

Global Urban Mobility

The Wide World of Worldwide Autonomy



But first....there's ALWAYS another business model...

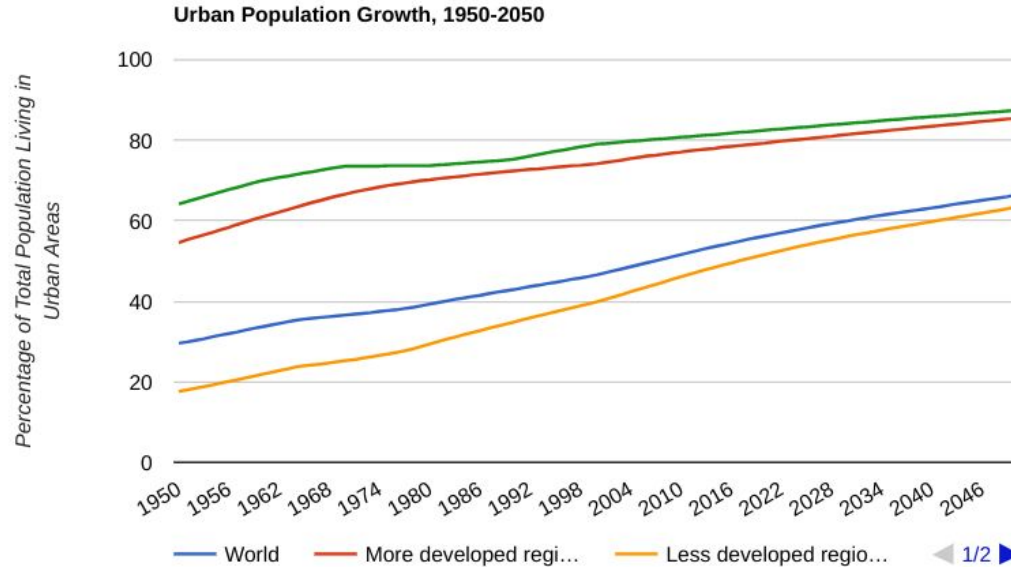
- First 2/3 of book is free - pay to unlock ending
- Pay per 1,000 words
- Tips at end of each chapter (\$0.15+)



Urban Economics

By 2050, more than $\frac{2}{3}$ of world's population will live in cities (was $\frac{1}{3}$ in 1950)

Large cities (>150,000/80% of population) account for 85% of US GDP but 2% of land area



Source: United Nations, Department of Economic and Social Affairs, Population Division.

WE NOW LIVE IN AN ERA OF MOBILITY ON-DEMAND



RIDE HAIL



PACKAGE
DELIVERIES



FOOD
DELIVERIES



SHARED
VEHICLES



AUTONOMOUS
VEHICLES

Cities are built around the human-driven car

Even though, human driven cars & trucks are really not suited to cities:

- Congestion
- Parking
- Pollution
- Space
- Safety

We have a serious urban UX problem with cars in cities, and if we keep going the same direction as we have been, we are only going to make it worse.

Intersection

Urban Mobility has been turned on its head (And AV isn't even here yet!)

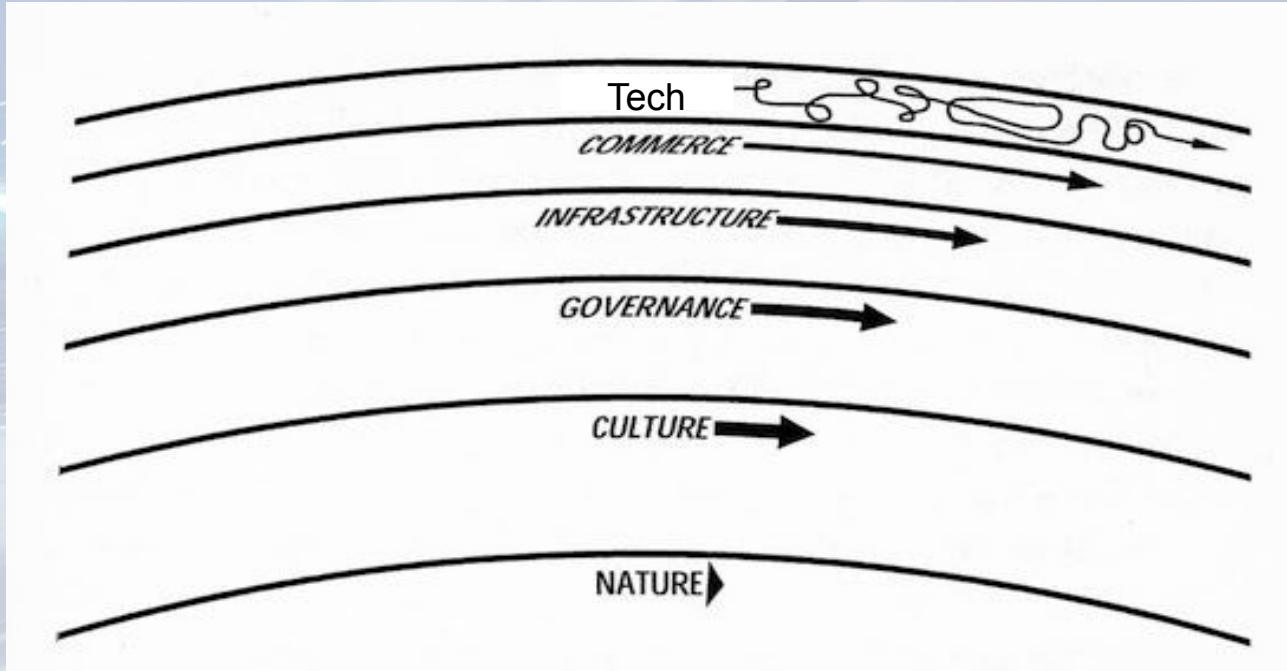
- Micromobility
 - Ride Sharing
 - Demographics (both young and old)
 - Growth in deliveries from Online shopping
- So many people to keep happy
 - NIMFY
 - So many powerful vested interests

Your AV business and Urban Mobility

- Push on!
- But be aware of the context and global differences
- At some point you will have to engage with:
 - Regulators
 - Communities
- Not just engineers & investors!
- Consider Lobbying groups



Find Your Pace Layer



When the car industry says “in ten years”, that’s in the next planning cycle.
When the tech industry says “in ten years”, they mean ‘just on the edge of science fiction’



