



Automated Vehicles & the Insurance Industry

- **Mike Stienstra, FCAS**

2014 CANE – Sturbridge, MA



Overview

- **Safety:**

- Are these vehicles safe? / What should the safety standard be?



What should we do?



- **Liability:**

- Who is liable in the event of an accident? / How should we assign liability?

Collaborate with automakers, state & federal regulators and other insurance companies to create a robust & transparent

testing and risk management structure that brings the

- **Today's regulations:**

WE DON'T KNOW

Tomorrow

technology to market as safely and efficiently as possible.

- What regulations should govern the testing and driving of these cars?

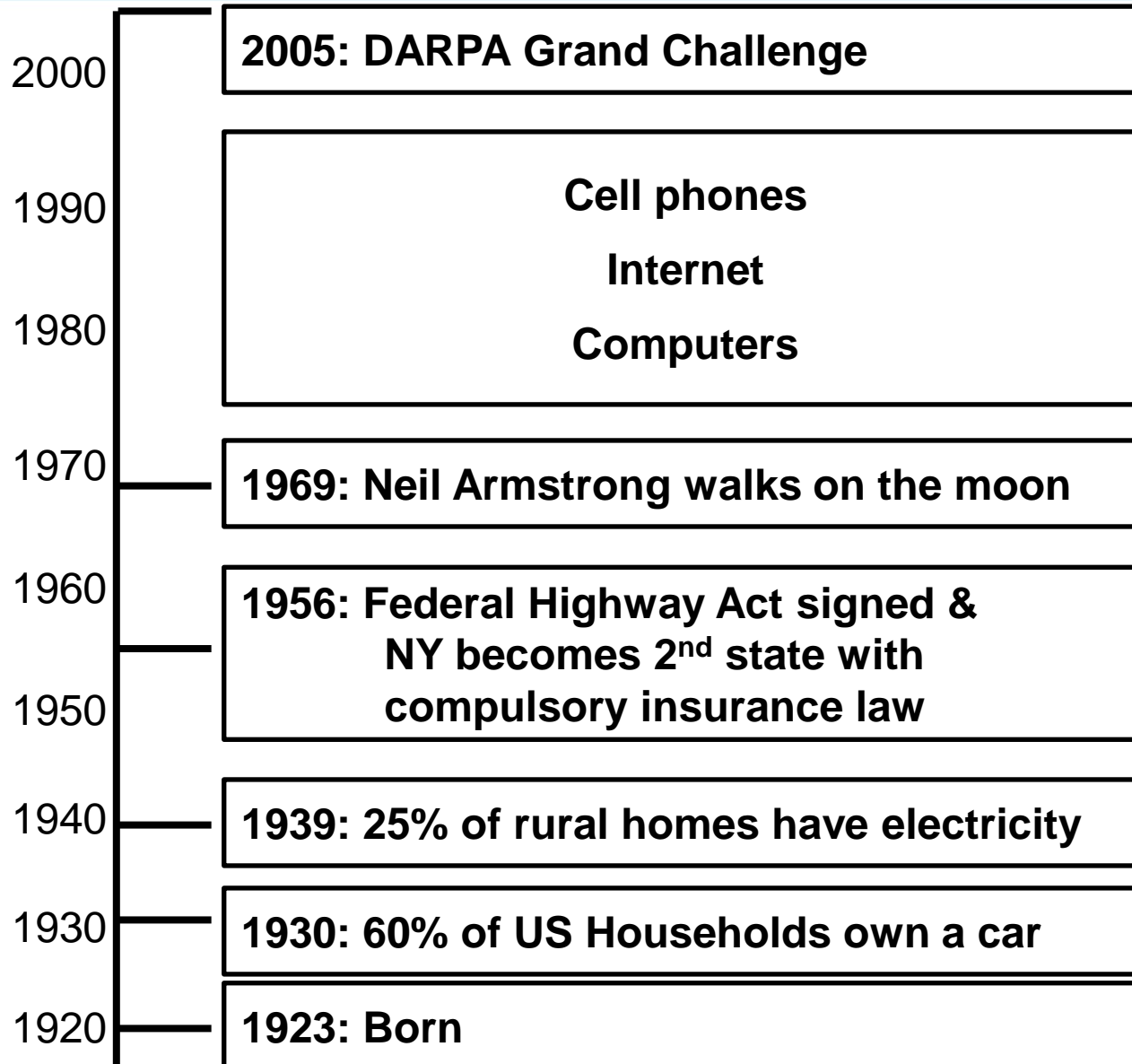
Background

- What's going on? -



QBE

Historical Context



Automated Vehicle Developments

2013

- Google surpasses 500K miles
- Oxford creates a \$7,750 self-driving car
- 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

