Future Mobility:

Handing Cities over to the car for a second time?

Report of the Transit Choices Workgroup AV

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3. **Definitions**
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7. **AV Potential**
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   - Parking
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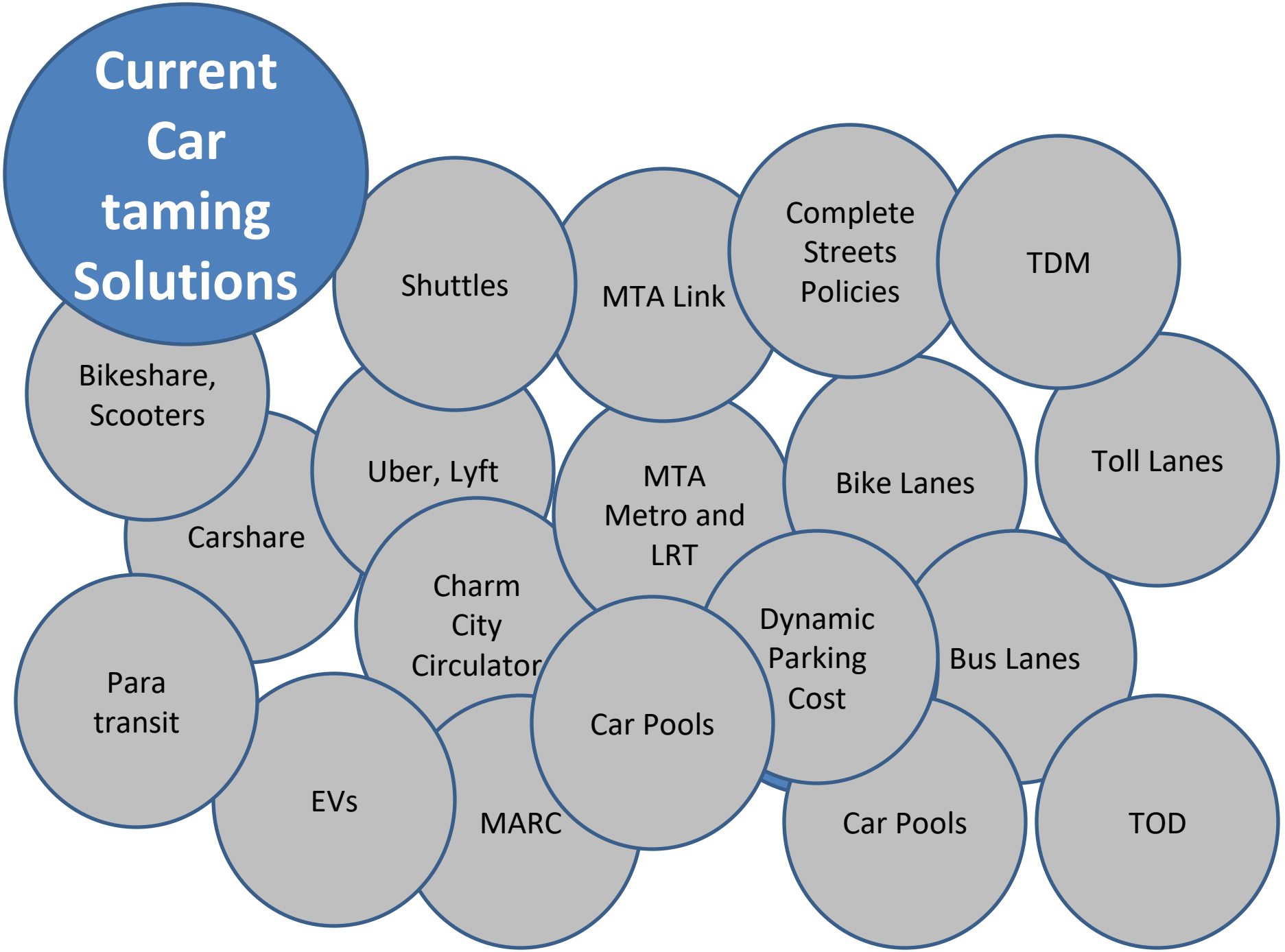
8. **Scenarios & Strategies**

