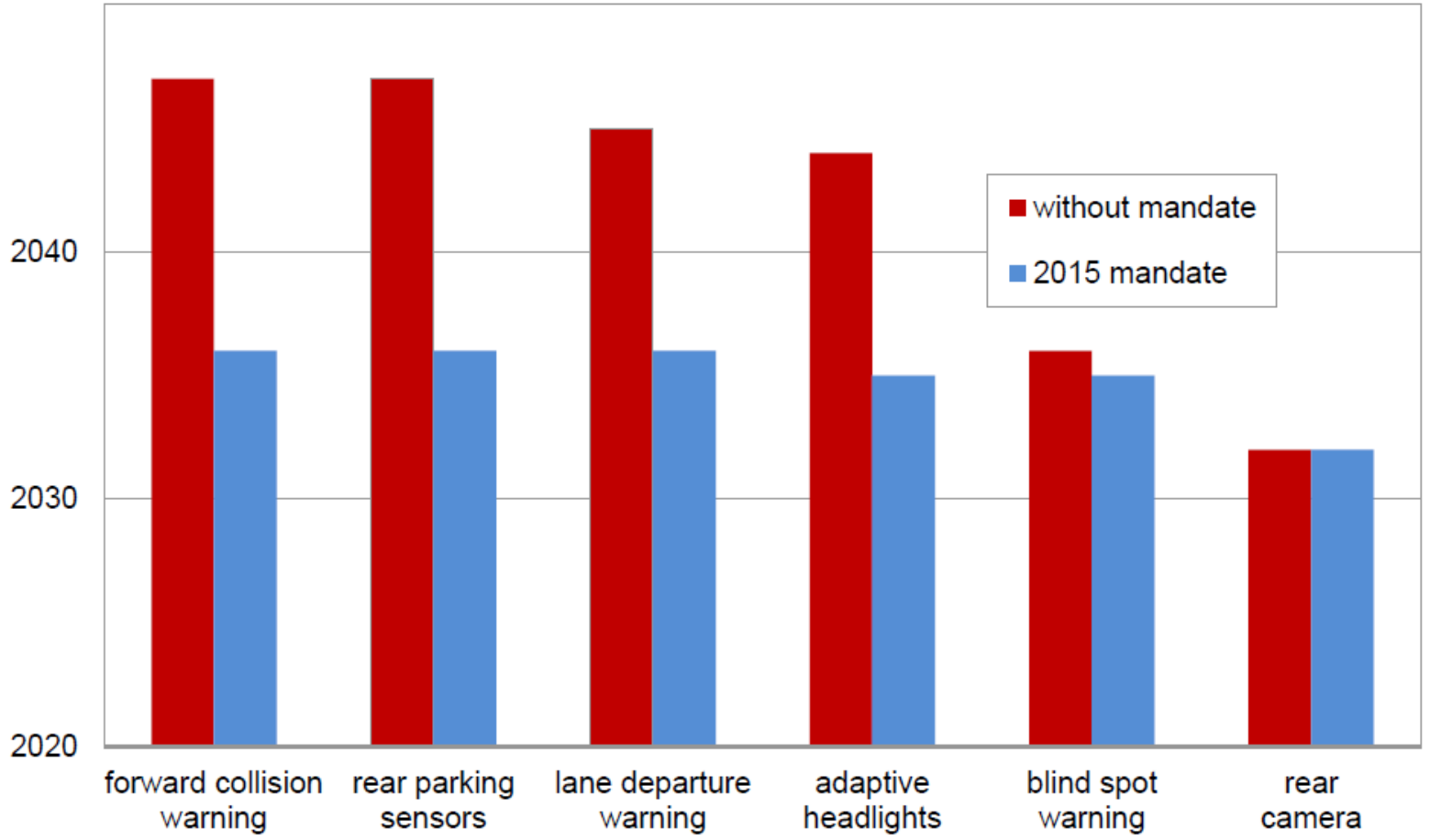
Adoption Patterns: ABS

Figure 3: Predicted percentage of registered vehicles with ABS



Adoption Patterns: Newer Technology

Calendar year features reach 95% of registered vehicle fleet with and without mandate



