AUTONOMOUS
VEHICLES
AND REDUCING GHG

by Ryan Snyder
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LEVELS OF AV TECHNOLOGY

LEVEL 2
combined function automation

LEVEL 3
limited self-driving automation

LEVEL 1
function-specific information

LEVEL 4
full self-driving automation

LEVEL 1

LEVEL 2

LEVEL 3

LEVEL 4

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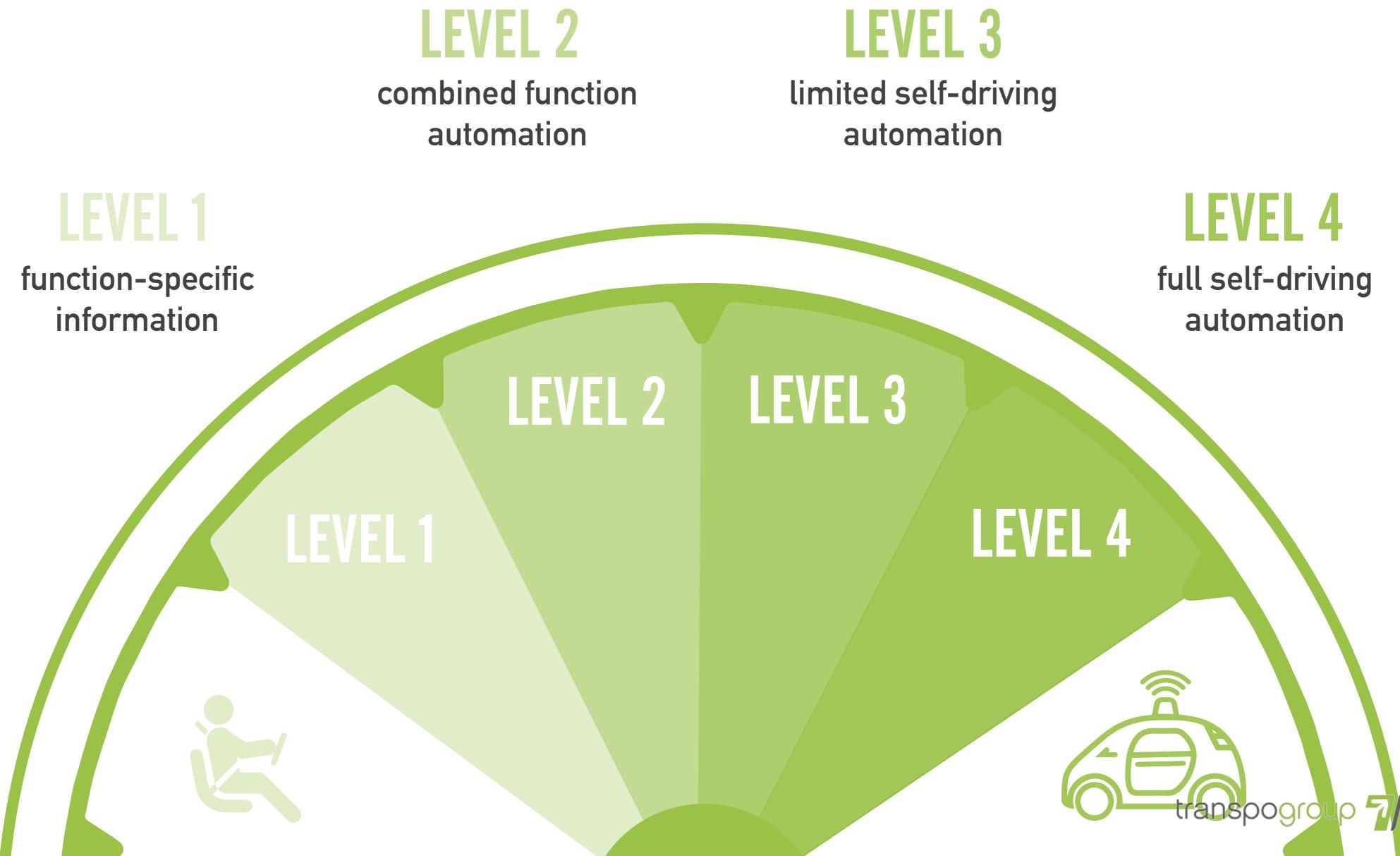
STATE OF THE ART
In Autos

Most cars sold today have

LEVEL 1
TECHNOLOGY

52%
have at least
forward crash alerts*

September 2015
NHTSA and IIHS
agreed with **10** auto
manufacturers to make
automatic emergency
braking standard

SINCE 1990s
adaptive cruise control
has existed

27%
of vehicles sold have
automatic emergency
braking*

Some cars now offer
COMBINED AUTOMATION
(lane assist, crash avoidance)

*Insurance Institute of Highway Safety (IIHS) (Status Report Vol. 50, No. 7, August 26, 2015.