2011

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

2010

Volvo CitySafe standard

2007

CMU wins DARPA Urban Challenge

2005

Stanford wins DARPA Grand Challenge

5

2014

- MI passes law
- NHTSA passes V2V

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

2009

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

Automated Vehicle Timeline

2020



2016

2014

\$250,000

2013



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

NOKIA



2005

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



TOYOTA



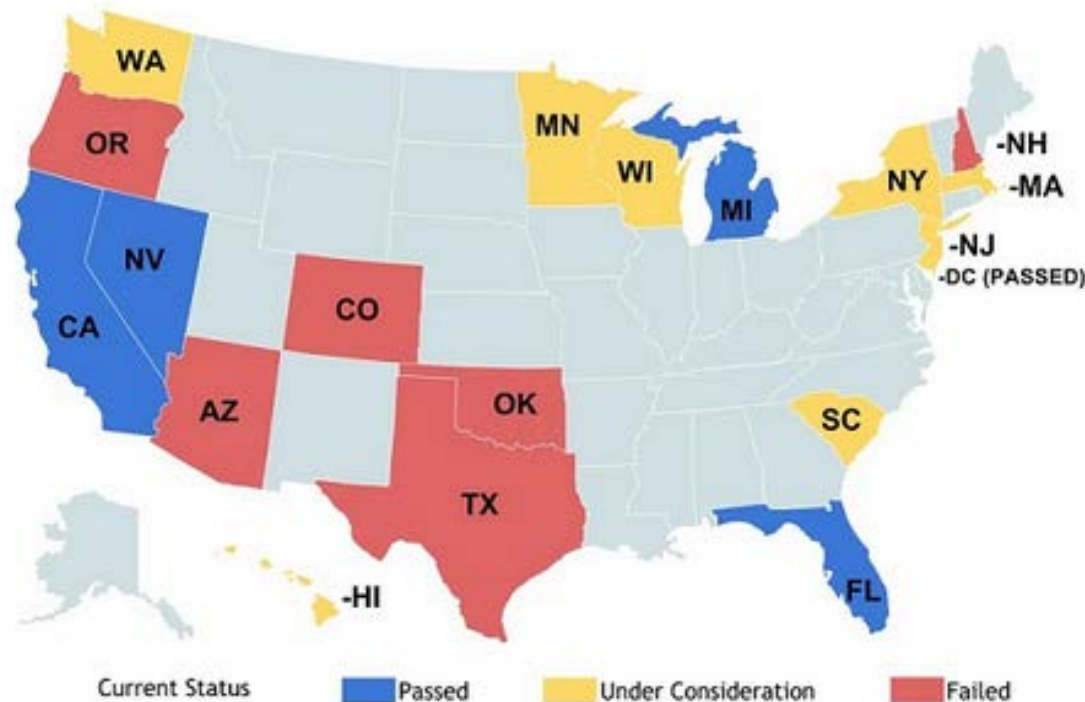
Regulatory Advancements

- States – piecemeal legislation being passed

- NHTSA:
 - 5/31/13 – Prelim Policy
 - 2014 – V2V Policy

- Congress
 - Senate: 5/15/13
 - House: 11/19/13

- International
 - Australia, Canada, China, Germany, India, Israel, Japan, Sweden, UK



Importance

- Why should we care? -



QBE

Importance

Actuarial responsibility

We are responsible for coming up with a rate that is not inadequate, excessive, or unfairly discriminatory.

Societal responsibility

The technology has the potential to dramatically transform our world, making transportation cheaper, cleaner, and quicker.

Actuarial Responsibility

We are responsible for coming up with a rate that is not inadequate, excessive or unfairly discriminatory.

- Past <> Future: Represents a fundamental change in relationship between driver & vehicle.
- Complex: Technology produces 750MB of data per minute
- Heterogeneous: Different products perform differently
- Black Box: Cannot readily discern differences
- Outside influence: Outside interests may put pressure on rates
- Consequences of failing to match price to risk

Florida Homeowners Market

Accurately matching premium to risk

What if current homeowners' premiums were charged at the onset of building?

- Fewer homes built and sold in risky areas
- Actual buyers' costs more stable over time
- With fewer homes and businesses along the coast, FHCF's capital inadequacy poses less of a risk

- Need all companies to recognize risk and charge adequate premiums.

MBS's & CDS's

Potential Benefits

- Allow underprivileged to become homeowners
- Allow banks to increase profit while minimizing risk
- Help the housing sector grow the economy

Credit Agencies

- Trusted model that required new mortgages to be written similarly to old mortgages

AIG

- Trusted the credit agencies' rating

Comparison to MBS's

Inadequate testing, reporting and risk control measures can transform a safe product into a risky one.

MBS

- Tremendous societal benefits
- Complex risk with little transparency
- Built in fail-safe
- “No way that MBS's can be riskier than a single home loan”

Automated Vehicles

- Tremendous societal benefits
- Complex risk with little transparency
- Built in fail-safe
- “No way that automated vehicles can be riskier than human drivers.”

Societal Responsibility

By making transportation safer, greener, cheaper & more efficient, automated vehicles can:

- Dramatically reduce automobile accidents
 - › Annual Deaths: 30K American & 1.2 million worldwide
- More efficient use of infrastructure
 - › Platooning can increase highway capacity by 500%
 - › US Highway Trust Fund set to go bankrupt 2015
 - › China & India require massive infrastructure improvements
- Fewer emissions
 - › Platooning can increase highway fuel efficiency by 20%
 - › Reducing accident frequency enables lighter materials to be utilized
- Increase mobility for elderly, impaired & poor
 - › Car sharing can decrease cost of mobility, increasing transportation options for poor.