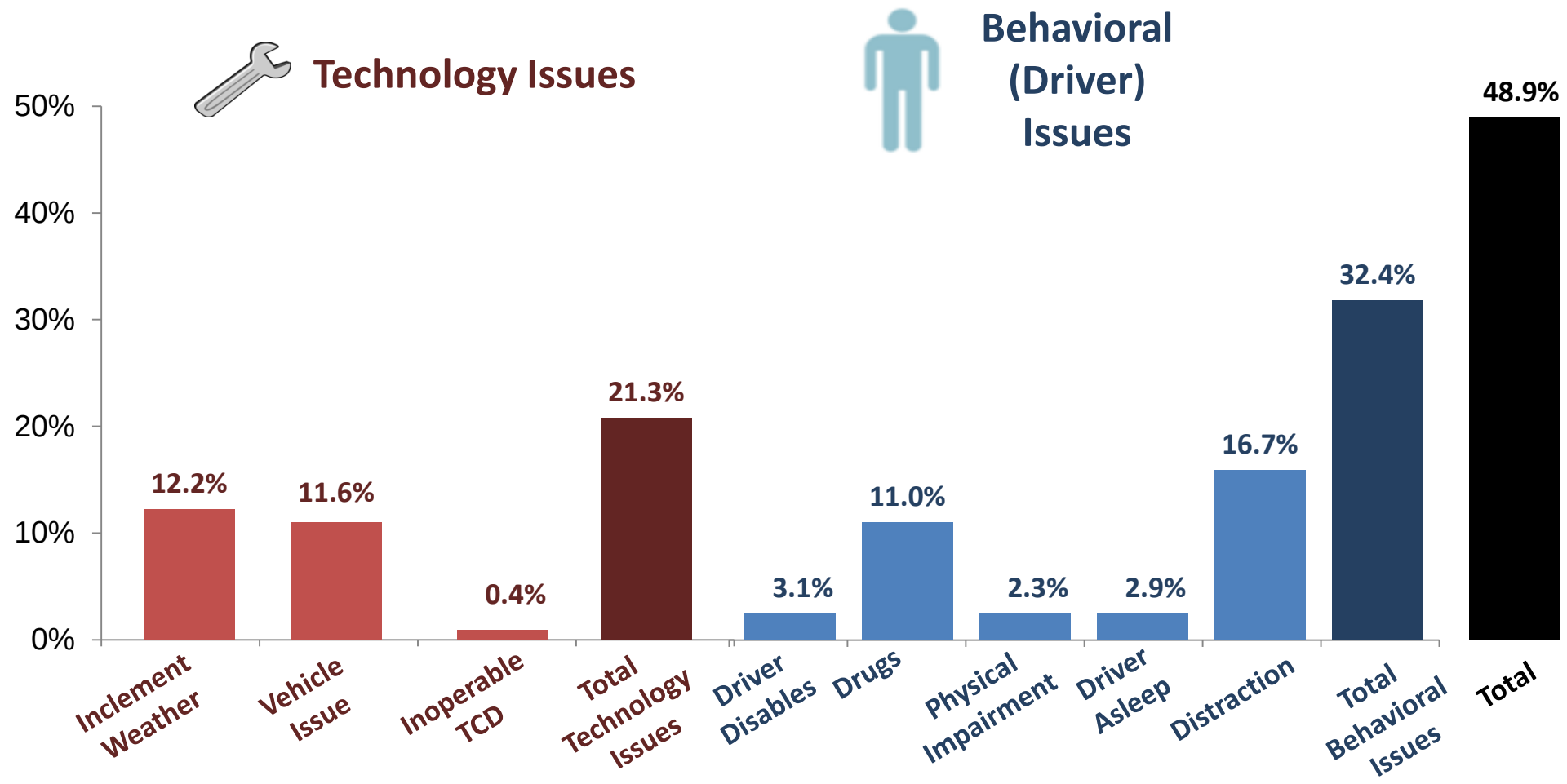
Possible Insurance Frameworks for AVs

1. Product Liability
   - Attach major liability to sellers and manufactures of the vehicle
   - Tends to be complex and expensive – as the standard to establish a defect is vague/unpredictable
2. Strict liability when an AV is at fault
   - Making the owner of the vehicle responsible when the owner's automobile is at fault
3. First party insurance
   - Similar to UM coverage, injured parties would look to their own insurers
4. A combination of above?

Automated Vehicle Risk Profile

“93% of accidents are caused by human error.”

NMVCCS – Limiting Factors



NMVCCS - Implications

- New benchmark should be calculated
  - Data is old and unrepresentative of future market
  - Human driving risks <> automated vehicle risks

- Different tests required for the different risks
  - Computer simulations can prove technology's error rate, but provide little insight into driver's actual use of technology.

- Policy changes can increase AV's safety.
  - Every 1% reduction in accidents corresponds to approx 55K fewer accidents, and $1.4 billion of economic value per yr.
  - Weigh policy's cost against policy's expected benefits (number and value of accident reduction expected to create)
  - E.g. Driver training program, Automated vehicle only lanes, Allowing the vehicles to speed.