Urban Mobility

All Shapes & Sizes

Shuttles

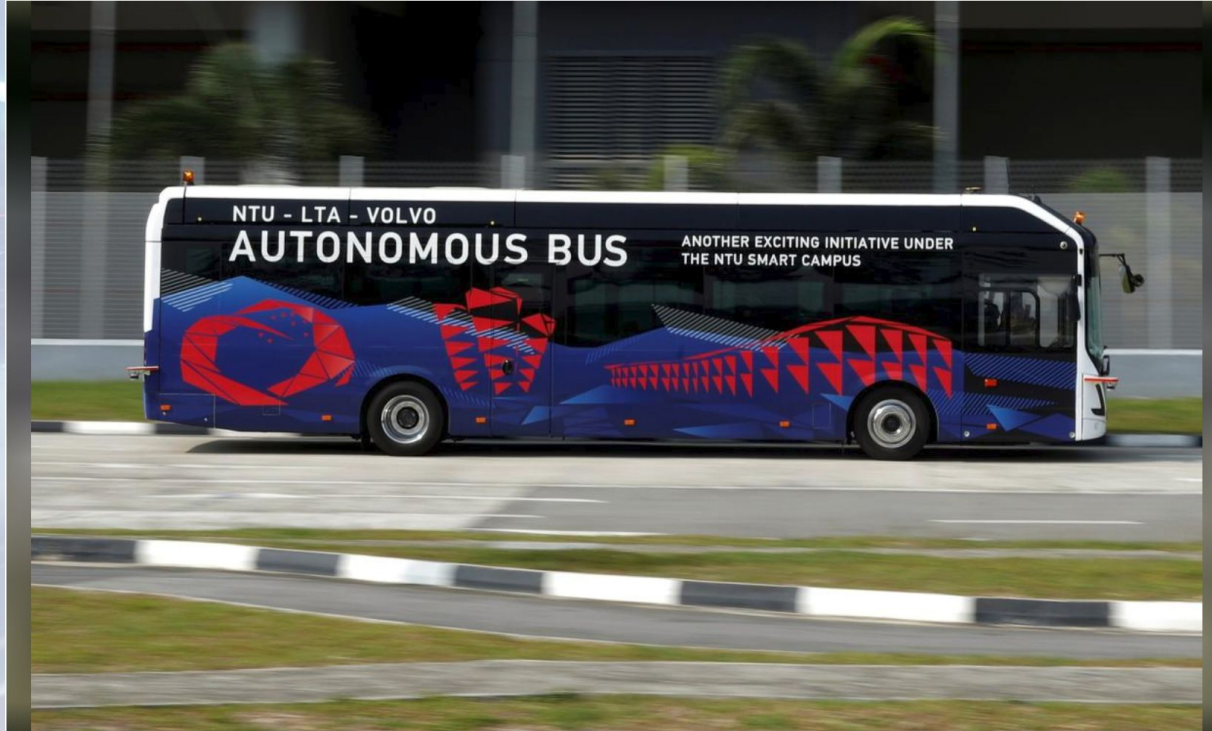


May Mobility 10k trips in Detroit



Navya, France - over 100 sold

Full size Passenger Bus



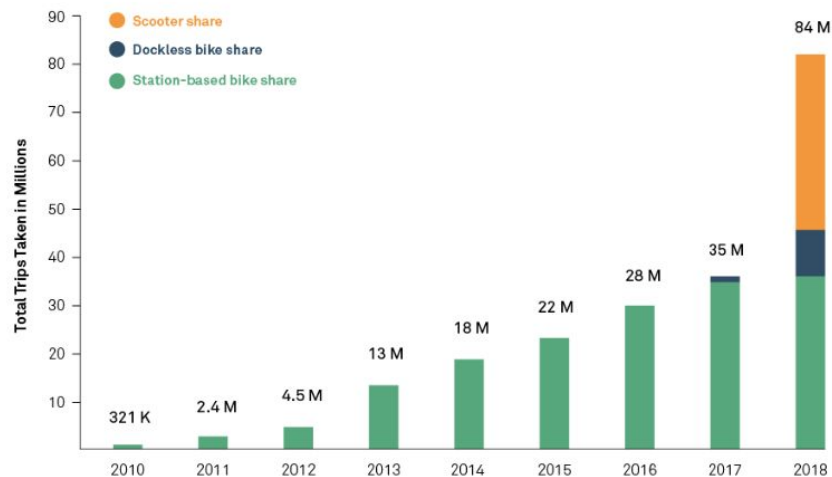
Nanyang Technological University (NTU) Singapore and Volvo Buses unveil their first full size autonomous electric bus in Singapore March 5, 2019. REUTERS/Edgar Su

Sweden: 7.5 Tonne Freight Movers



Micromobility

84 Million Trips on Shared Micromobility in 2018



Source: NACTO

FIGURE 3

Authorities have experimented with a variety of approaches to micromobility



CONTRACT

The city enters into a public-private partnership with a micromobility provider. The city retains significant control over the deployment of vehicles. Most often seen with docked bikeshare programs.

Example: New York City Citi Bike



OPEN

The city has minimal requirements of providers—e.g., prohibition on sidewalk riding but no fleet caps. This is often a temporary position when dockless micromobility enters a new market.

Example: Indianapolis



BAN

The city explicitly forbids the presence of certain types of micromobility vehicles. Can include cease-and-desist letters, impoundments, and operator fines.

Example: Columbia, South Carolina



PERMIT

City has a formal application and permitting process. Successful permittees must comply with city conditions, which can include fleet caps, data sharing, and other parameters.

Example: San Francisco

Source: Deloitte analysis.

Deloitte Insights | deloitte.com/insights

MIT Persuasive EV

- Shared Autonomous Bike
- Package delivery capability
- 20mph
- 25 mile range per charge



Don't ignore Micromobility!

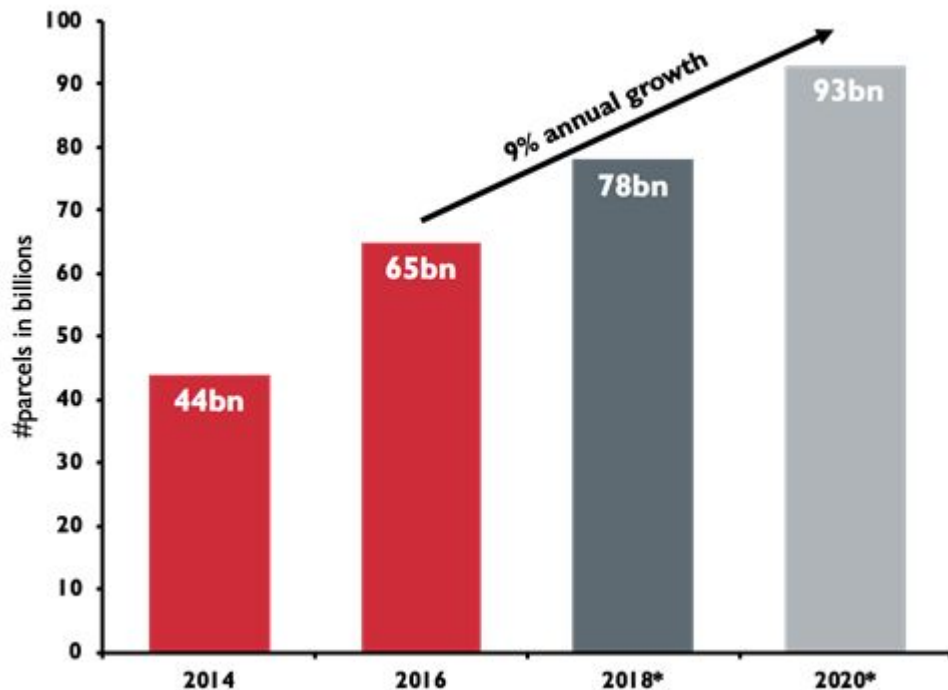
More than half of the car trips taken annually in the United States cover less than five miles.... making those journeys open to short-range alternative modes such as e-scooters and bikes

Think of it as a platform/continuum

Lime: Scooters, Bikes, Cars

Urban Mobility isn't just about people

#Parcels Delivered Worldwide



Self-driving vehicles and sidewalk robots could slash last-mile delivery costs in cities by as much as 40 percent

McKinsey, 2018

Starship 50,000 and now Scout; Kiwi in Berkeley





100 Robots
2,000 deliveries
/week

GATIK AI

Autonomous Vehicles (L4) for Urban Logistics



Last Few Feet of the Last Mile

FedEx Bot testing in Plano, TX

USPS RFI on Autonomous Capabilities

“The battle between every startup and incumbent comes down to whether the startup gets distribution before the incumbent gets innovation.”

Alex Rampell,
Andreessen Horowitz



Crowded Sidewalks

The McKinsey Institute predicts that self-driving shuttles and rovers will make up 85% of last-mile deliveries by 2025

Response to sidewalk robots? Banned in several places....

sf.curbed.com/2017/12/6/16743326/san-francisco-delivery-robot-ban

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San Francisco bans robots from most sidewalks

Delivery drones permitted only in low-foot traffic zones after Tuesday vote

By **Adam Brinklow** | Dec 6, 2017, 3:16pm PST

Facebook Twitter Email

ROBOTS **DELIVERY**

Idaho is the second state to allow unmanned robots to deliver to your front door

Virginia was the first. Wisconsin and Florida may be next.