Issues

- What are the risks? -

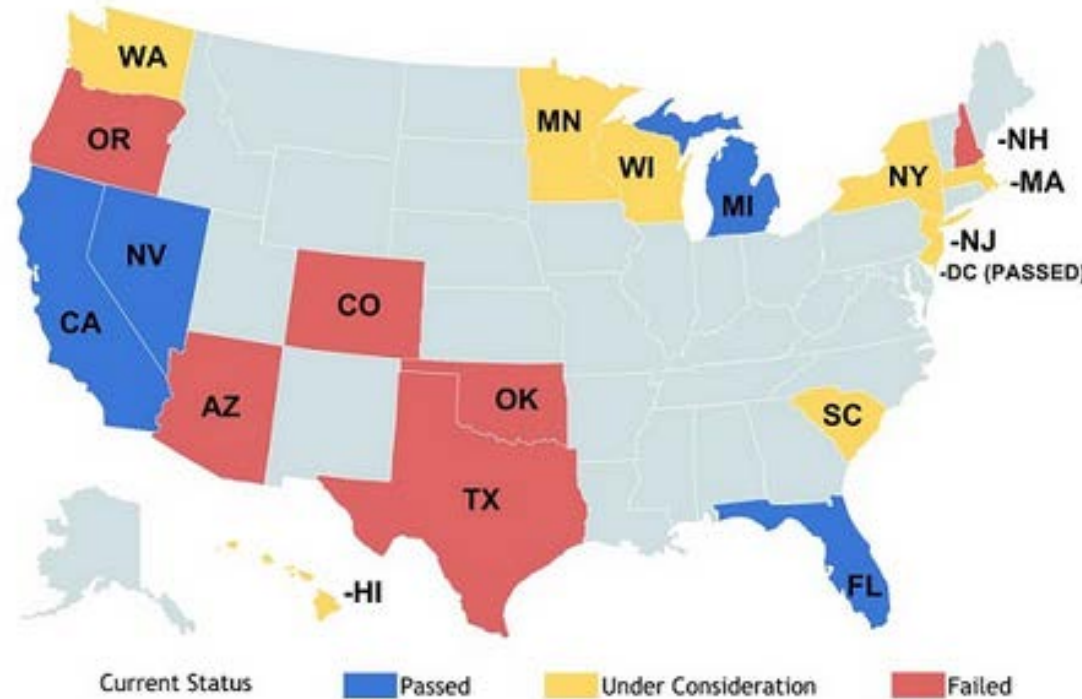


Current Approach

- States – piecemeal legislation being passed

- NHTSA:
 - 5/31/13 – Prelim Policy
 - 2014 – V2V Policy

- Congress
 - Senate: 5/15/13
 - House: 11/19/13



Current approach: General Issues

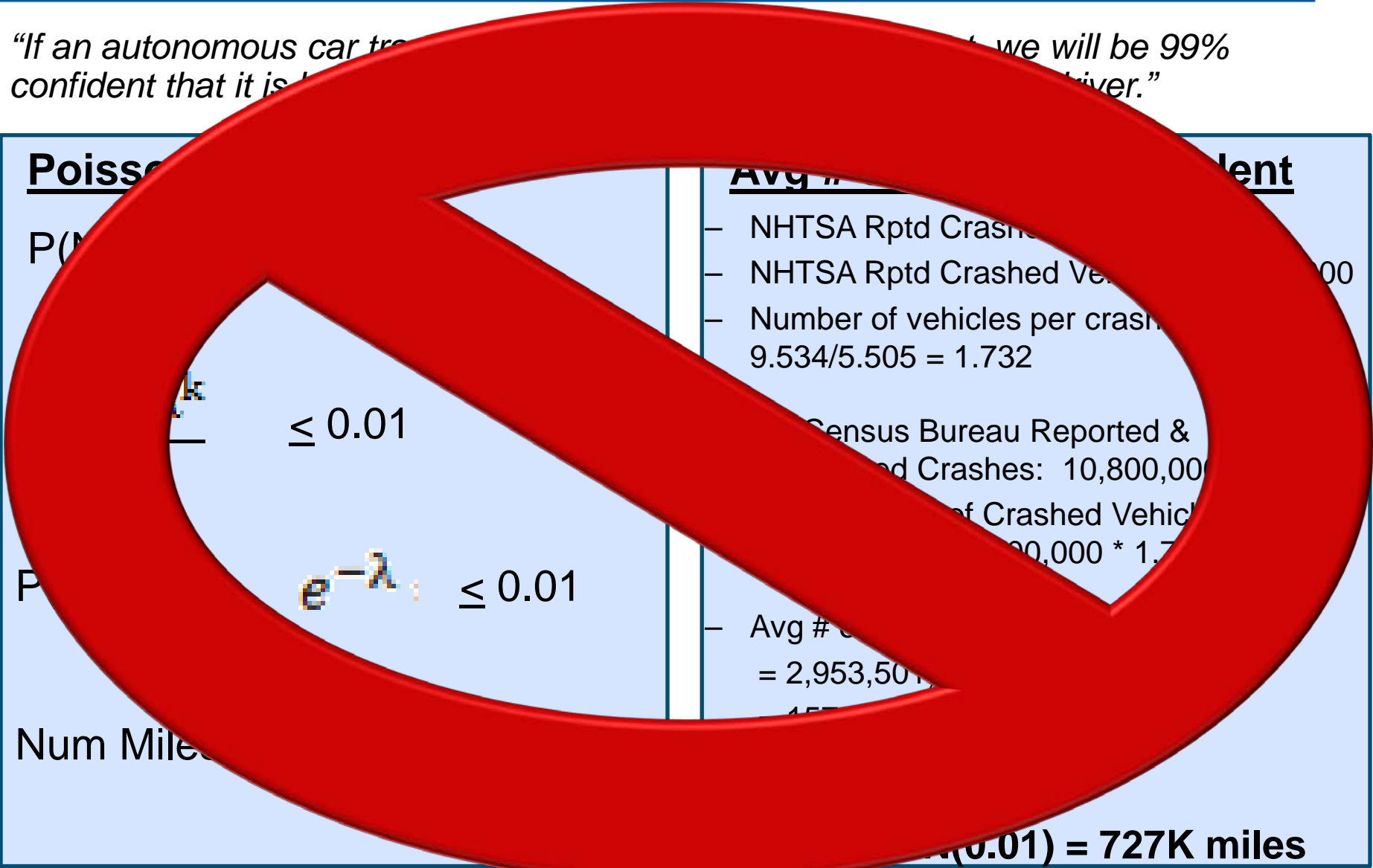
- **Lower product safety**
 - Less transparency
 - Inconsistent standards between states & companies
 - Misunderstanding of risk
 - Encourages risky behavior
 - Inadequate oversight
- **Higher testing costs**
 - 51 separate regulatory codes
 - Duplicate tests required
- **Higher adoption costs**
 - High levels of uncertainty
 - Auto insurance premiums unchanged
 - GL/PL insurance unavailable or unaffordable

Current Approach: Specific Issues

- Safety standard
- Automobile accident causation

Safety Standard: 727K miles

"If an autonomous car travels 727,000 miles, we will be 99% confident that it is safe for a human driver."



Poisson	Avg # Crashes	Percent
$P(X \leq k)$	– NHTSA Rptd Crashes	
≤ 0.01	– NHTSA Rptd Crashed Vehicles	100
	– Number of vehicles per crash	
	$9.534/5.505 = 1.732$	
	– Census Bureau Reported & Estimated Crashes: 10,800,000	
	– Number of Crashed Vehicles	
	$10,800,000 * 1.732$	
	– Avg # Crashes	
	$= 2,953,500$	
	–	
Num Miles		
		$(0.01) = 727K \text{ miles}$

Accident causation

*“Human error contributes to 93% of automobile accidents” <>
“Automated vehicles will reduce accidents by 93%.”*

Accurate understanding of risk necessary for:

- Infrastructure investment decisions

Weather: - Does not work in bad weather

Tech Issues

- Potential insurance reductions

Bad roads: - Deletions & clear road markers required

-> Will not prevent all “human error” accidents

- Societal benefit valuation

- Risk management actions

Speeding: - Is speeding an error or a choice?

Usage Issues

Alcohol: - Will a 95% system encourage D&D?

-> Accident reduction depends heavily on product's usage



Insurance Industry's value

- More detailed accident data & models
- Risk management expertise
- Best understanding of 51 different state driving regulations
- Best understanding of products liability & general liability
- Financial incentive to decrease losses
- A commitment to charge rates that are not excessive, inadequate or unfairly discriminatory

Action Plan

- When should we act? –**
- What should we do? –**



When to Act?

Price Self Driving Cars

T E S T S

- Price explanatory factors
 - Determine explanatory factors
 - Account for process risk
 - Overcome unknown
-

Set up testing
regulations &
data requirements

What should we do?

- **Should help answer these questions:**
 - Are these vehicles safe? / What should the safety standard be?
 - Who is liable in the event of an accident? / How should we assign liability?
 - What regulations should govern the testing and driving of these cars?