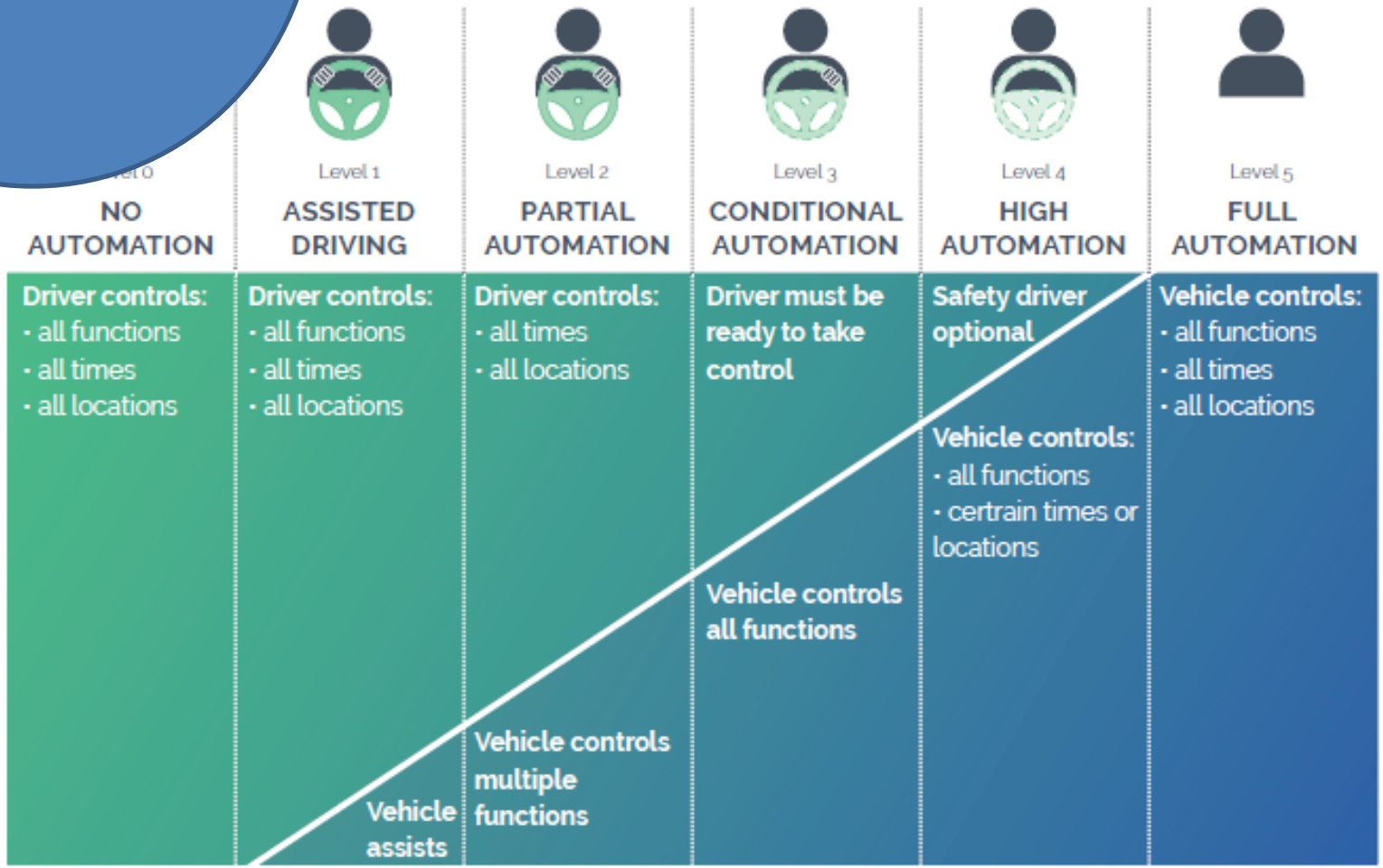
Problems from the first handover

- Low transit ridership
- Rising VMT
- Low job access rate via transit resulting in inequities
- High cost of owning a car
- High levels of congestion
- Much public space devoted to vehicle storage
- High air pollution levels from transportation
- High fatality and injury rates


Current Car taming Solutions
Shuttles
MTA Link
Complete Streets Policies
TDM
Bikeshare, Scooters
Uber, Lyft
MTA Metro and LRT
Bike Lanes
Toll Lanes
Carshare
Charm City Circulator
Dynamic Parking Cost
Bus Lanes
Para transit
EVs
MARC
Car Pools
Car Pools
TOD

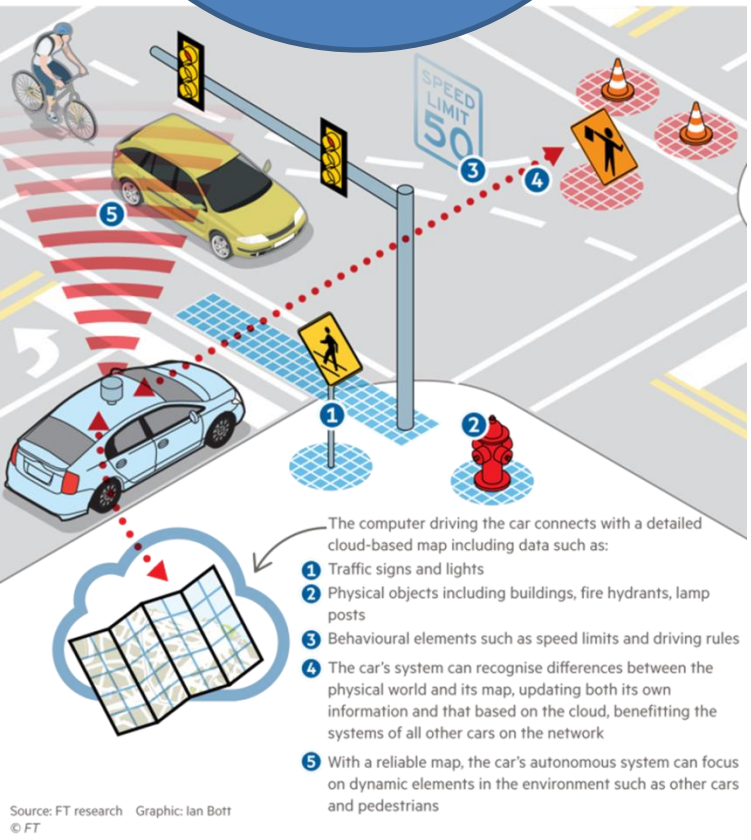
AV Levels

1. definitions:



AV Technology

How autonomous

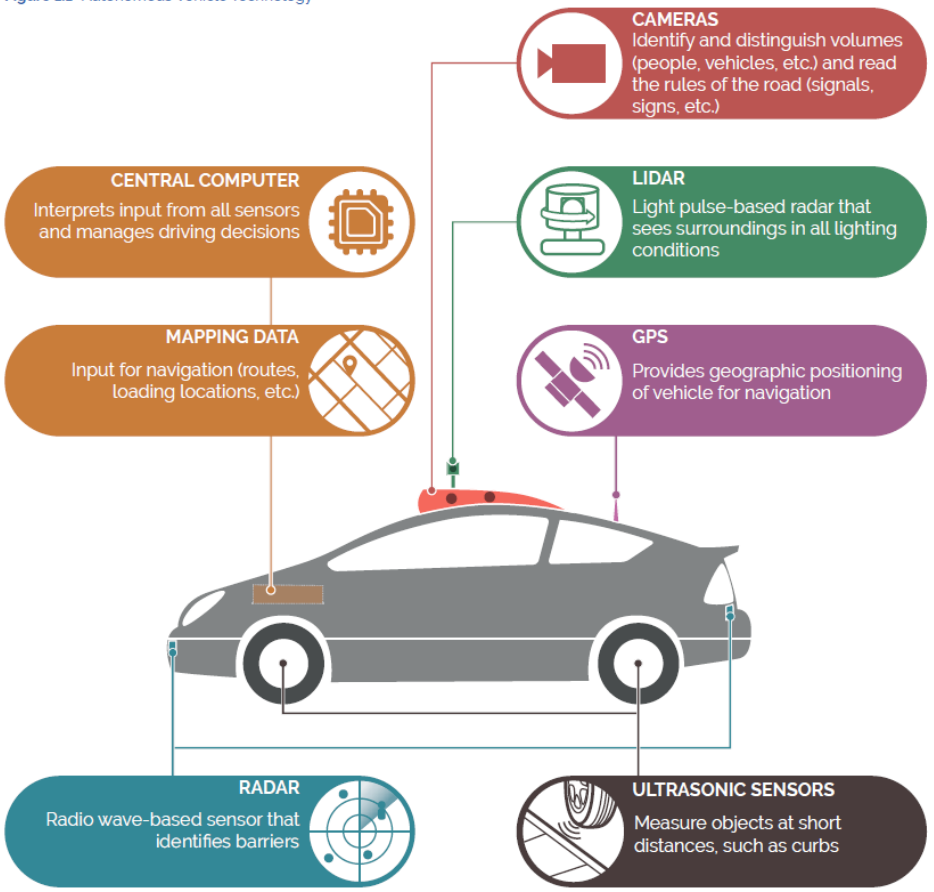


The computer driving the car connects with a detailed cloud-based map including data such as:

1. Traffic signs and lights
2. Physical objects including buildings, fire hydrants, lamp posts
3. Behavioural elements such as speed limits and driving rules
4. The car's system can recognise differences between the physical world and its map, updating both its own information and that based on the cloud, benefitting the systems of all other cars on the network
5. With a reliable map, the car's autonomous system can focus on dynamic elements in the environment such as other cars and pedestrians

Source: FT research Graphic: Ian Bott

Figure 1.1 Autonomous Vehicle Technology



"Autonomous"
or "Connected"?

“Autonomous” or “Connected”?

“anyone relying on LIDAR is doomed. Doomed. It’s expensive and unnecessary a fool’s errand,”

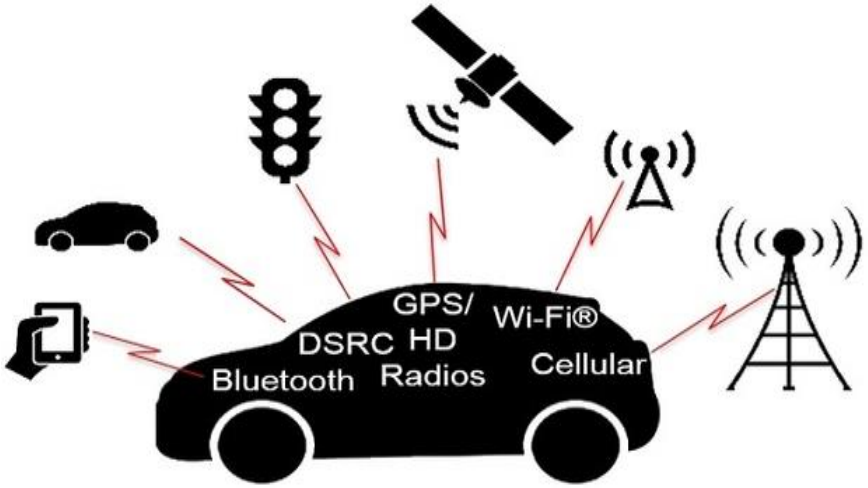
"We have quite a good simulation too. But it does not capture the long tail of weird things that happen in the real world.

The real world's really weird and messy, you need the cars on the road.

…the real world is very weird and has millions of corner cases. If someone can produce a self driving simulation that accurately simulates reality, that in itself would be a monumental achievement of human capability. They can't. There's no way."

High-precision GPS maps for self-driving cars are a “really bad idea,”

“Autonomous” or “Connected”: Implications for Cities



“Connected”
needs the car and the setting to be smart. It needs a lot of new infrastructure for sensors and communication

“autonomous”
needs just the car to be smart

AV Applications

AUTONOMOUS VEHICLES?

THE LANDSCAPE	AUTONOMOUS SHUTTLE	AUTONOMOUS CAR	AUTONOMOUS BUS	AUTONOMOUS TRUCK
CAPACITY (PAX)	8	5	30 to 50	2
CARGO (CUBIC LITERS)	0	4	0	30
RANGE (KMS)	15	500	300	1000
MAX SPEED (KM/H)	25 - 40	250	150	120

bestmile

Delivery Robots

Predictions

In general, the rapid uptake of ride share (**TNCs) in cities likely portends the urban response to AVs**, particularly shared AV services, once they are available. […]

TNCs have demonstrated latent demand for a **more user-friendly form of transportation** than existing forms, including driving and riding transit.

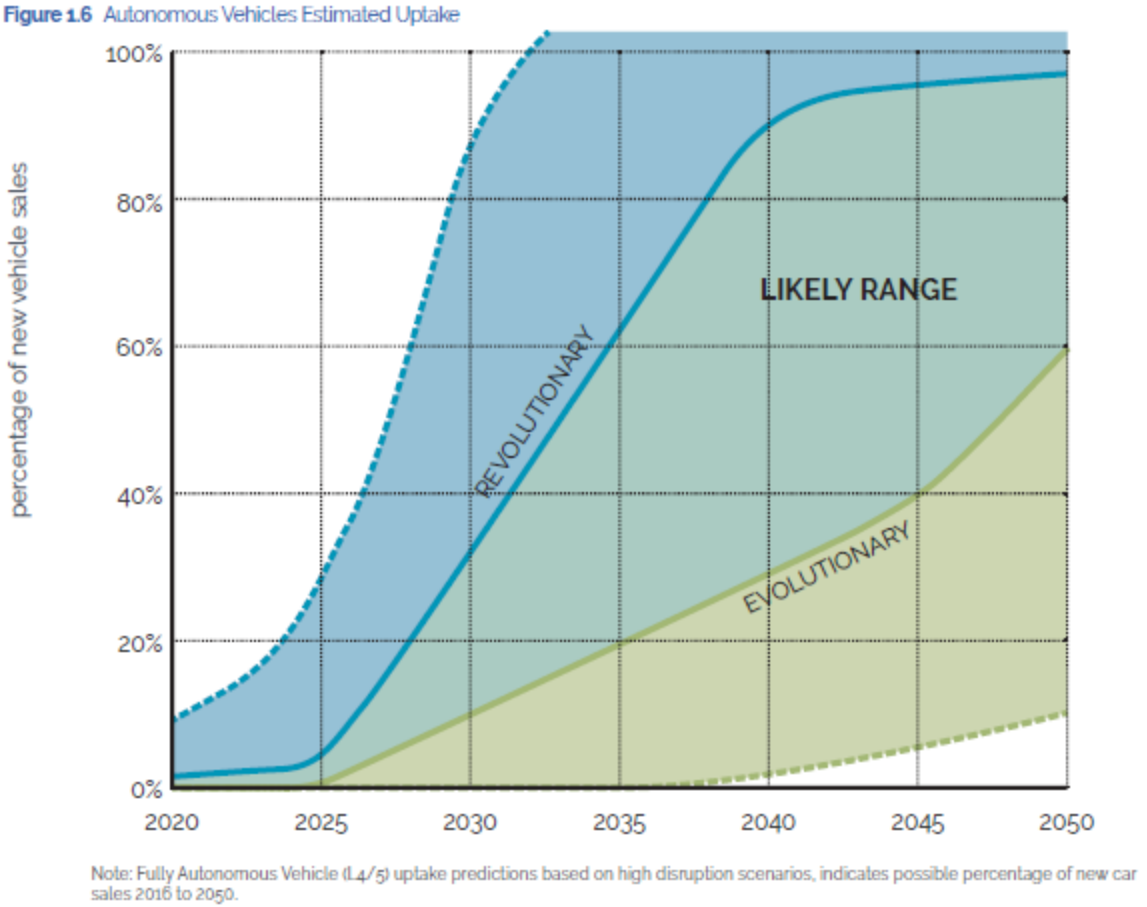
While offering an appealing service to individuals, **TNCs have had a significant impact on cities**, inducing more traffic, increasing the demand for curb space, and uncertain implications for public transit.