By **Auril Glaser** | @aurilaser | Mar 27, 2017, 2:29pm EDT

So if you can't have the sidewalk, where do you go next?

In the Air



Delivery locations ▼

About Delivery

UTM



Wing: Autonomous Drone delivery live in Canberra, Australia and soon in Helsinki, Finland. FAA approval, April 2019

Amazon Prime Air testing in Cambridge, UK



amazon

Or back to the road....Nuro



Ford - Walmart, Postmates, Dominos Deliveries Trials *(Autonomy is not just about moving people)*



Toyota E-Palette Concept



Oxbotica & Ocado Trial



Mobile Shops?

The Amazon “Treasure Truck” already invites Prime members in certain cities to rendezvous at one of several scheduled stops to get a special discount on a single item. What would it take for services like this to start reshaping the layout and culture of neighborhoods?



Autonomous Sweepers



A driverless sweeper truck designed by <http://Autowise.ai>, a Songjiang-based company, is carrying out routine cleaning at Shanghai Disney Resort.

In the Aisles



Sea-Tac Airport



Off Highway and the High Seas



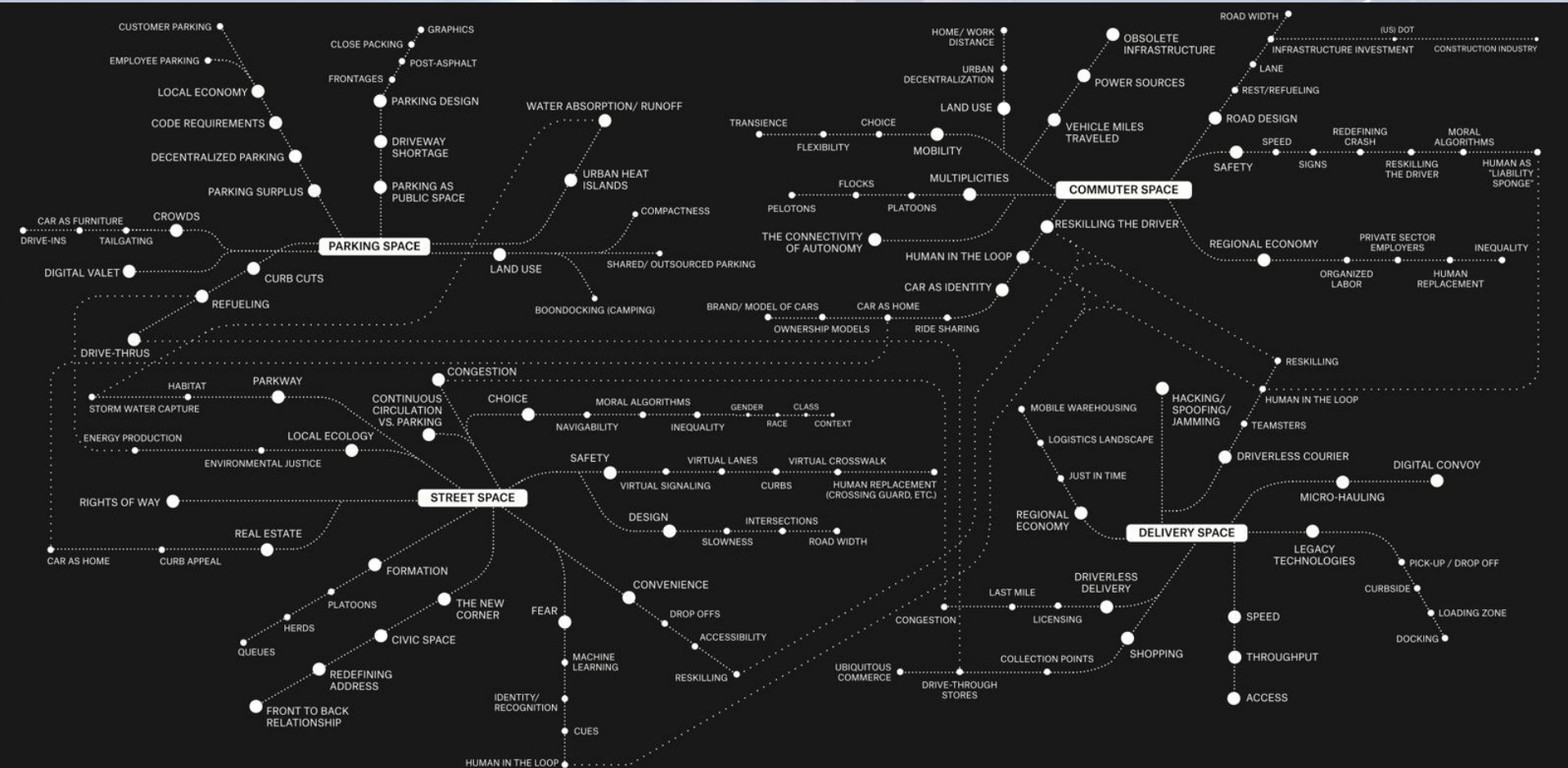
- 2.5cm precision GPS
- John Deere alone has 1.4m connected machines
- 15m sensor measurements / second to the cloud



Phantom Auto Remote Oversight & Control



Urban Mobility Touches the Entire City



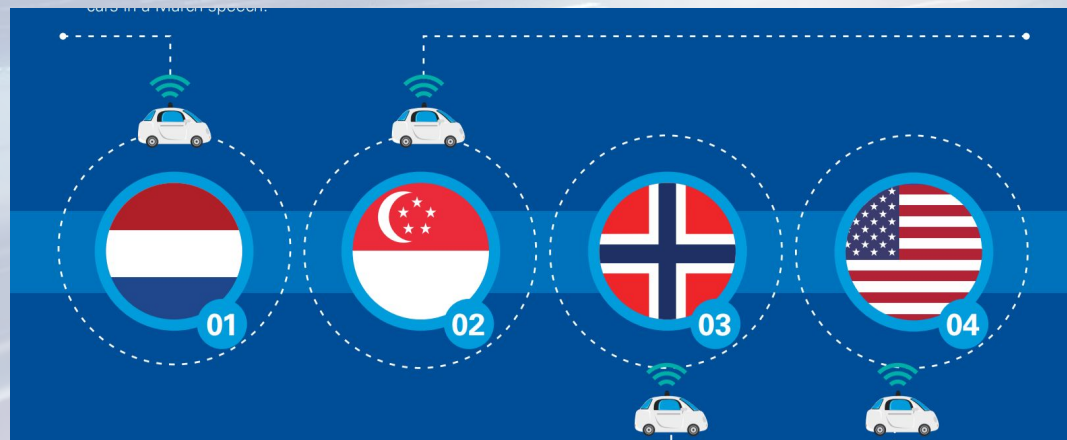
Quad Bottom Line Framework



Global Summary

“There are many uncertainties over the effects of AVs, both in time-scale, degree and direction”

Rates 25 indicators across 25 countries



KPMG

2019 Autonomous Vehicles Readiness Index

Assessing countries' preparedness
for autonomous vehicles



KPMG International

kpmg.com/avri

Common Themes Globally but Differing Priorities

- Interaction with Transit
- Impact on suburbs (sprawl, health)
- Jobs impact
- VMT tax - ZOV/SOV
- Curb rules

Technology, innovation and its attendant wealth creation should not be considered from a purely domestic point of view...the incalculable value of a global perspective.