STATE OF THE ART
Human Error Crashes

93%
of crashes are caused by
HUMAN ERROR

▶ **1** fatality per **18.55** million miles driven**

▶ **1** injury crash per **637,000** miles driven**

Google has had **1** crash per **125,000** miles driven; no report on injuries/ fatalities; none the fault of the car

*2NHTSA, National Motor Vehicle Crash Causation Survey, DOT HS 811 059, July 2008.
**3NHTSA Traffic Safety Facts, December 2014.

STATE OF THE ART
Communications Technology

→ NHTSA is experimenting with Vehicle-to-Vehicle (V2V) technology

→ General Motors will have V2V technology on some cars by 2017*

→ US DOT is now testing Vehicle-to-Infrastructure (V2I) technology

*4GM News, "Cadillac to Introduce Advanced Intelligent and Connected Vehicle Technologies on Select 2017 Models", September 7, 2014.

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WHEN?

Audi, BMV, GM, & Nissan expect to sell self-driving vehicles

22%-59% *of vehicles on the road could be self-driven**

Uncertain, but within the forseeable future

TODAY — 2020 — 2025 — BEYOND

2017 Google plans to have Level 4 technology

11%-34% *of vehicles on the road could be self-driven**

Continental Automated Systems projects producing cars with a high level of self-automation
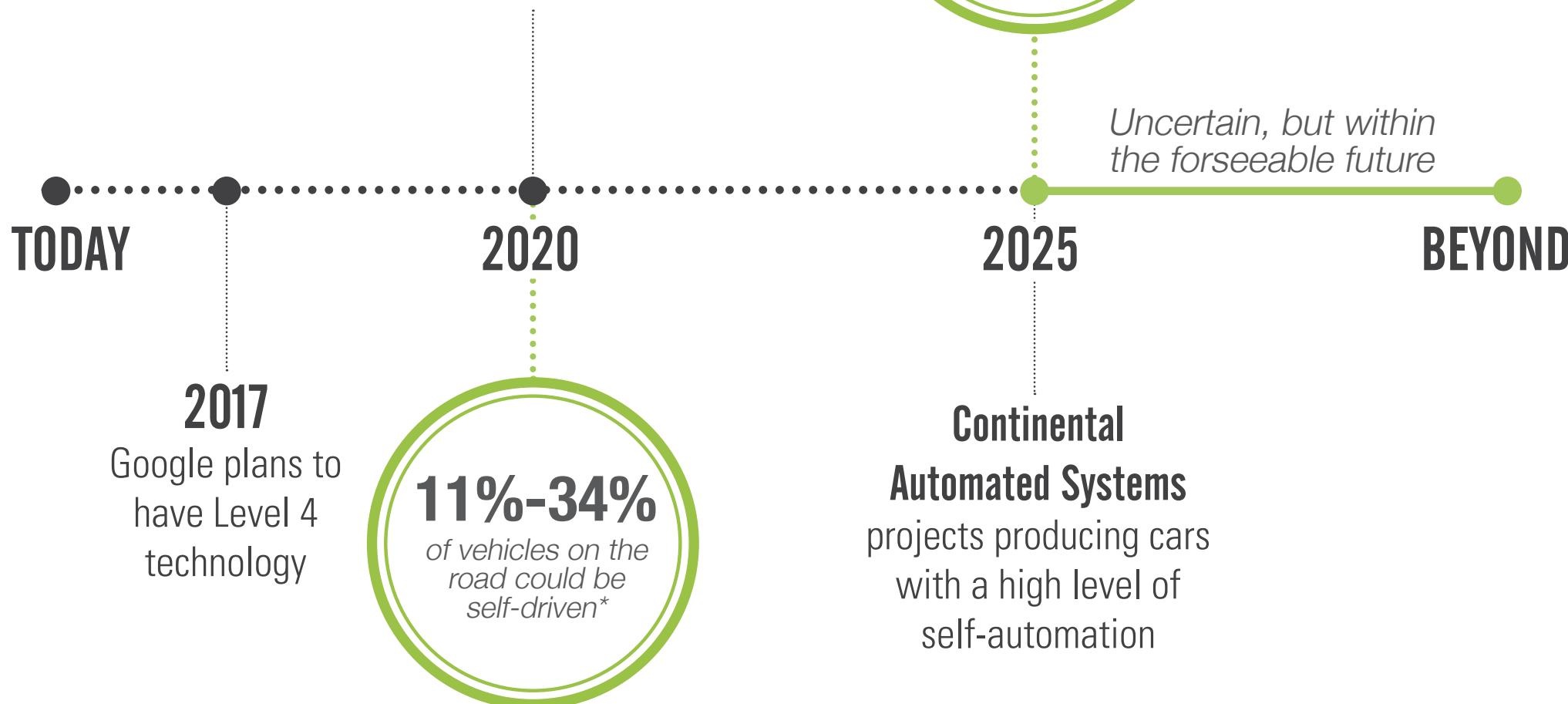
*Jerome Lutin, Alain Komhauser, Eva Lerner- Lam, "The Revolutionary Development of Self-Driving Vehicles and Implications for the Transportation Engineering Profession", Institute of Transportation Engineers Journal, July 2013.