Meanwhile, regulatory conflicts have resulted in mixed outcomes for cities. Heeding **the lessons of TNCs will be critical for cities** and metropolitan areas with the advent of AVs. (Perspective Paper AVs)

Uncertainties

- induced demand!
- environmental impact

Variation in adaptation timeframes



Behavior

On a 10-year view, the macro socio-economic effects of urban millennial and Generation Z attitudes to car ownership and mobility will have a dramatic effect and yield a motor industry largely based on selling rides, increasingly deploying autonomous mobility, and monetizing miles: an emergent industry that will probably be as large as today's automotive industry.

Autonomous Vehicles - Thematic Research 3/19

Preparations of Cities:

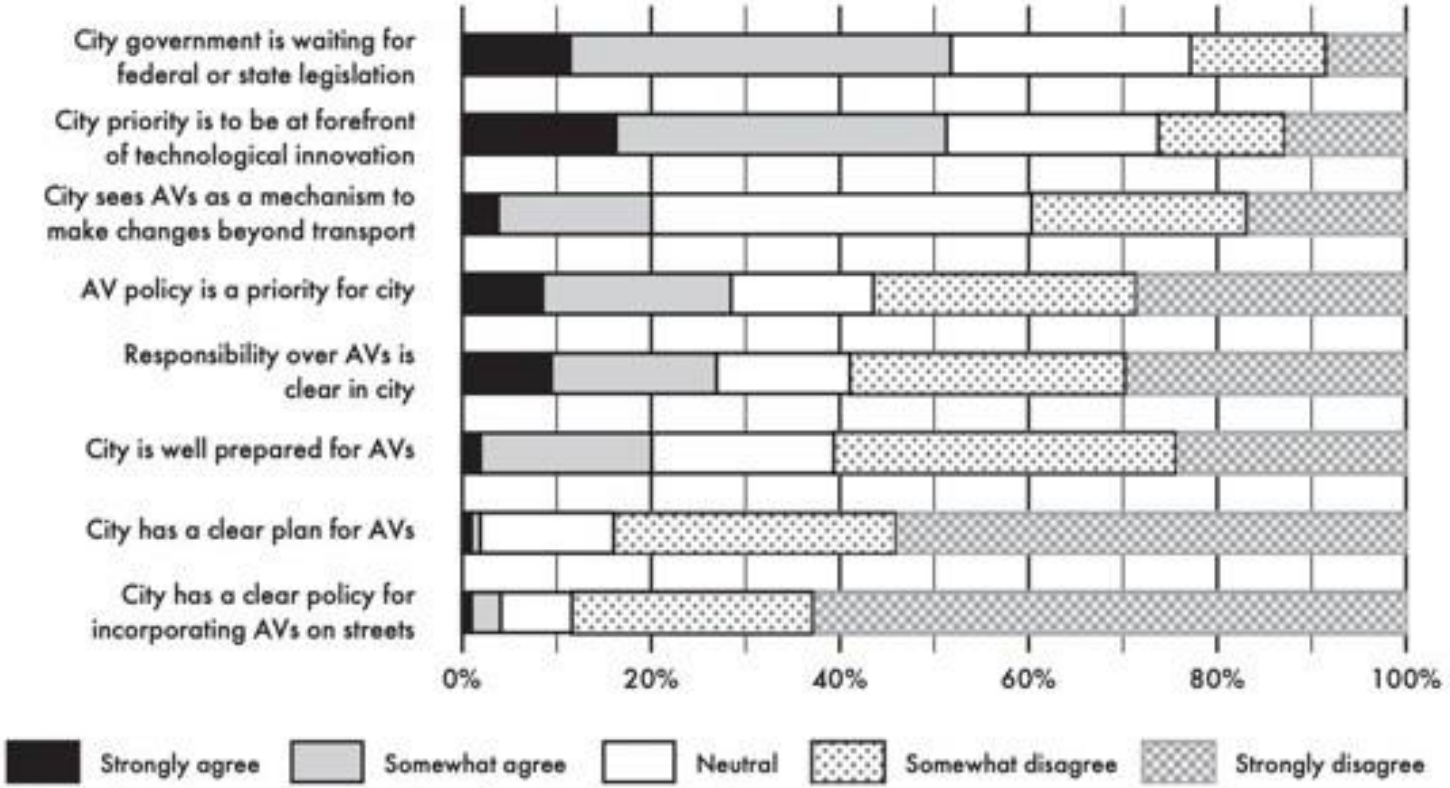


Figure 1. Respondents' sense of preparations for autonomous vehicles.

https://mobility.mit.edu/publications/9998/freemark-are-cities-prepared-autonomous-vehicles-planning-technological-change-us

Promises

- **Affordable: Access to housing and jobs**
- **Connected: Integration with Transit**
- **Diverse: Provide additional Equity**
- **Healthy: Vision Zero**
- **Vibrant: A New deal for Mobility**