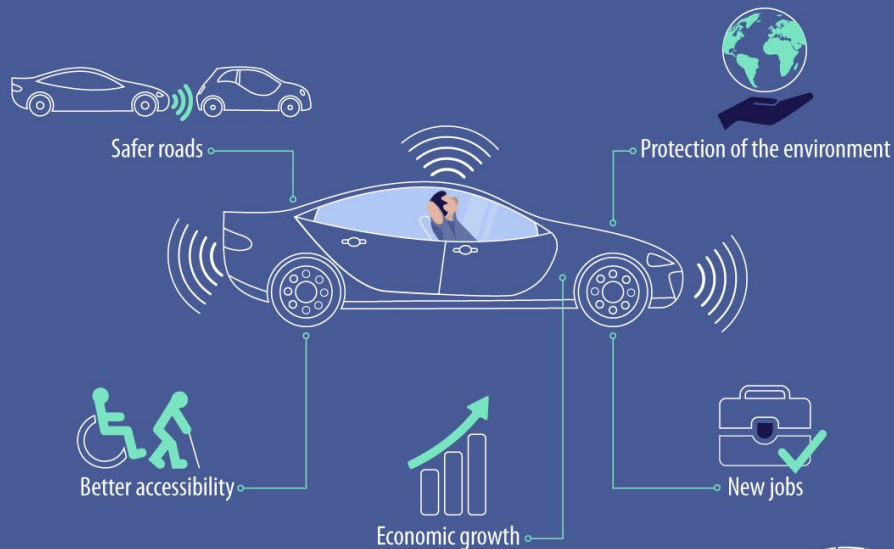
Naveen Jain, Moonshots

A blurred, high-speed photograph of a tunnel, likely a subway or train tunnel, with light trails from the walls and ceiling. The perspective is from the center of the tunnel, looking down its length. The walls and ceiling are curved, and the floor is also visible. The overall color palette is cool, with blues and greys, and some warm light trails from the tunnel's lighting. The text 'EU' is centered in the middle of the image.

EU

“Self-driving cars in the EU: from science fiction to reality”

BENEFITS OF SELF-DRIVING IN THE EU



Sources: EPRS, European Commission



Challenges of autonomous driving in the EU:

- Road safety
- Liability issues
- Data processing & cybersecurity
- Ethical questions (EU guidelines for artificial intelligence are being drafted)
- Infrastructure

EU policies and legislation concerning automated and connected transport should cover all transport modes, including:

- short-sea shipping
- inland waterway vessels
- drones transporting goods
- light rail systems

ICE will be banned by 2040

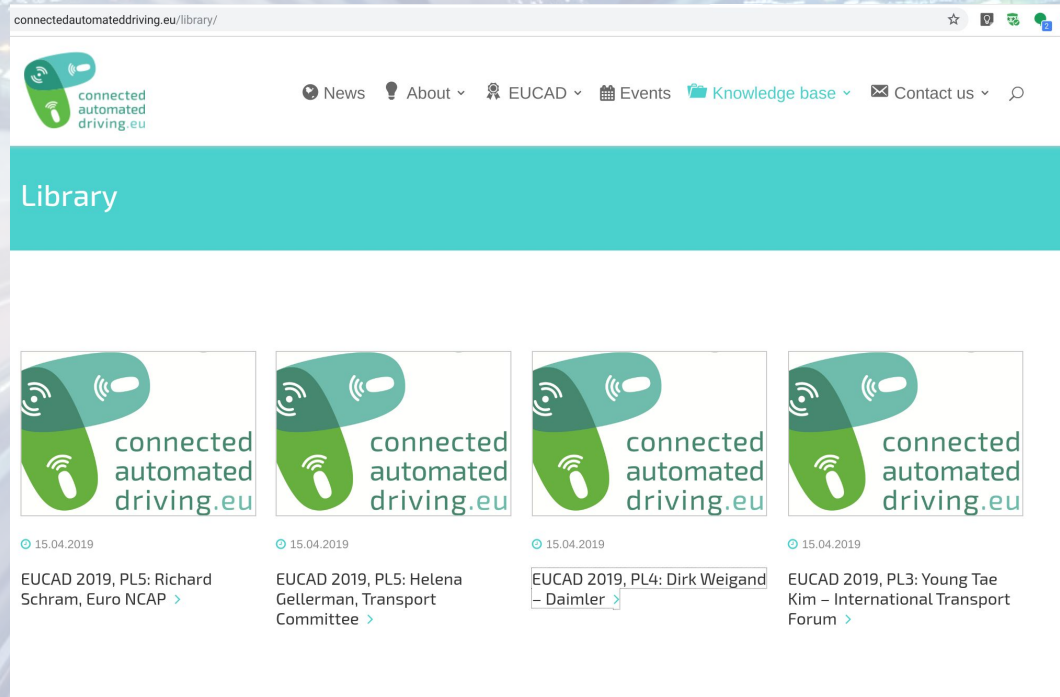
Connectivity - WiFi vs 5G

Galileo Satellites more precise than GPS (1m/1cm)

EU Focus

- Trust
- First/last mile connection to mass transit

- Decarb
- Safety & Security
- Connectivity
- Access



Not waiting for Autonomy: From GDPR to GSR (2022)



- Advanced emergency braking (cars, vans)
- Alcohol interlock installation facilitation (cars, vans, trucks, buses)
- Drowsiness and attention detection (cars, vans, trucks, buses)
- Distraction recognition / prevention (cars, vans, trucks, buses)
- Event (accident) data recorder (cars, vans, trucks, buses)
- Emergency stop signal (cars, vans, trucks, buses)
- Full-width frontal occupant protection crash test - improved seatbelts (cars and vans)
- Head impact zone enlargement for pedestrians and cyclists - safety glass in case of crash (cars and vans)
- Intelligent speed assistance (cars, vans, trucks, buses)
- Lane keeping assist (cars, vans)
- Pole side impact occupant protection (cars, vans)
- Reversing camera or detection system (cars, vans, trucks, buses)
- Tyre pressure monitoring system (vans, trucks, buses)
- Vulnerable road user detection and warning on front and side of vehicle (trucks and buses)
- Vulnerable road user improved direct vision from driver's position (trucks and buses)

UK 9 principles (as far as possible)