Collaborate with automakers, state & federal regulators and other insurance companies to create a robust & transparent testing and risk management structure that brings the technology to market as safely and efficiently as possible.

Industry solution

- Increases influence
- Increases tests' strength & validity
 - › McCarran-Ferguson Act
- Protects against uncompetitive pricing
 - › **CAS Task Force on Automated Vehicles**

Questions

Additional Sources

NEWS

- www.Highwaysandhorizons.com
- www.DriverlessCarHQ.com – follow on FB
- www.motorauthority.com
- Google alerts

Gov't Groups

- Senate Committee on Transportation – Sen. Rockefeller III
- House Committee on Transportation – Rep. Shuster
- House Subcommittee on Highways and Transit – Rep. Petri
- National Highway Traffic Safety Administration

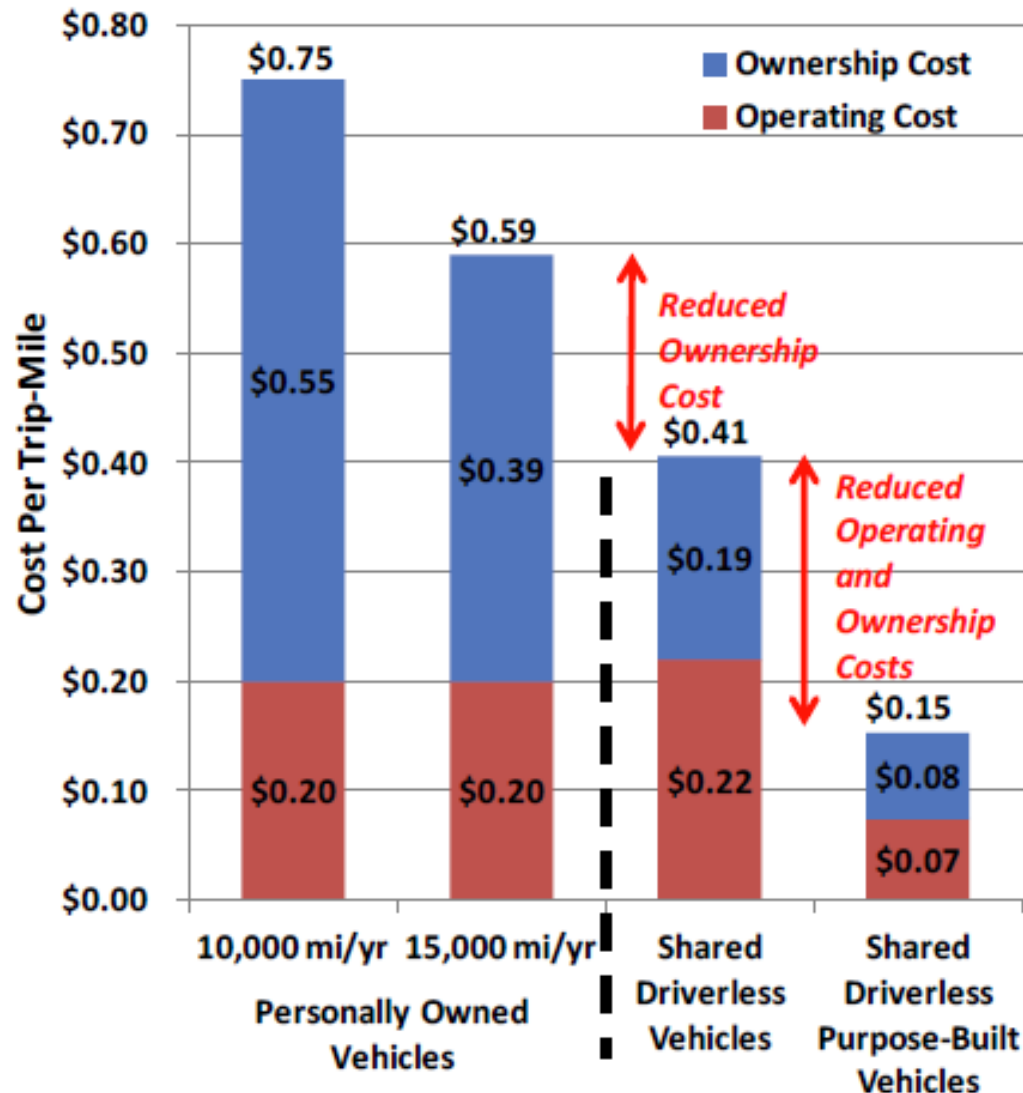
Other Groups

- Center for Automotive Research (CAR Group)
- IIHS & HLDI
- SAE International
- ENO Center for Transportation