Risk Strategies

Jeff Speck, Ten rules for cities about automated vehicles, Oct 2017, CNU

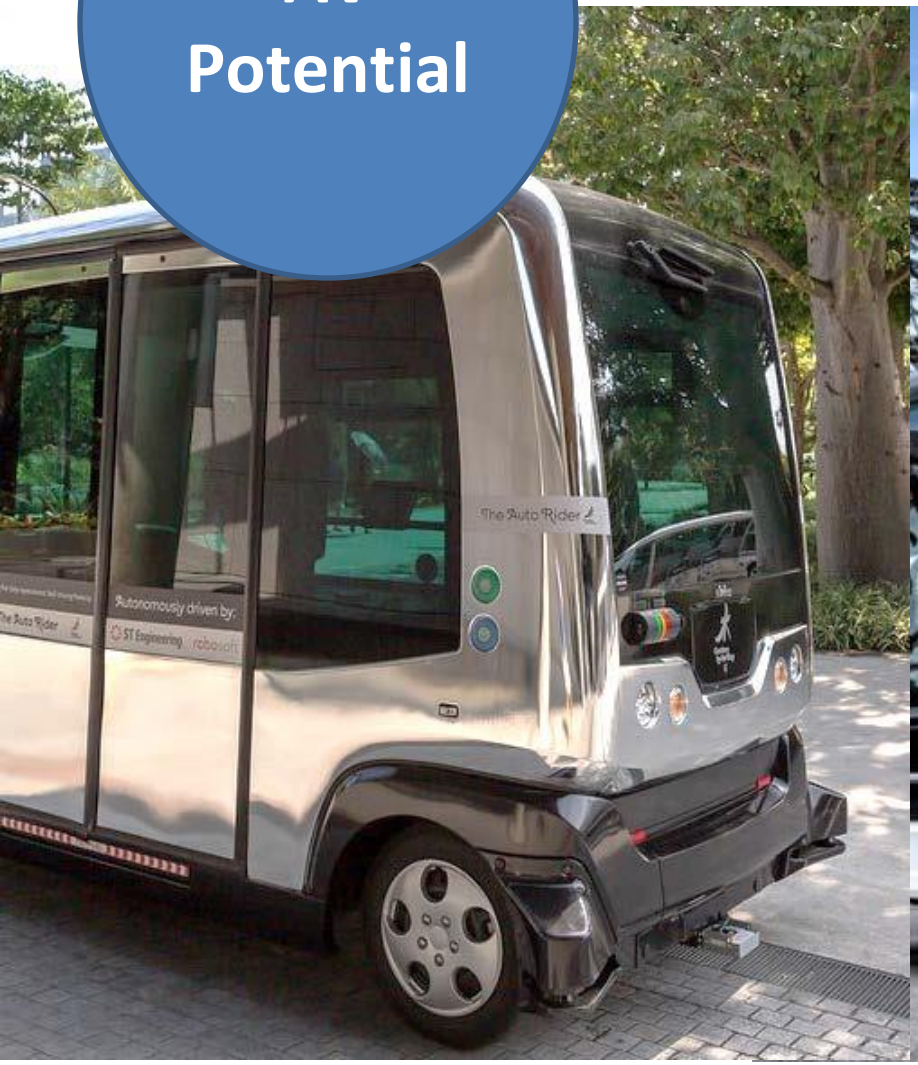
1. Be afraid
2. Be realistic
3. Decide how much traffic you want
4. Plan for more sprawl pressure
5. Understand transit geometry
6. Don't rob transit
7. Own the streets and own the data
8. Don't buy any urban vision that forgets urbanism
9. Unify around a set of policy demands
10. Invest in the current technological revolution

Every new transportation technology impacts the geography of our communities and the structure of our lives. Autonomous vehicles (AV) are one such technology. Just as our freeway system or the streetcar network shaped our cities and lifestyles, AV will remake the metropolis once again. The question is how? And in so doing, with what unintended consequences? As with most technology it depends on how it is used.

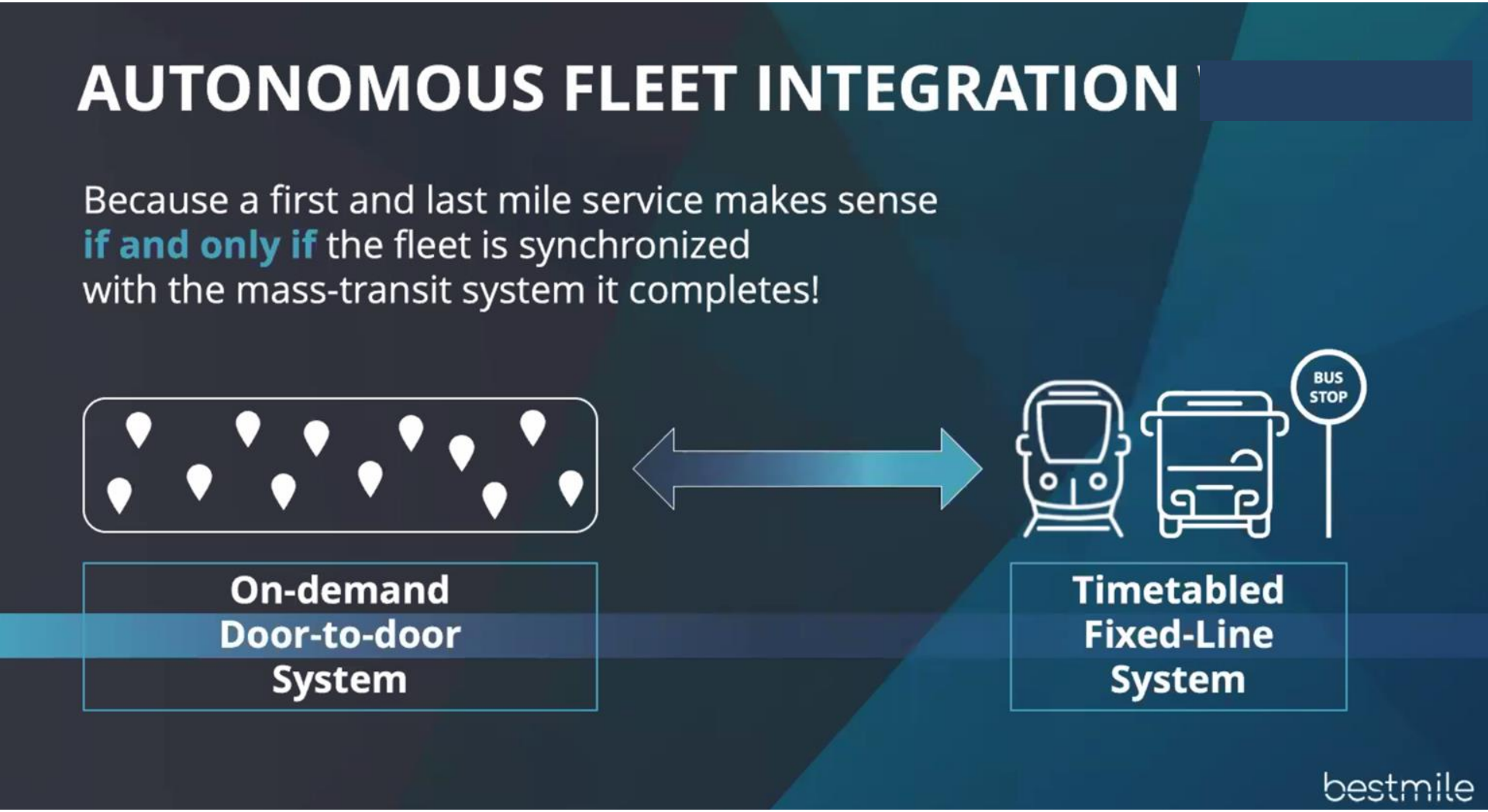
Peter Calthorpe, **Autonomous vehicles: Hype and potential** 2016