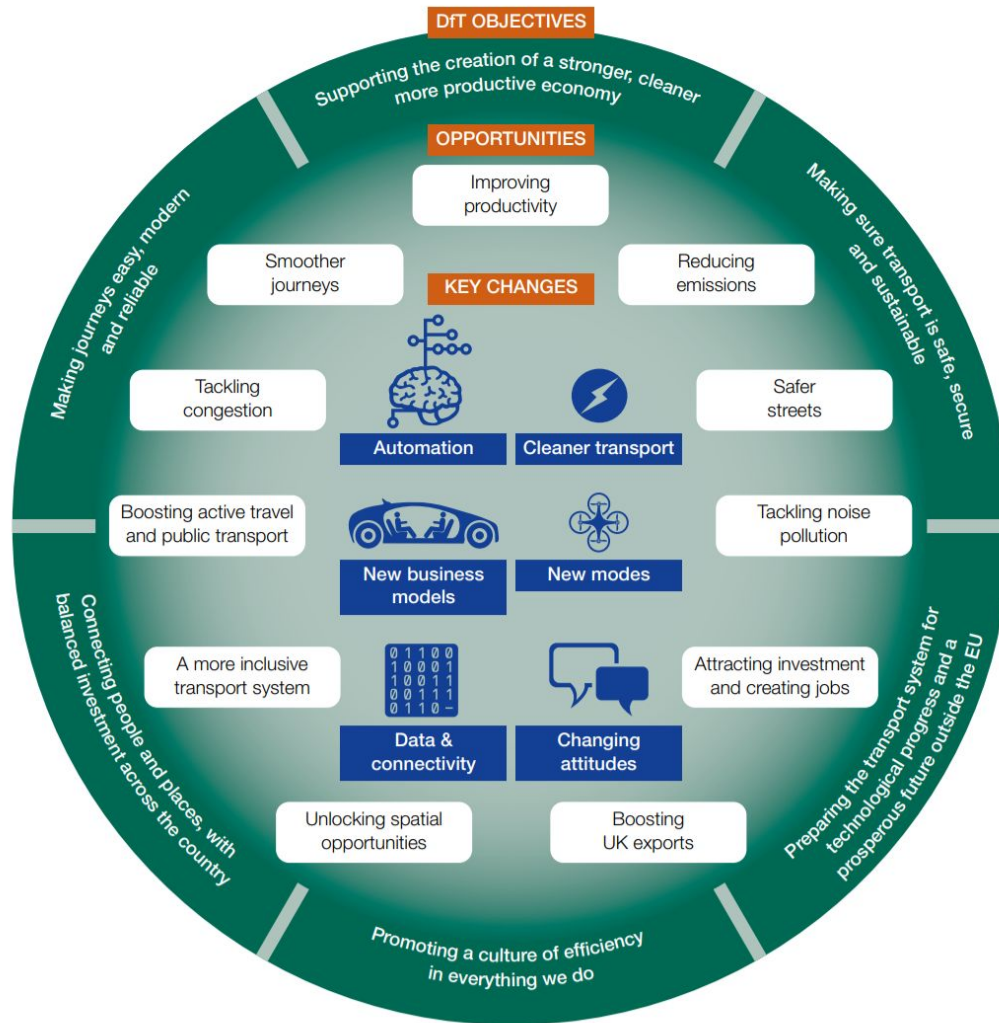
1. New modes of transport and new mobility services must be safe and secure by design.
2. The benefits of innovation in mobility must be available to all parts of the UK and all segments of society.
3. Walking, cycling and active travel must remain the best options for short urban journeys.
4. Mass transit must remain fundamental to an efficient transport system.
5. New mobility services must lead the transition to zero emissions.
6. Mobility innovation must help to reduce congestion through more efficient use of limited road space, for example through sharing rides, increasing occupancy or consolidating freight.
7. The marketplace for mobility must be open to stimulate innovation and give the best deal to consumers.
8. New mobility services must be designed to operate as part of an integrated transport system combining public, private and multiple modes for transport users.
9. Data from new mobility services must be shared where appropriate to improve choice and the operation of the transport system

Future of Mobility: Urban Strategy

Moving Britain Ahead



March 2019



Implementing a flexible regulatory framework

Initiating four new areas of focus for our Regulatory Review:

- **Micromobility vehicles, and how to trial them**
- **Mobility as a Service**
- **Transport data**
- **Modernising bus, taxis and private hire vehicles legislation**

These are in addition to existing regulatory programmes for:

- Zero emission vehicles
- Self-driving vehicles
- Drones and future flight
- Maritime autonomy

FHWA looks to Europe

- Public Private Partnerships
- Integration with Transit
- EU support for electrification
- Intermodal hubs
- “One card to rule them all” - MVG More app in Munich
- Fare/Subscription Integration - Bus, Bike, Train Tram, Car share, Scooter
- Business Mobility Plans (Firms with >50 staff)



Initiative on Cities and Autonomous Vehicles

About



Is your city getting ready for AVs? This is a guide to who's doing what, where, and how.

As the pace of autonomous vehicle (AV) innovation picks up, cities have become the proving ground of choice. Tech giants, automakers, and startups alike are focused on cities because that is where future customers live and work.

This Atlas is the world's first inventory of how cities around the globe are preparing for the transition to a world with AVs. As cities seek to learn from one another, they can look to this map for up-to-date information on what's underway worldwide.

2017:
45

2019:
98

Yandex Trial

- Innopolis
- Order via Telegram chat



China

- a. Beijing has set up a licensing program for Baidu.
- b. Shanghai has set a licensing program for Ali Baba.
- c. Shenzhen has set up a licensing program for Tencent.

PSA, BMW, Audi & Mercedes all testing

Beijing and the Xiongan New Area in Hebei province, and will be operational by 2020

2 of 8 lanes dedicated to AV

62 miles



Singapore Land Transport Authority

- 2022: Piloting the deployment of autonomous buses & cars in 3 districts to provide convenient first-last mile connectivity for residents, workers and students.
- RFI - 122 pages long - 34 on 5G alone
- The city has designated chunks of the island to test drones where they won't interfere with the airport or the central business district. Airbus and Wilhelmsen are among the companies conducting trials in Singapore to resupply ships that stay at sea.
- Singapore is also using 200 driverless cranes to unload cargo, and driverless trailers to carry the goods. The new port, being built on reclaimed land in the west of the country, will feature almost 1,000 of these cranes and driverless vehicles

US Urban Mobility Regulation

3.0 will move USDOT's role beyond simply overseeing the safe development of AVs to assisting with the actual implementation of automation technologies across all modes of surface transportation – passenger vehicles, trucks, buses, rail, and maritime.

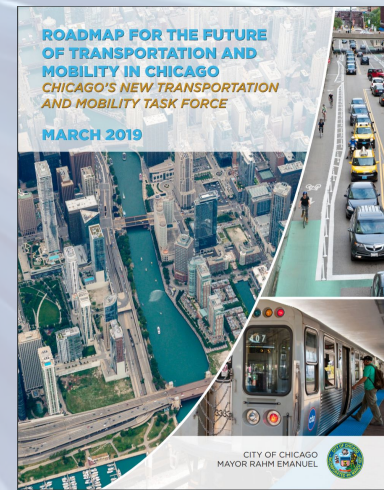
“It's an exciting time for the future of our nation's transportation,” she said.

“Autonomous technology – including automated cars, trucks, and drones – has the potential to revolutionize the way we travel, transport goods, and connect with one another.”

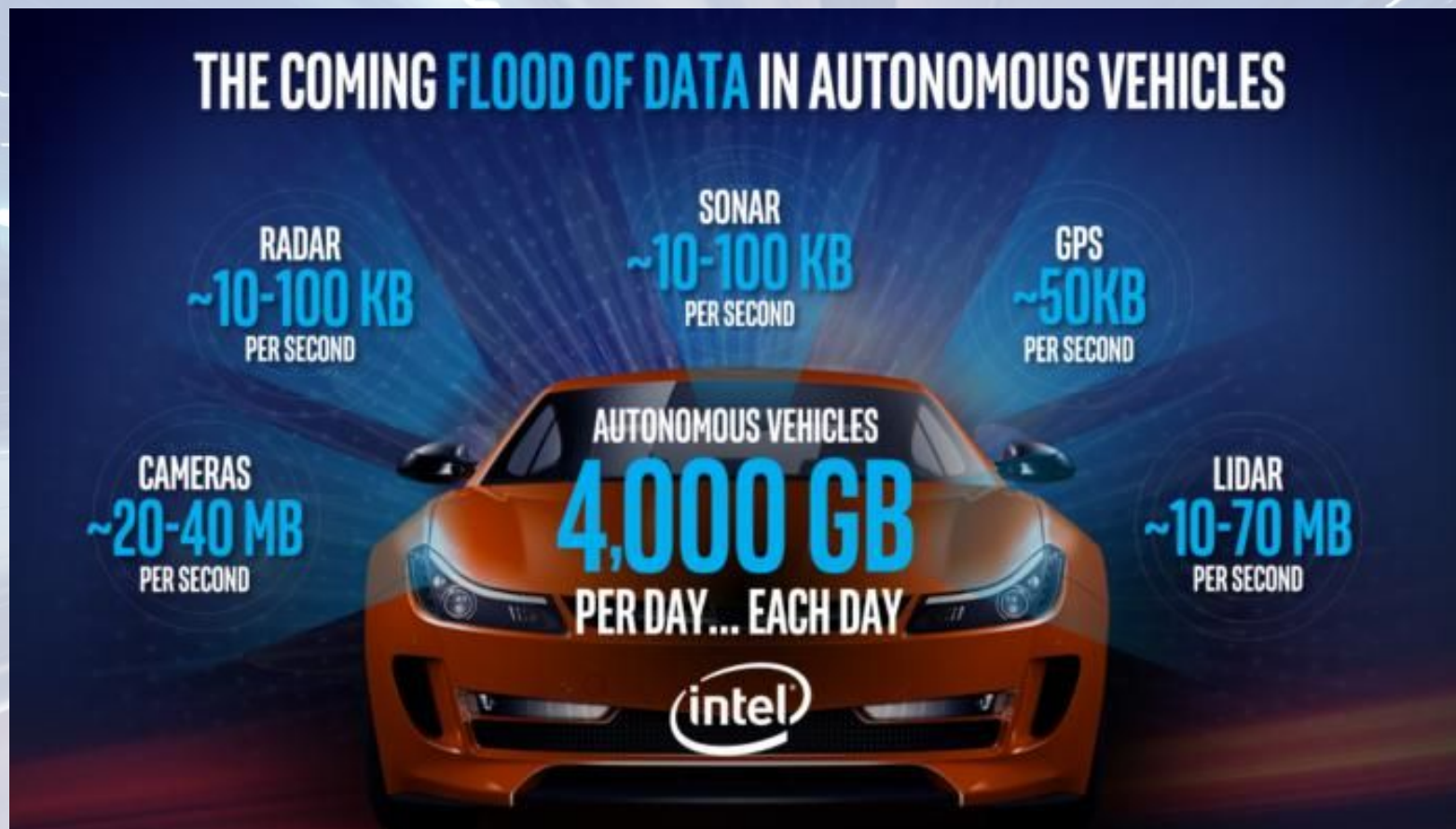
CA Light Trucks (ie delivery) Consultation April 12th to May 27th