Benefits



Reduce transportation costs

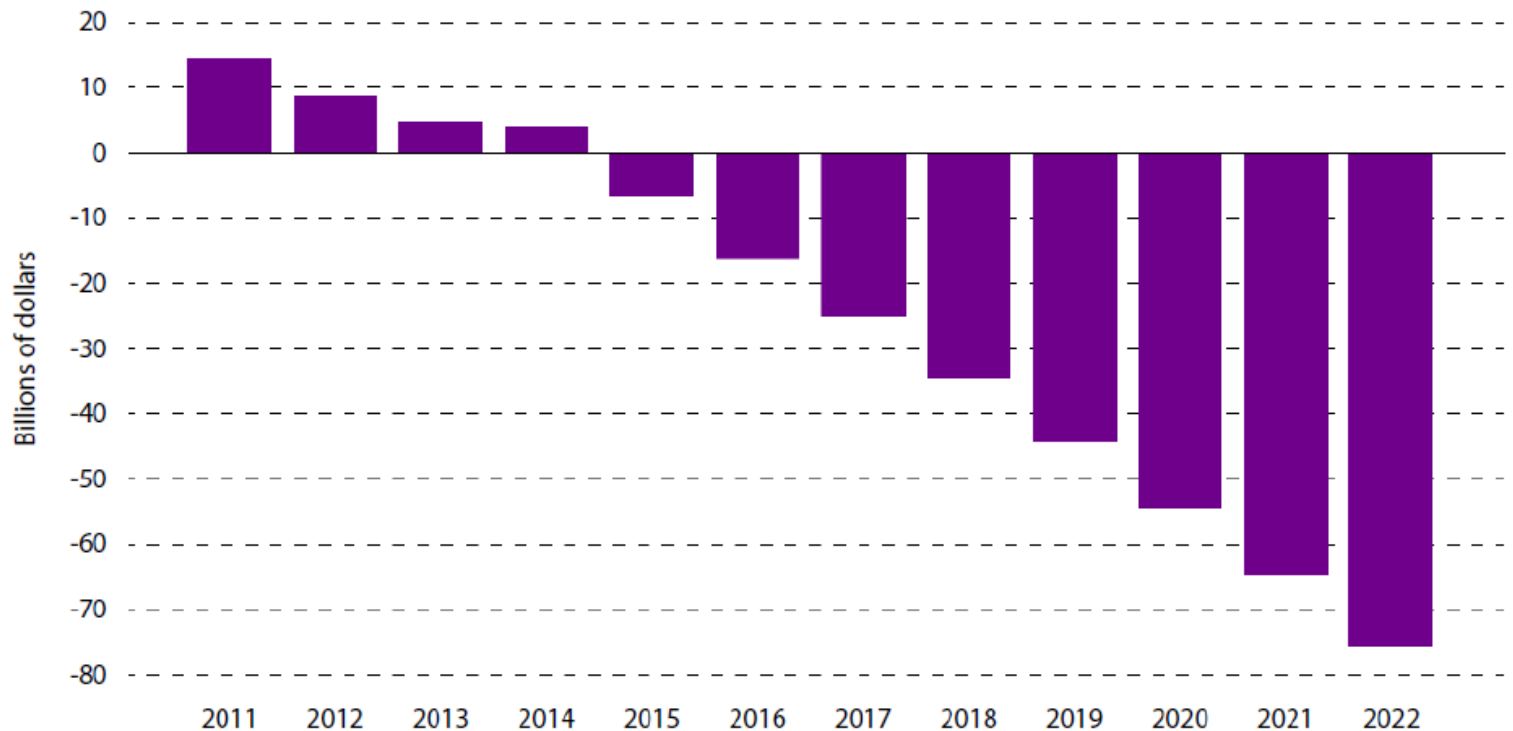


- A shared, driverless vehicle fleet can provide the same mobility as personally owned vehicles at far less cost
- Cost/trip-mile could be reduced by 80% compared to a personally owned vehicle driven 10,000 miles/yr
- Reduced parking costs and the value of time not spent driving would further increase these benefits

Infrastructure Issues

- 25% of urban roads are in poor condition
- Poor road quality costs drivers \$335 to \$746
- Infrastructure spend should be increased to \$166 bill from \$75 bill

Highway Trust Fund Projections





Greener

- Increase highway fuel efficiency by 20%
- 40% of fuel in cities is wasted looking for parking
- Reduce stop & go traffic
- Reduced accident risk allows vehicles to be lighter
 - › Lighter vehicles key for dramatic improvement needed

Greener – How power is generated

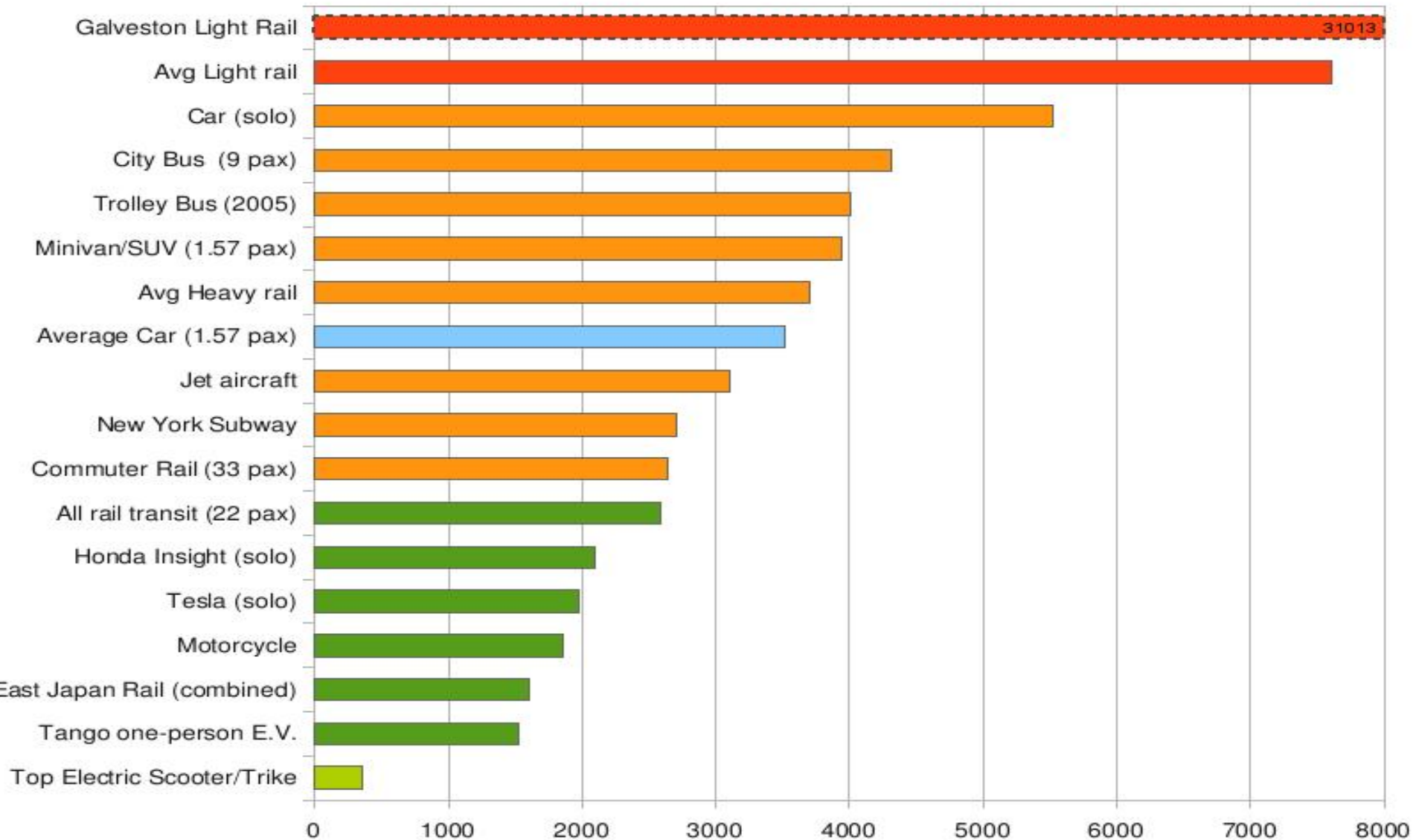
Gas Automobile

- Oil pumped from ground & transported to factory
- Refinery turns oil into gas, ships to gas station
 - › 82% of well energy makes it to gas station
- In car, gas burned to turn engine.