AV Potential

- Transit: fixed schedule and demand based



- **Transit: fixed schedule and demand based**

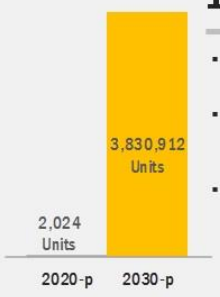


Mobility as a service

A multimodal on-demand service providing region-wide access to travel options and payment via a single platform

Robo Taxi

Attractive Opportunities in the Robo-Taxi Market



CAGR
112.67%

- The robo-taxi market is projected to grow from 2,024 units in 2020 to 3,830,912 units by 2030.
- Increasing developments and investments by companies in autonomous driving, connectivity, electrification, and shared mobility are expected to drive the robo-taxi market.
- Rising demand for ride-hailing services, vehicle safety, and fuel efficiency by manufacturers and government is likely to propel the market.

- **Restricted access for private vehicles**

“Congestion Pricing “

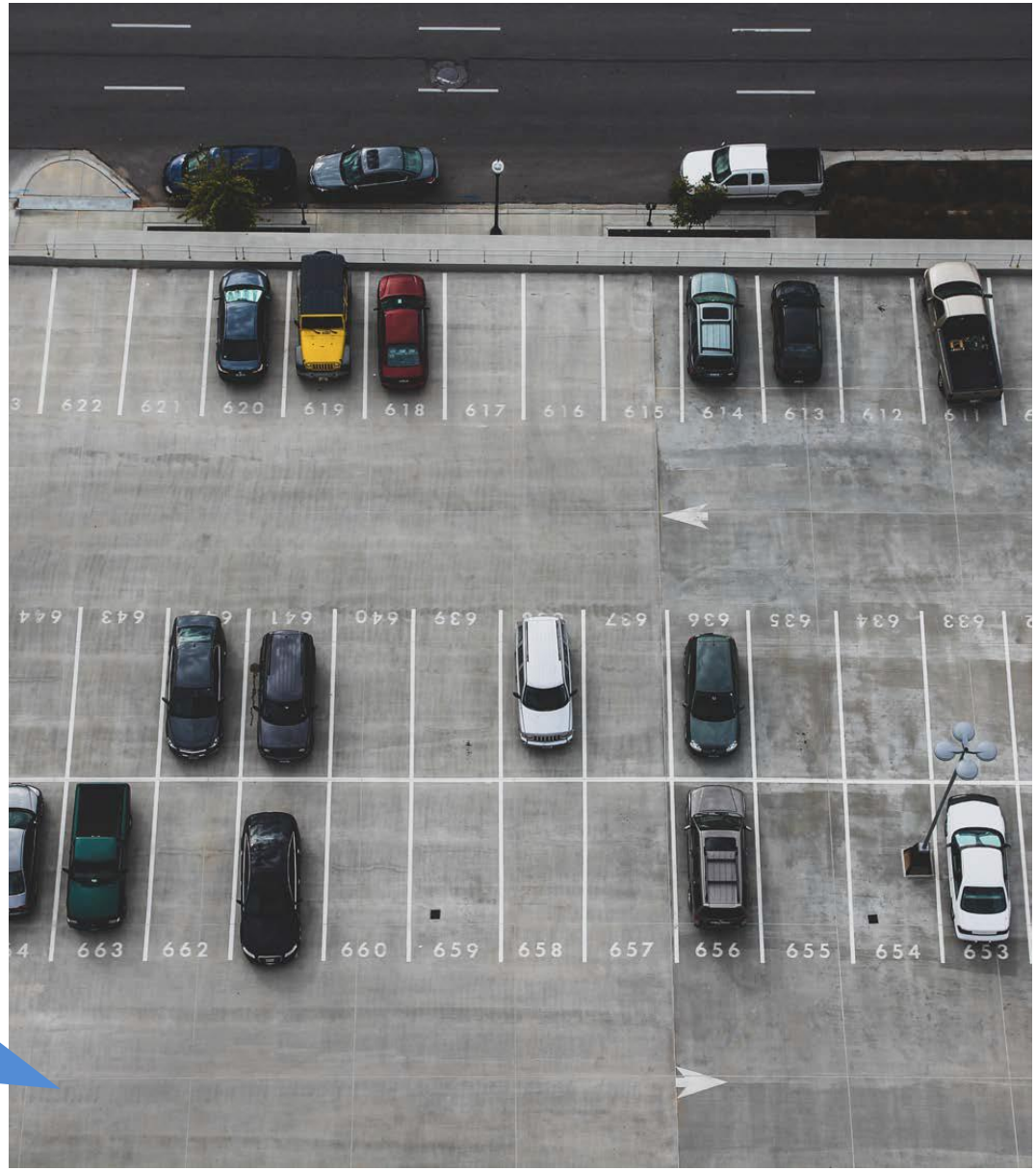
The solution to increased efficiency is congestion pricing and greater mobility options—not more highway lanes.

AUTONOMOUS VEHICLE HEAVEN OR HELL?

Less Parking

there are currently 263 million non-autonomous cars on the road, and roughly 2 billion parking spaces in the United States.