Free delivery only

50 Recommendations in Chicago's roadmap....



Not These Data



Data: The Urban Perspective

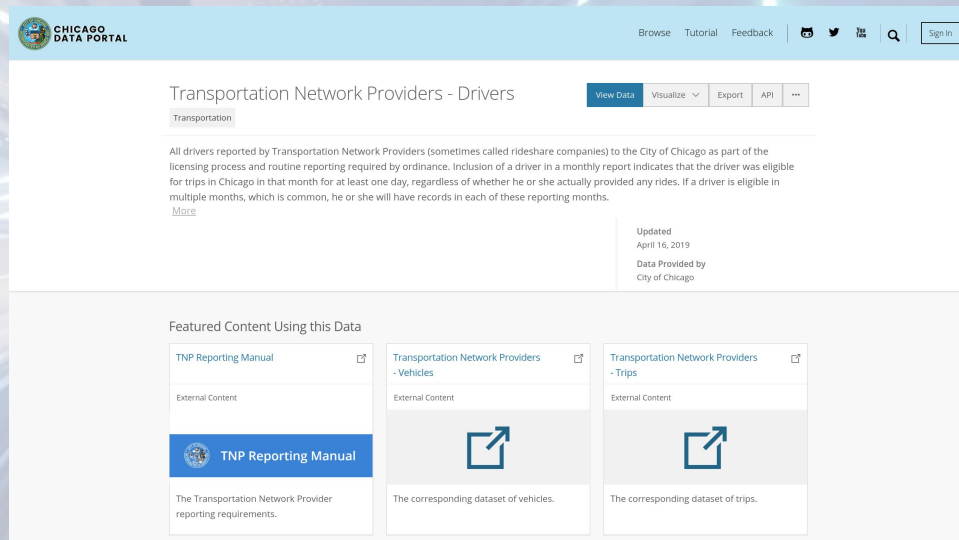
LA DoT Mobility Data Specification (MDS)

8 scooter/bike companies 36,000 vehicles

Provider API, enables mobility companies to send information about individual devices directly to the city. Information about the start, end, and route of each dockless vehicle trip, accurate within a few hundred feet. Whether the vehicle is broken, out of power, or in the process of being “rebalanced” (that is, being moved to another part of the city).

Agency API. It enables a city to instantly send digital information and instructions directly to private mobility companies. It allows the city to alert companies to events like a crash or a parade, and to notify companies of vehicles that are illegally parked. In theory, it could also allow cities to adjust pricing (like scooter fees) to incentivize mobility companies’ behavior.

Opposition from Uber and EFF but adopted by several other cities

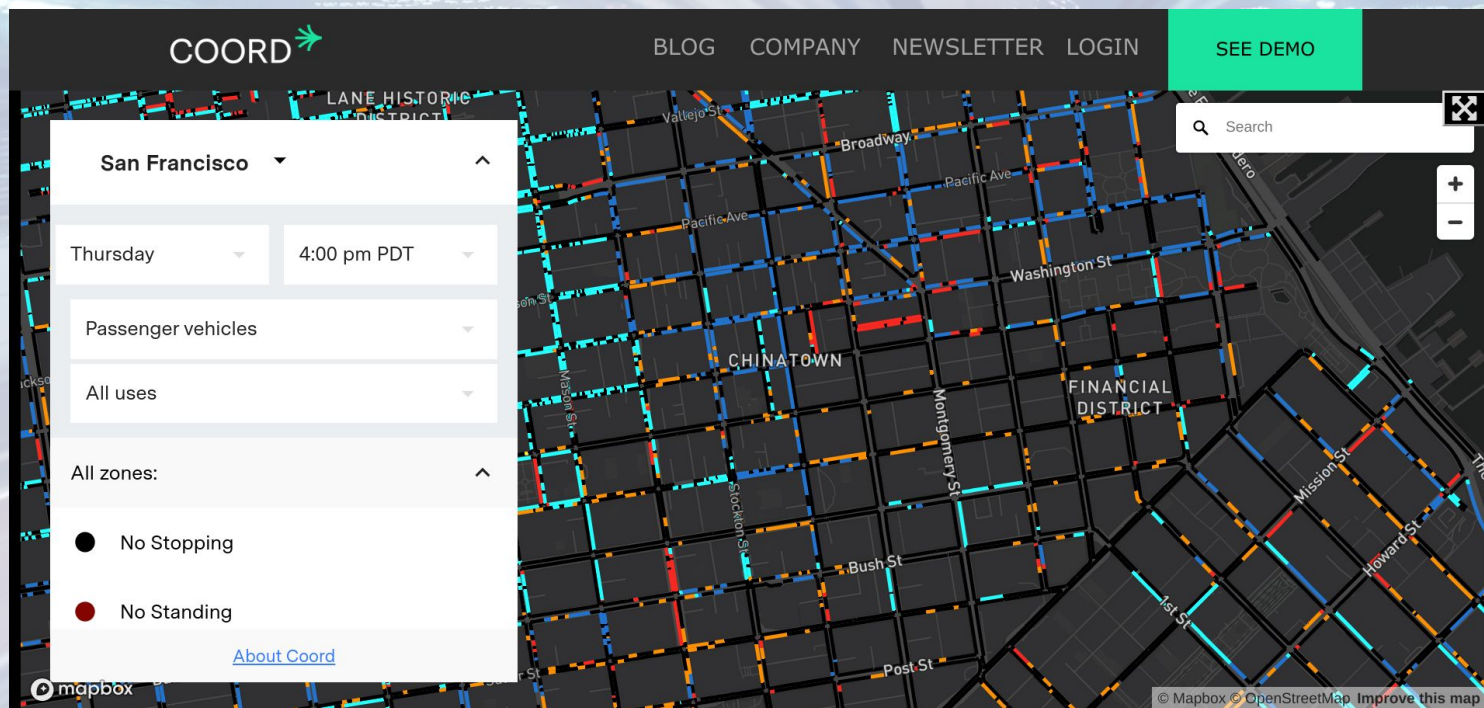


The screenshot displays the Chicago Data Portal interface. At the top, the header includes the Chicago Data Portal logo, navigation links (Browse, Tutorial, Feedback), social media icons, and a search bar. The main content area is titled "Transportation Network Providers - Drivers" and features a "View Data" button, a "Visualize" dropdown menu, and "Export" and "API" buttons. Below the title, a paragraph explains that all drivers reported by Transportation Network Providers (sometimes called rideshare companies) to the City of Chicago are included in the data. It notes that inclusion in a monthly report indicates eligibility for trips in Chicago for at least one day, regardless of whether the driver actually provided any rides. A "More" link is provided for further information. On the right side, a box indicates the data was updated on April 16, 2019, and is provided by the City of Chicago. The bottom section, titled "Featured Content Using this Data", contains three cards. The first card, "TNP Reporting Manual", includes an external content link and a thumbnail image of the manual. The second card, "Transportation Network Providers - Vehicles", includes an external content link and a thumbnail image of the corresponding dataset of vehicles. The third card, "Transportation Network Providers - Trips", includes an external content link and a thumbnail image of the corresponding dataset of trips.