Electric Vehicle/Train

- Coal mined from ground & shipped to power plant
- Fuel burned
 - › DoE estimates plants are 40% efficient turning coal into energy
- Electricity sent over wires & then into electric battery
 - › Approx 7% energy lost
- Electric motor powers motor with minimal loss
- **Really run on 50% coal, 18% natural gas, 20% nuclear & some renewables**

Greener



Adoption Impact



Adoption trends

Long time

- 30 year adoption curve for ABS & Airbags
- Vast technological improvements needed
- Infrastructure improvements may be required
- May be too expensive
- Cars run longer
- Liability questions
- People like to drive
- Afraid of the unknown
- Lobbyists: \$2 trillion of industry depends on people driving cars (municipality tickets, taxi drivers, etc..)

tom lines?

**PERCENTAGE
ED VEHICLES
L AIRBAGS**

liability
availability

2020 2025 2030

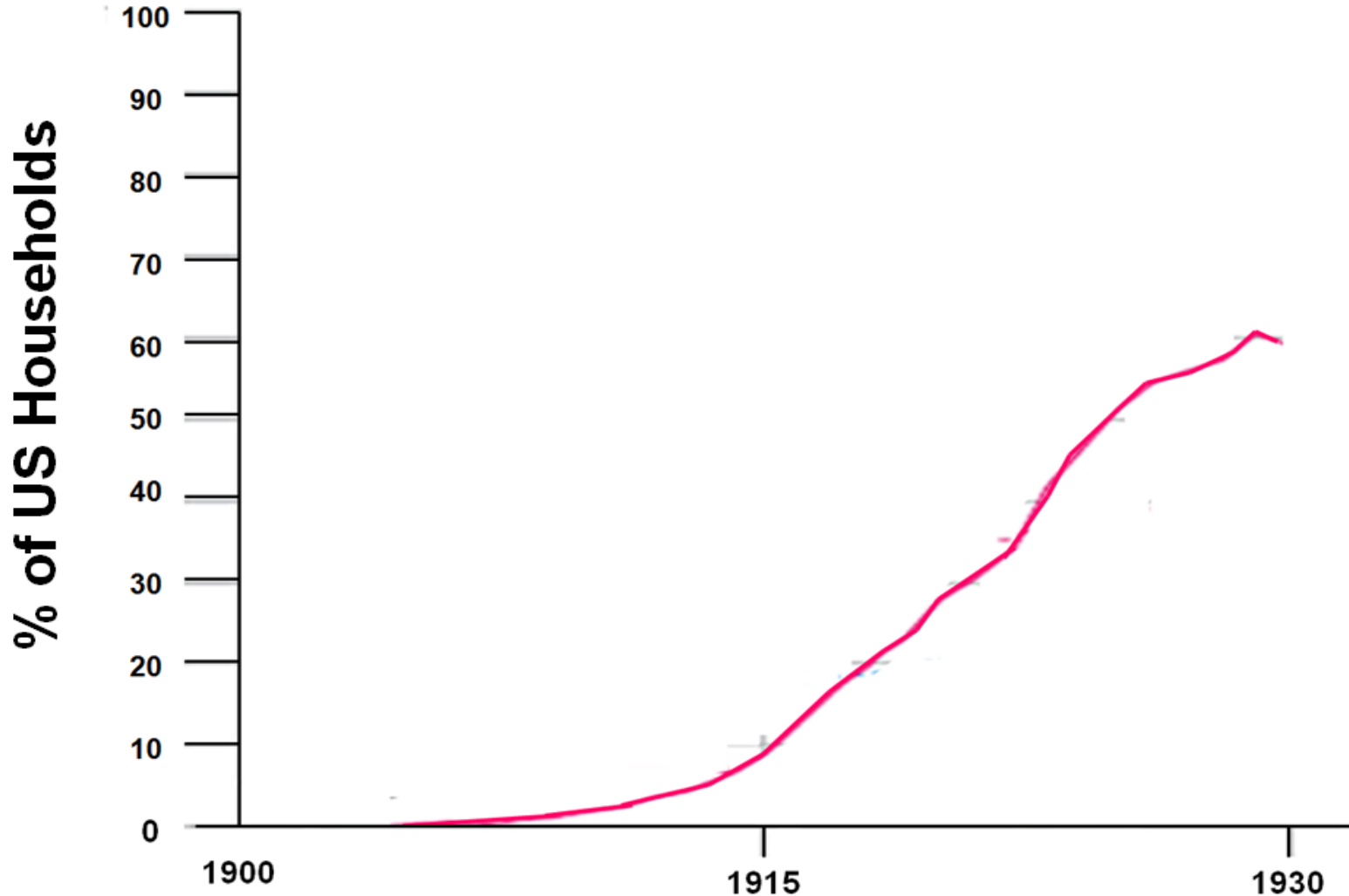
Adoption trends

Two issues:

1. Assumes the answer to “*when should we act*” is “*when automated technology reaches XX% of registered vehicles.*”
 - › Market will be established
 - › Liability will be clearly defined
 - › Reporting requirements will be clearly established
 - › Insurance industry’s influence will be minimal
2. Risk management
 - › Concern ourselves with the chance that something bad will happen
 - › Likelihood that adoption could reach critical mass before expected

Adoption trends

Car Ownership



Adoption trends

Rapid adoption

- Critical mass could be reached at 25%

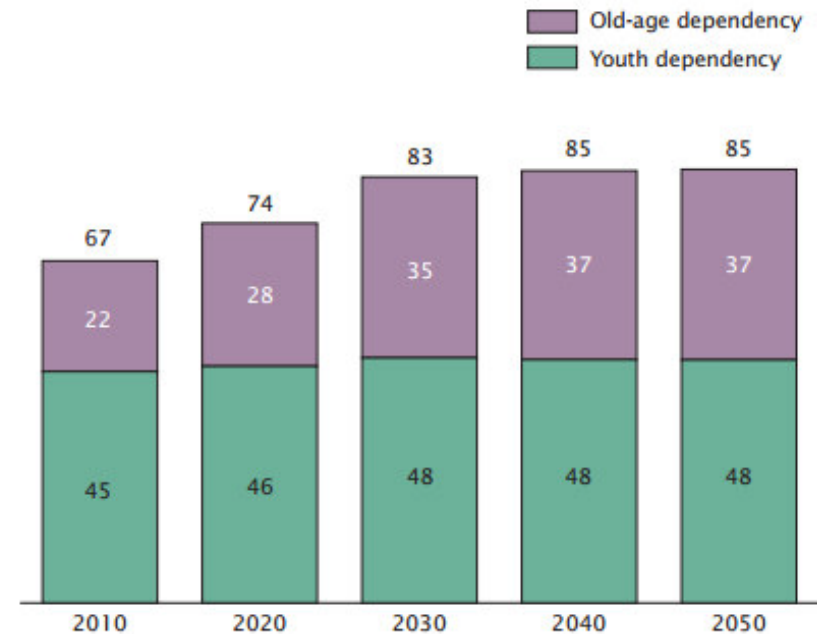
- Demand driven by elderly & young
› 2030: 2X as many old/young as in between (20-65)