"Streets are 25 to 35 percent of a city's land area... [the] most valuable asset in many ways," Zabe Bent, principal at Nelson\Nygaard



Clean Air

The transportation sector contributes to the largest proportion of greenhouse gas emissions in the U.S.
at 28.5 percent. Powering all forms of autonomous vehicles with renewable energy sources represents an enormous opportunity to curb transportation's contribution to climate change. AUTONOMOUS VEHICLE HEAVEN OR HELL?/ EPA 2016

Regulation

If left up to the free market without adequate regulation, we can expect a “hell” scenario dominated by personally-owned autonomous vehicles that are only accessible to those who can afford them, while further congesting our streets and polluting our air, leaving others to cope with worse traffic, longer commutes and under-resourced public transit.

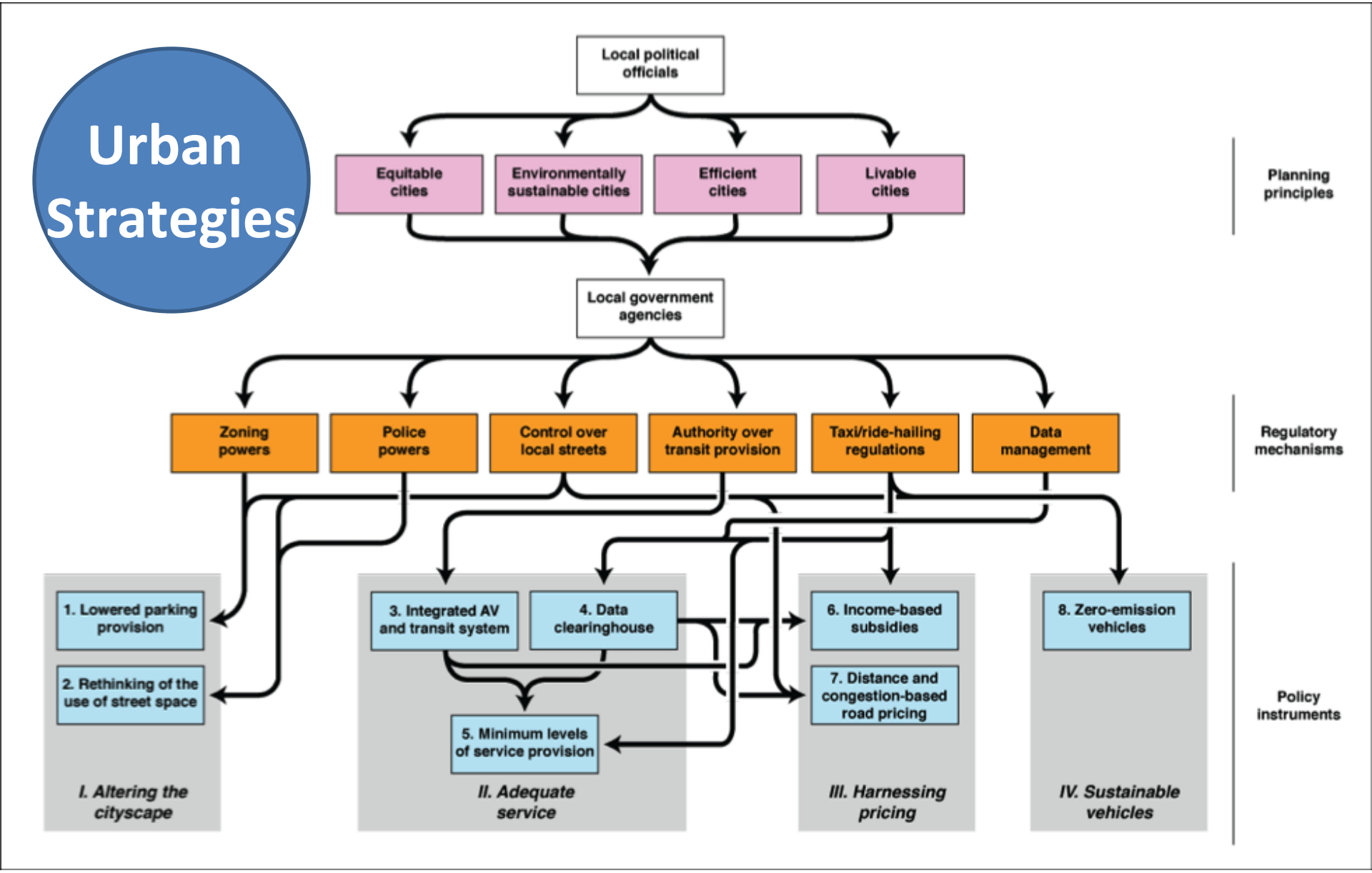
Autonomous Vehicle Heaven Or Hell? Creating A Transportation Revolution That Benefits All, Jan 2019

FIGURE 1

Five regulatory principles to tackle emerging technologies

Source: William D. Eggers, Mike Turley, and Pankaj Kishnani, *The future of regulation*, Deloitte Insights, June 19, 2018.

Urban Strategies



https://mobility.mit.edu/av

Opportunities
Risks
Strategies

1. Land Use

AV OPPORTUNITIES AND RISKS

URBAN RENAISSANCE

SPRAWL RENAISSANCE

PRIORITY STRATEGIES

- Repurpose off-street parking for infill development, parks and micro-transit hubs
- Institute parking maximums for both on- and off-street parking supply
- Retain or strengthen urban growth boundaries to control greenfield development

Opportunities
Risks
Strategies

2. Transit

AV OPPORTUNITIES AND RISKS

Shared AV service could introduce a transit renaissance with improved on-demand services