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TECHNOLOGICAL POSSIBILITIES

Enhanced detection of pedestrians and bicycles

ECONOMICS

58 cents/mile to drive an average car*

= $725/month

With carsharing, roughly less than 72 hours/month better than owning ($10/hour)

Cost of transit bus drivers **54%** of operating costs**

At some point is it cheaper to take "driverless Uber pool" than to own.

Then why own a car?

*"Your Driving Costs 2015", American Automobile Association
**American Public Transit Association, 2013 Public Transit Fact Book, p. 26.

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POTENTIAL BENEFITS
User Conveniences

➤ Mobility for those who don't drive

➤ Better use of time

➤ Less stress

➤ Deliveries

➤ Select an appropriate vehicle for the trip

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POTENTIAL BENEFITS
Safety

→ Fewer crashes

→ Already likely receiving benefits

→ Will improve conditions for walking and bicycling

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POTENTIAL BENEFITS
Capacity & Better use of streets

- Roughly double

- Less congestion

- More opportunities for road diets

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POTENTIAL BENEFITS
Capacity & Better use of streets

After

Before

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TECHNOLOGICAL CAPABILITIES
Increased Capacity

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TECHNOLOGICAL CAPABILITIES
Lane Clearance for Priority Vehicles

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TECHNOLOGICAL CAPABILITIES
Optimized Traffic Flow

POTENTIAL BENEFITS
Land Use

- Cars are parked 95% of the time*

- Won't need so much parking in lots, structures or on the streets

- What could we use the space for?

*Don Shoup, The High Cost of Free Parking, American Association of Planning Press, 2005

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POTENTIAL BENEFITS
Environmental

Potential to reduce
GHG by 87%-94%*

> Using smaller vehicles
> More use of electric vehicles
> Decreases in emissions of electricity
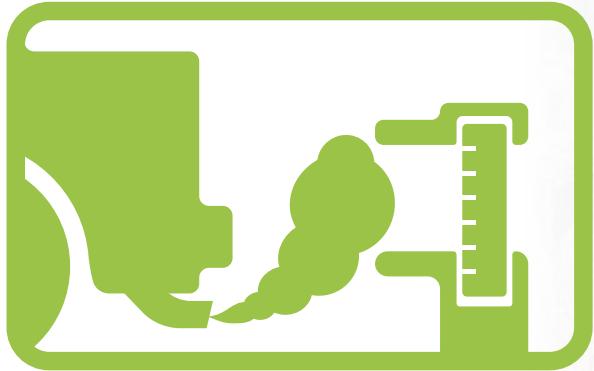
*Nature Climate Change (Jeffrey Gleenblatt and Samveg Saxena, "Autonomous Taxis Could
Greatly Reduce Greenhouse-Gas Emissions of US Light-Duty Vehicles", July 6, 2015

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POTENTIAL BENEFITS
Transit

➤ Increased service

➤ Faster service

➤ New viable ridesharing services

➤ Possibility of high-speed buses

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TECHNOLOGICAL CAPABILITIES
High-Speed Buses

GREATER USE OF
MICRO TRANSIT

Source: www.gizmodo.com

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POTENTIAL BENEFITS
FASTER Emergency ACCESS

Less congestion to drive in

With lane clearance, emergency vehicles could have priority

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POTENTIAL DRAWBACKS
Job Loss