Curb data

Tolls, Curbs, Parking, Bike Share

Real time regulation data

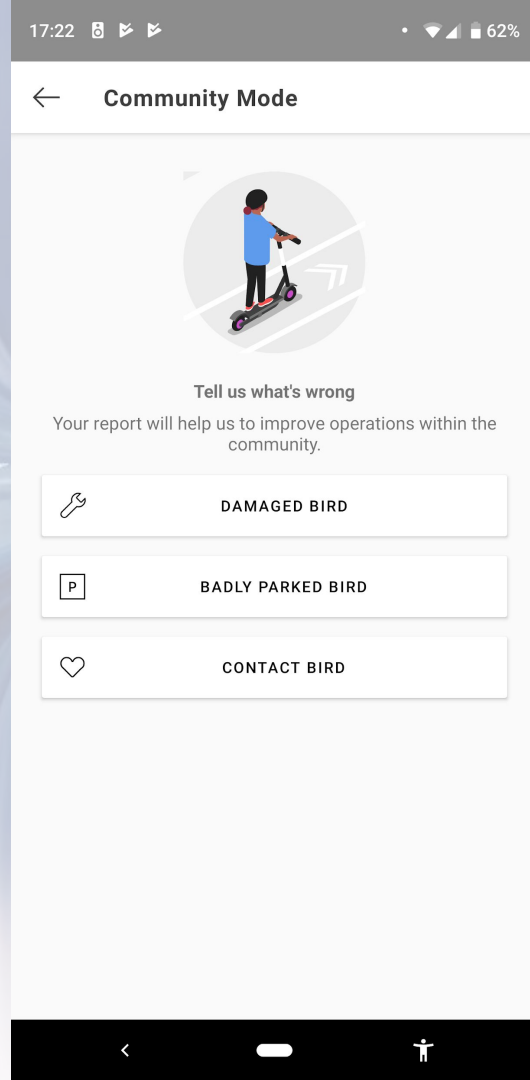


Bird Data

Community Mode

700 reports per day

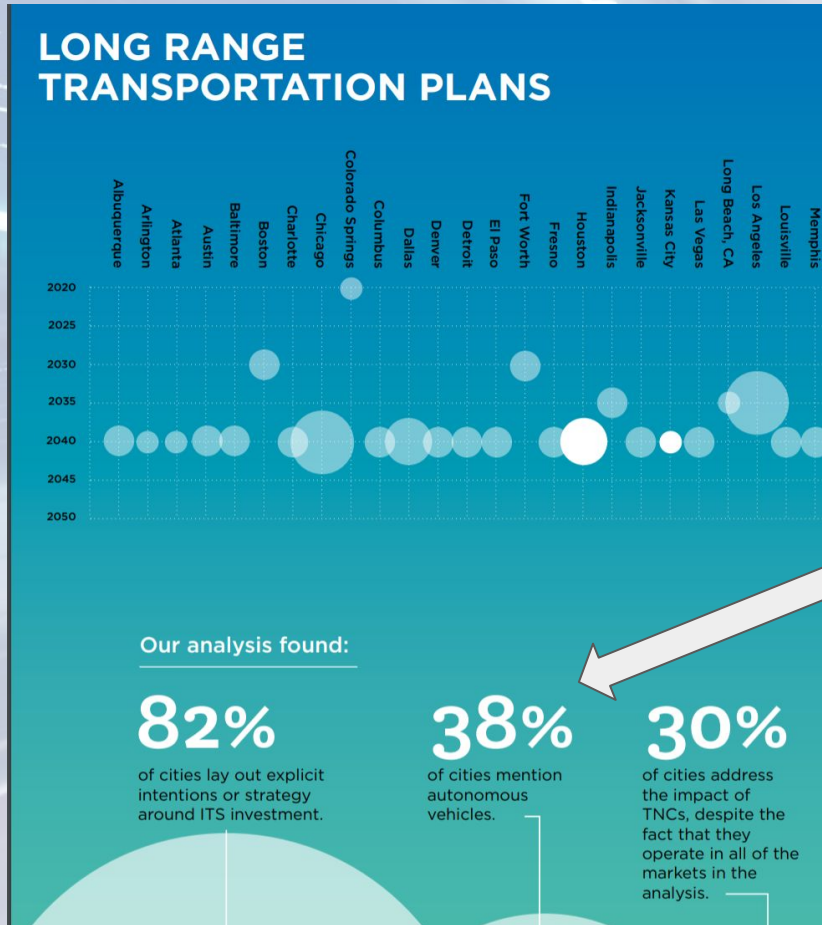
70,000 people have used



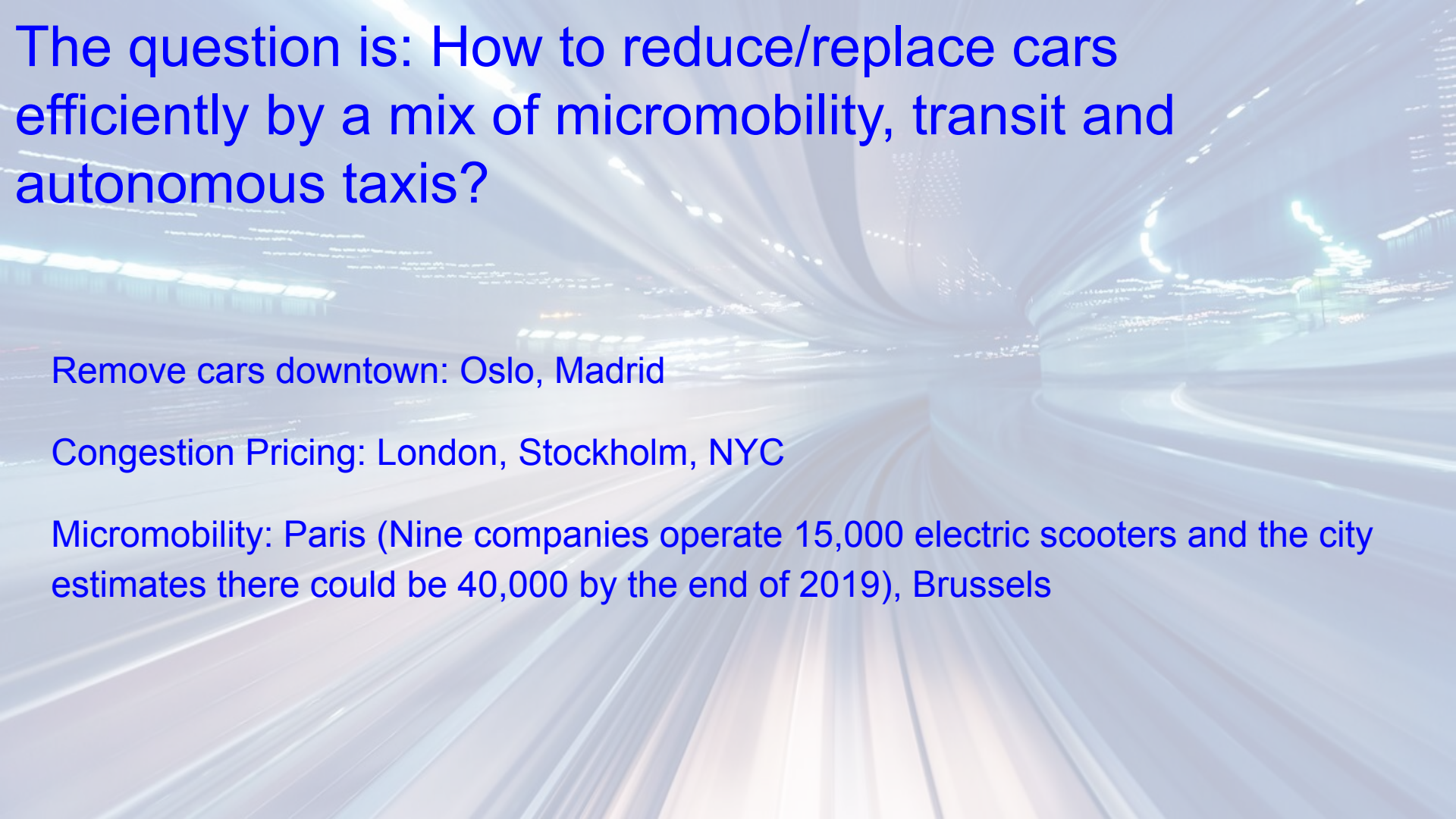


Change and the Role of Cities

National League of Cities 2017 Report



In 2014, that figure was only 6%



The question is: How to reduce/replace cars efficiently by a mix of micromobility, transit and autonomous taxis?

Remove cars downtown: Oslo, Madrid

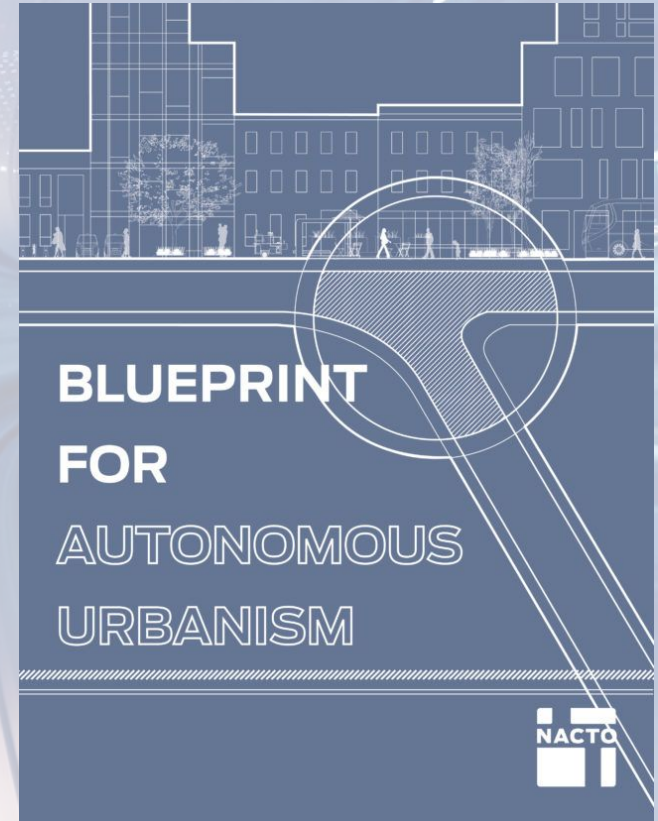
Congestion Pricing: London, Stockholm, NYC

Micromobility: Paris (Nine companies operate 15,000 electric scooters and the city estimates there could be 40,000 by the end of 2019), Brussels

NACTO

Automated vehicle technology holds many promises for cities, but the potential benefits of automation are not guaranteed. City policies must proactively guide the technology to prioritize people-centric design.

- Safety is top priority
- Provide mobility for the whole city
- Rebalance the Right of Way
- Manage Streets in Real Time
- Move more with fewer vehicles
- Public Benefit guides Private Action



What are cities afraid of?

- Loss of parking revenues
- Lobbying from vested interests
- Difficulty of building or moving infrastructure
- Zoning/Planning constraints
- Liability
- 2nd/3rd Order impacts - Transplants, Trophic Cascade

“We don’t just need new software running on our streets—we need to update the hardware of the streets themselves”

Janette Sadik-Khan, a former transportation head in New York City, board NACTO.