CHEAPER TRANSIT

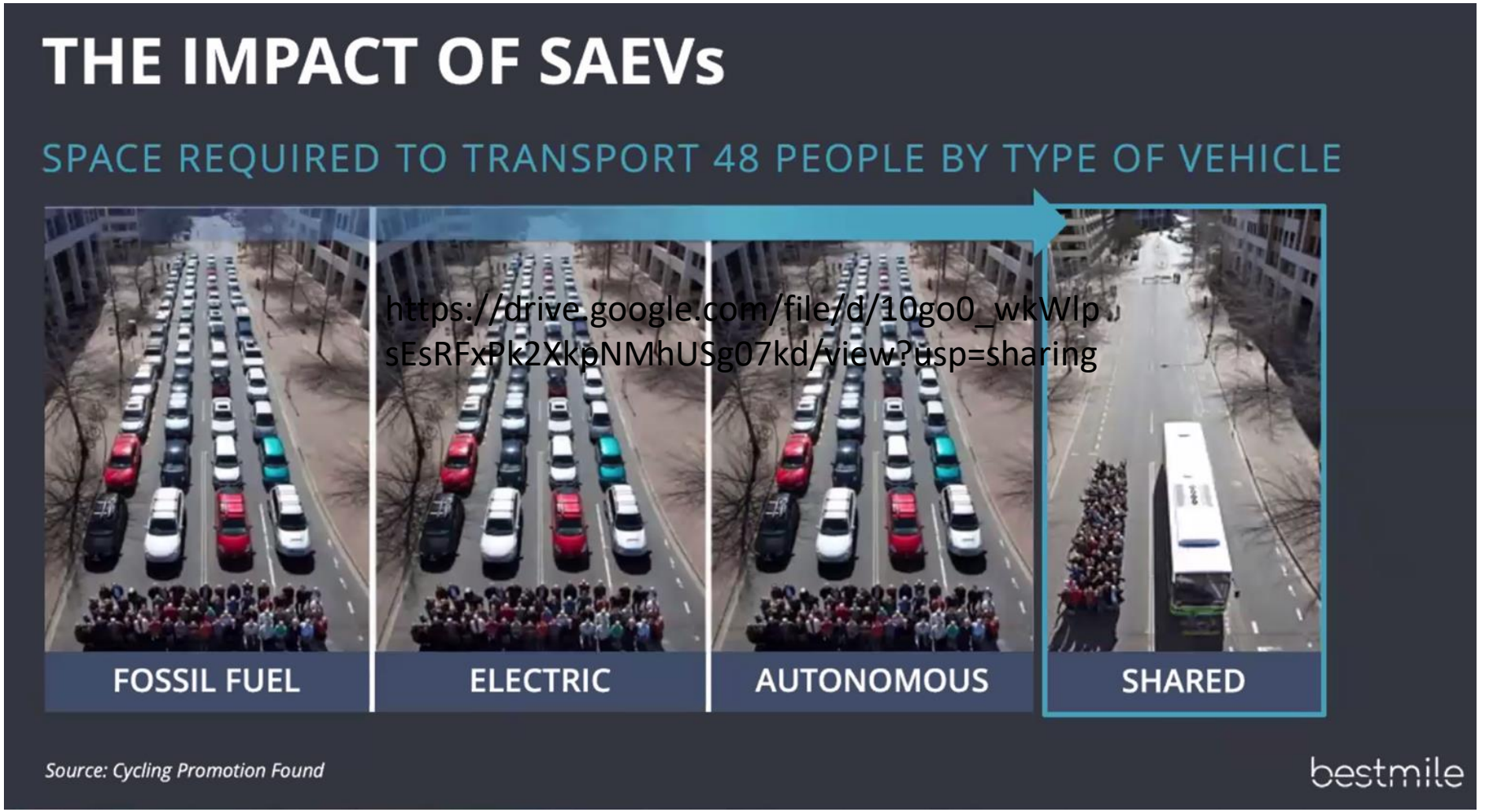
AVs could worsen congestion with more induced travel and empty vehicle circulation

AV CAR-SHARE "EATS" TRANSIT

PRIORITY STRATEGIES

- Double down on high-capacity bus and rail corridors
- Innovate suburban transit with autonomous, on-demand micro-transit
- Develop a mobility-as-a-service platform to provide a unified equitable gateway to services and information

The geometry reason for transit



Opportunities
Risks
Strategies

3. Equity

Mobility Equity: a transportation system that increases access to high quality mobility options, reduces air pollution, and enhances economic opportunity for marginalized populations such as low-income people, people of color, the elderly and people with disabilities.

AV OPPORTUNITIES AND RISKS

Better access for those who cannot or do not drive

Less access, more expensive, added barriers

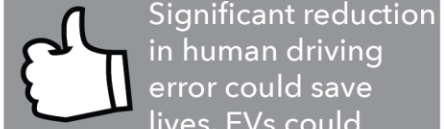
PRIORITY STRATEGIES

- Mandate equitable provision of mobility services with transparent reporting
- Subsidize public transit innovations, replacing fixed route transit in some Communities of Concern
- Prioritize AV mobility service or programs that serve communities of concern

Opportunities
Risks
Strategies

4. Safety

AV OPPORTUNITIES AND RISKS



FEWER CRASHES
BETTER AIR QUALITY

MORE SEVERE CRASHES
WORSE AIR QUALITY

PRIORITY STRATEGIES

- Cap speed limits in downtowns and in neighborhoods
- Mandate that all AVs and EVs invest in the necessary infrastructure
- Develop "boundary program" to reduce hacking vulnerability

Opportunities
Risks
Strategies

5. Economy

AV OPPORTUNITIES AND RISKS

Reduction of transportation and logistics operating costs

JOBS IN FLEET MANAGEMENT OR MAINTENANCE

AVs could cause rapid job loss or a shift to other occupations

LOSS OF TAXI DRIVERS AND TRANSIT OPERATORS

PRIORITY STRATEGIES

- Strengthen the capacity of training programs to expand opportunities for workers
- Target job clusters on industrially-zoned land near population clusters for production, distribution, and repair
- Pilot innovative AV applications that could spur new job opportunities

Opportunities
Risks
Strategies

6. Cost

AV OPPORTUNITIES AND RISKS

Fleet based transportation saves cost over privately owned car

AV technology makes vehicles too expensive and drives cost up

PRIORITY STRATEGIES

- Use non geo-fenced technology
- Incentivize fleet use over private use and ownership
- Regulate parking cost and core city access in favor of fleet use
- Support R&D of AV technology

Opportunities
Risks
Strategies

7. Environment

AV OPPORTUNITIES AND RISKS

Fleet based EV-Avs reduce trips, space needs and emissions

LESS ENERGY CONSUMPTION

Privately owned AVs increase VMT, need more space, induce sprawl and need more energy

MORE ENERGY CONSUMPTION

PRIORITY STRATEGIES

- Promote electrification of transportation
- Incentivize fleet use over private use and ownership with tools like taxes, tolls, rebates, etc.
- Prohibit private vehicles in high density core and supplement with micro-transit
- Priority high capacity transit