- Likely the biggest problem from AVs

- Bus, taxi, truck, delivery driver jobs

- Some other auto industry jobs

- Need retraining programs to emerging technologies

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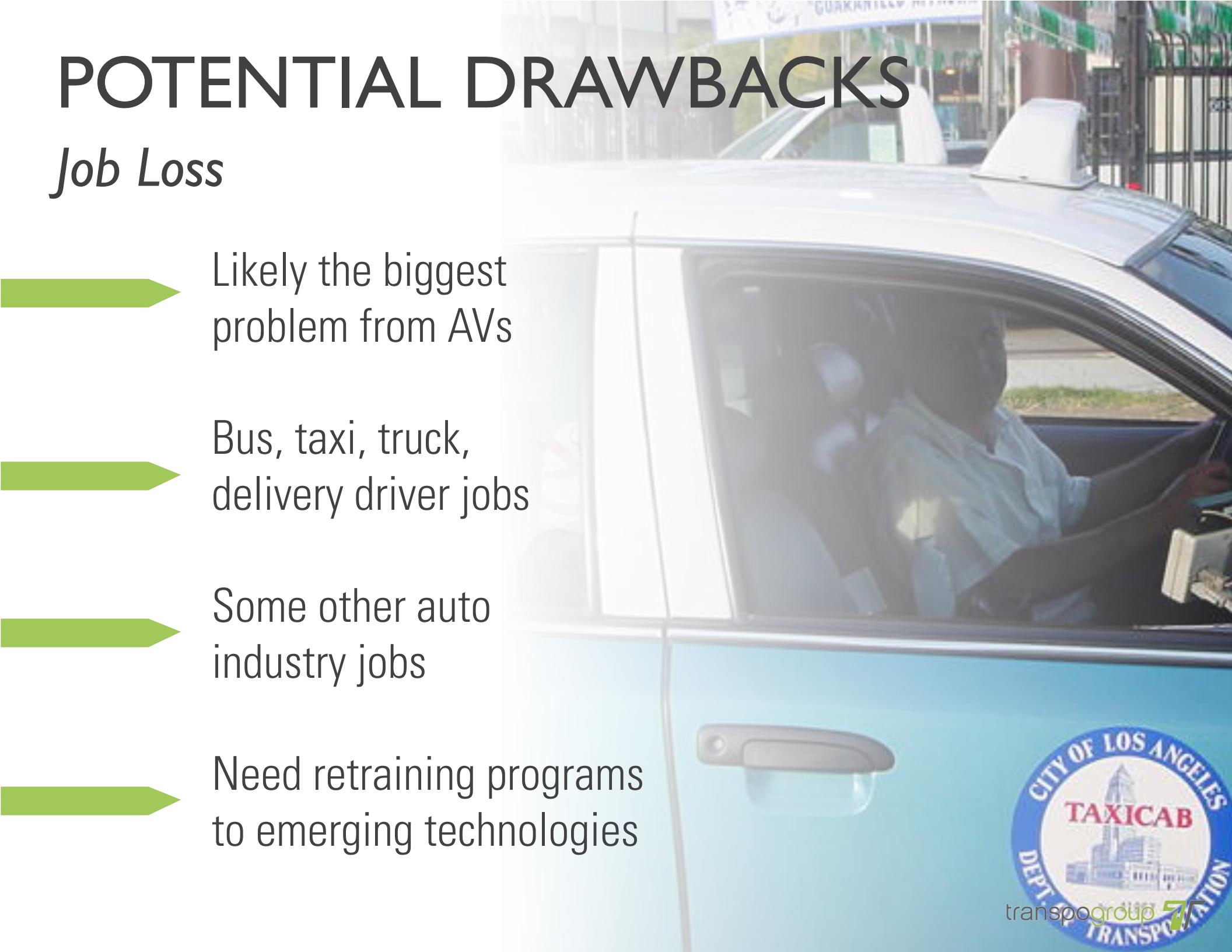
POTENTIAL DRAWBACKS
Encouraging driving and longer commutes

➤ Better use of time not driving

➤ No stress

➤ Reduces "cost" of driving

➤ Enact policies to encourage efficient travel

POLITICS OF ALGORITHMS

Determining Priority

➤ Private companies might start lobbying for control

➤ Prioritize multi-occupant vehicles
over single-occupant cars

➤ Ped/Bike priorities

➤ System needs to reflect good policy over politics

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POLICIES

- Decide where AVs can operate during transition

- Equipment requirements

- Revisit the issue of a requirement for the driver

- Research & Development

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POLICIES

➤ Pricing strategies

➤ Give time advantages

➤ Liability issues

➤ MUTCD issues

➤ Parking codes

photo cred: AUVSI

photo cred: Volvo

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CONCLUSIONS

AVs offer many potential benefits

Policy can and should speed AV

Policy should ensure beneficial outcomes

We should change assumption in today's decisions

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