- Government intervention
› International competition
› Dramatic growth reduces debt
› Reducing weight only way to produce “gre
› New mileage standards in 2025
› Reduce infrastructure spending



Less
Conges
Fewer
Accide

Figure 2.
**Dependency Ratios for the United States:
2010 to 2050**



Note: Total dependency = ((Population under age 20 + Population aged 65 years and over) / (Population aged 20 to 64 years)) * 100.

Old-age dependency = (Population aged 65 years and over / Population aged 20 to 64 years) * 100.

Youth dependency = (Population under age 20 / Population aged 20 to 64 years) * 100.

Source: U.S. Census Bureau, 2008.

Tort Reform for Vaccines



Vaccine Injury Compensation Act

**1970 to early
1980's**

**Crisis in Vaccine
Production in the US
caused by increased
litigation against
manufacturers along
with high product
liability insurance costs**



1986

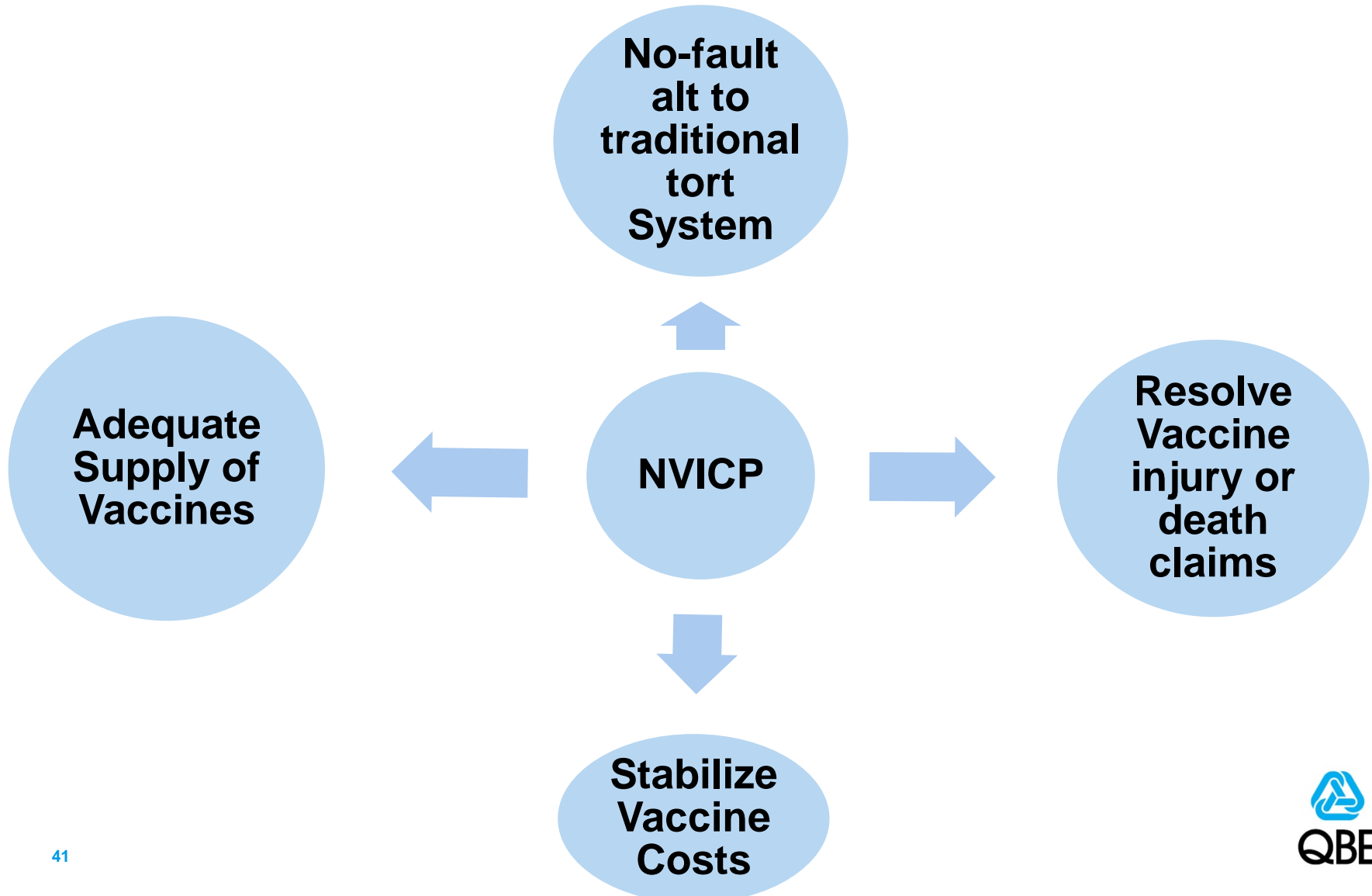
**National Childhood
Vaccine Injury
Compensation Act
(NCVIA) Passed**