Auto Insurance Analysis
- Vehicle Symbol -

Vehicle Symbol Calculation

Approach

- Each vehicle is grouped into an experience group.
  - Each group's experience is weighted and combined with similar vehicles
- There are two complements of credibility:
  - Vehicle's body style factor
  - Prior year factor
- Automated Vehicle Symbol calculation has two options:
  - Option 1: Assume it is a brand new vehicle
  - Option 2: Assume it is an update to a current vehicle

Vehicle Symbol Calculation

- Option 1: rate AV as brand new vehicle (no prior year factor)
  - e.g. Mercedes introduces a new fully automated vehicle
  - Growth trend impacts credibility

Vehicle Symbol Discount						
# of Exposures	Year	Loss Attenuation 0%	25%	50%	75%	100%
2,500	1	0.0%	0.5%	0.9%	1.3%	1.8%
5,000	2	0.0%	1.4%	2.6%	3.9%	5.1%
7,500	3	0.0%	2.8%	5.1%	7.4%	9.7%
10,000	4	0.0%	4.4%	8.0%	11.6%	15.2%

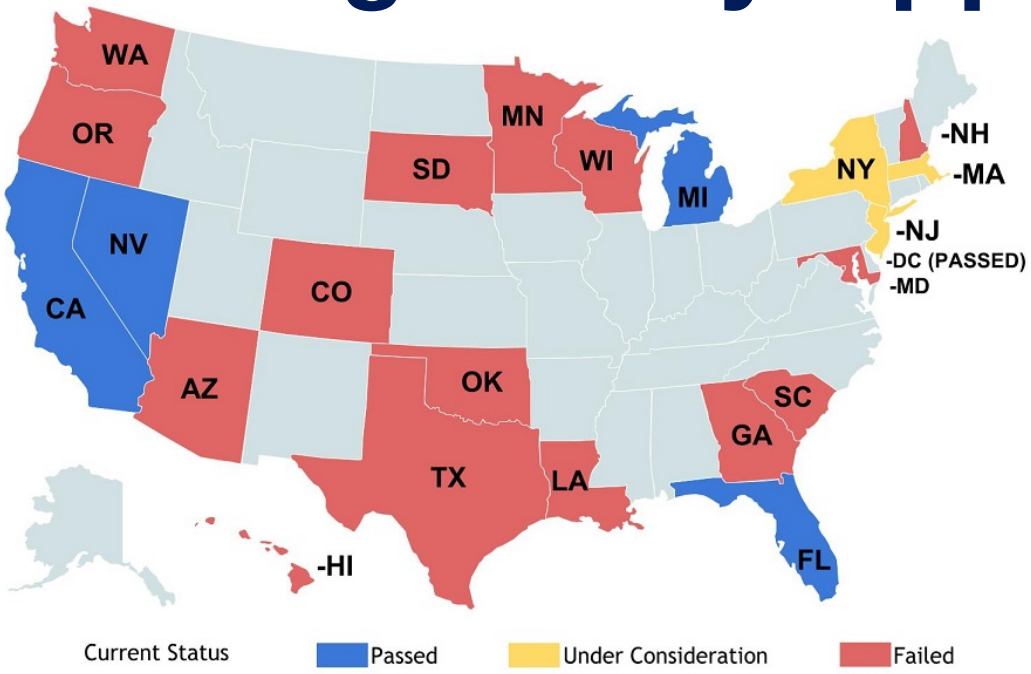
Vehicle Symbol Calculation

- Option 2: rate AV as current vehicle (actual exposures)
  - e.g. all new Honda Civics sold with AV equipment

Averge 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%

Regulatory Overview

Current Regulatory Approach



- **States**: NV, CA, MI, FL and DC have regulations that permit the operation/testing of autonomous vehicles.
- **NHTSA**: In May 2013, published a statement with guidance to states on autonomous vehicle regulations. Statement also outlined NHTSA plans for testing autonomous vehicle technology.

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

Auto Manufacturer Regulations

Consumers protection against auto manufacturer error

- NHTSA establishes regulations that manufacturers must self-certify with.
- State regulators can impose additional requirements
- Individuals can sue manufacturers if an error occurs

- What happens if automobile accident risk shifts entirely to manufacturers?

Regulatory Approach
- Need for change -

- Insufficient protection for consumers and manufacturers
  - Dawson vs. Chrysler
  - Tusary Park
- NHTSA not large enough to take over for auto insurance industry.
- NHTSA lacks the same financial incentive insurance companies have to accurately evaluate & monitor risk.
- Different claim
- Manufacture

Compensating claimants fairly and efficiently is a core competence of the insurance industry.

Next Steps

Studies

- Pre-market: identify and quantify risks to improve the technology's safety and speed to market
- Post-market: ensure the product is priced accurately
- Post-claim: ensure claimants are compensated fairly and efficiently

Questions and Discussion

NMVCCS - Application

	Major Risks	Risk Minimization	NYC Taxi
NMVCCS	• Weather	• Tech/Location/Invest	• Road magnets
	• Vehicle Issues	• Regular maintenance	• 3 inspections per yr
	• Inoperable Infrastructure	• Restrict location/ Investment	• Avg trip 2.6 miles
	• Driver Issues	• Remove driver	• Increases profit $38K
OTHER	• Old Technology	• Mandate software updates	• Manufacturer owns fleet
	• Animal hits	• Restrict location	• Minimal risk
	• Unavoidable Accidents	• Limit speed	• 25 mph speed limit 9.5 mph avg speed

Economics

Costs	NYC Taxi	NYC Uber - AV
Vehicle	$30,000	$125,000
Medallion	$1,000,000	$0
Total Startup	**$1,030,000**	**$125,000**