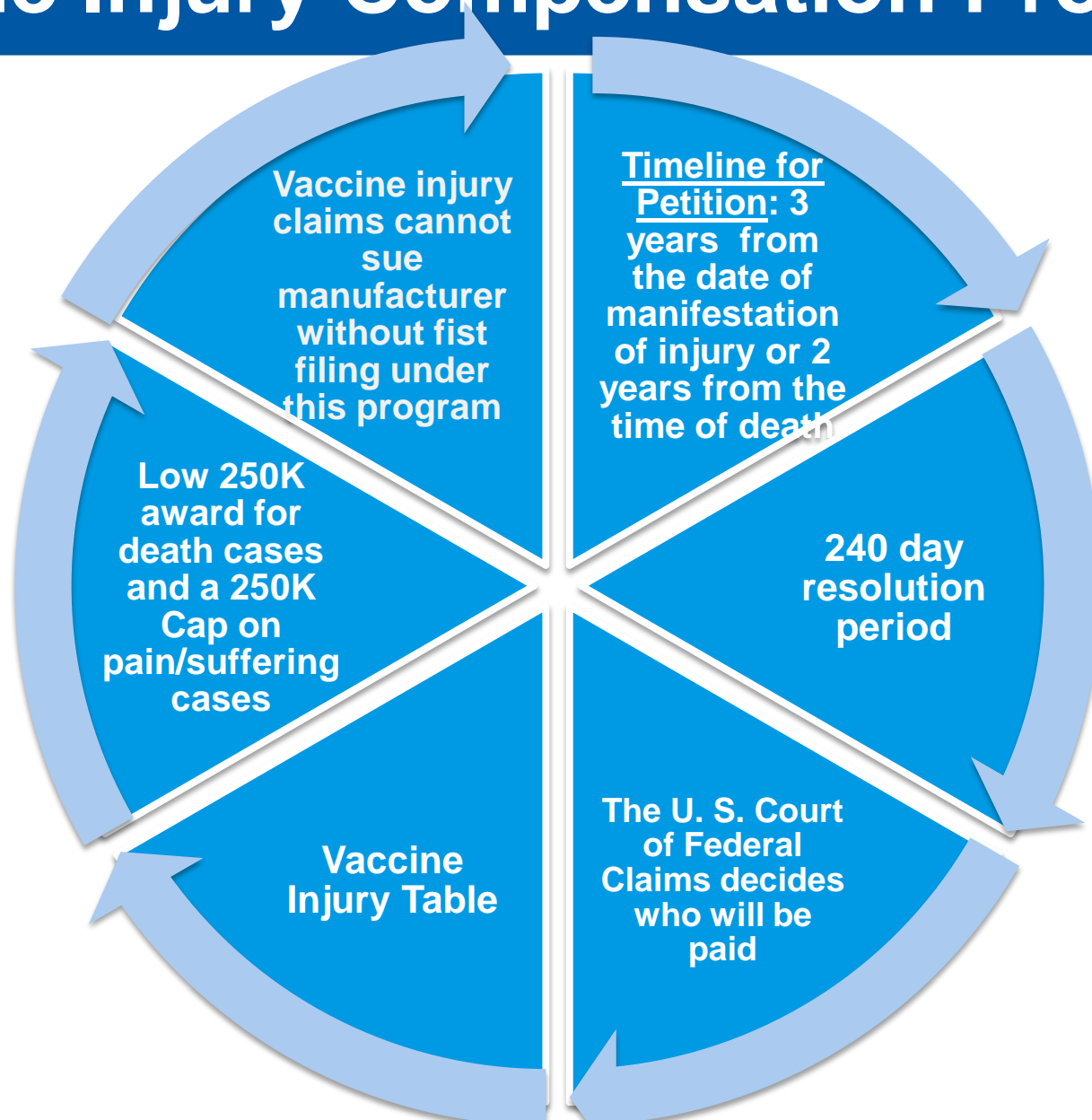
1988

**National Vaccine Injury
Compensation Program
(NVICP) took effect**

Vaccine Injury Compensation Program



Vaccine Injury Compensation Program



Vaccine Injury Table

VACCINE INJURY TABLE

Vaccine	Illness, disability, injury or condition covered	Time period for first symptom or manifestation of onset or of significant aggravation after vaccine administration
---------	--	--

Illustration

- From original 10 vaccines to 19 vaccines being covered in today's context.
- Challenges Today:
 - 1989 to 1992: 90% Petitions files asserted Table Injuries
 - 2007-10: 90% of the Petitions assert only **non-table injuries**
 - As a result, the program has become a slower and adversarial process compared to the initial intention of “fast, informal adjudication.”

Vaccine Injury Compensation Program

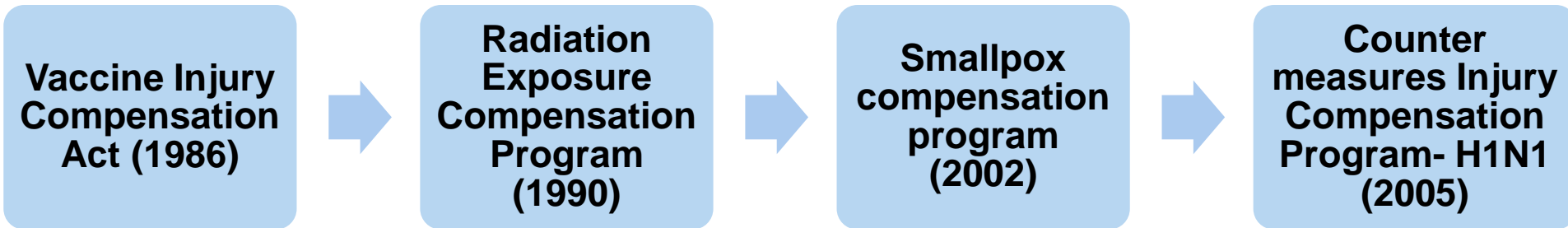
Vaccine Injury Compensation Trust Fund est. Oct, 1988

Funded by \$0.75 excise tax paid by the citizens (as part of vaccine costs), on each dose of a vaccine made

Monetary damages for vaccine injury victims, as well as attorneys' fees and costs, are paid by the trust fund

As of Feb'14, Fund stands at US\$ 3+ Billion.

Other similar federal programs



- Overall intention has been to reduce uncertainties around product liability insurance and related costs which are potential barriers to entry for such industries.
- On the whole, while such programs have protected the industry (manufacturers/doctors/healthcare providers) to a large extent (*supporting numbers not available at present*), it seems that the interests of the petitioners have not been satisfied.

Vaccine Injury Compensation Program

Tier 1

Pre-defined Liability Limits for all related coverages (Limits will need to be sizeable, esp. for Bodily Injury aspects to make it effective)

Product Liability terms (under this tier) to be clearly defined (Is that possible?)

Administered at a federal level?

Standard cost (embedded into car price?) and accumulated into a central fund (Who decides the price? And Should the cost be entirely funded by the vehicle buyers or the car manufacturer should pay a share too? After all, there is liability associated with them and they will benefit from this structure.)



Tier 2

Claims not resolved under the Tier 1 may be Covered by Products Liability insurance bought by the car manufacturing companies.

Such tiering *may* reduce the overall uncertainties and the high insurance costs associated.