“I think the hardware may be ready before society is ready.”

Bill Ford, great-grandson of Henry Ford

Regulation + Policy ≠ Public Perception



- Safety
- Ethics
- Federal v Local



- Privacy
- Urban Planning
- Policing



- Public Perception

“These are not easy questions; applying 100 year old thinking to some of the most technologically advanced machines yet created is hardly likely to yield an optimal result”

Public Perception



Even the most supportive, progressive and permissive regulatory frameworks imaginable won't be enough to guarantee success for driverless cars if the public do not adopt and adapt.

“The future is already here. It's just not evenly distributed” - William Gibson

“Public education is an important responsibility if you're a self-driving car company. Today, if you live in places like the San Francisco Bay Area, Pittsburgh or Phoenix, Austin or Miami—you may have seen a self-driving car on the road, and simply by virtue of that firsthand experience, the technology somehow becomes more normal. Less unknown.

But most people across the country haven't yet had that chance—and consequently, a lot of people have a lot of misconceptions about the technology, and how it will play out” - Chris Urmson

“...the incredulity of mankind, who do not truly believe in anything new until they have had actual experience of it.”

— Niccolò Machiavelli, The Prince

WSJ | OPINION

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OPINION | LETTERS

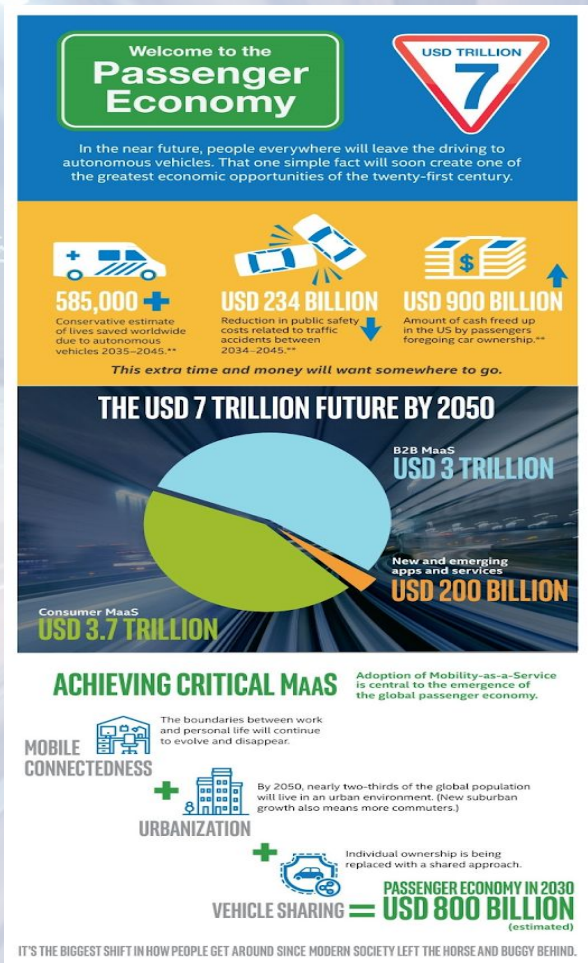
Rural Voters Will Still Need To Own Their Own Cars

Those of us in rural areas can't hail a car willy-nilly. We will need to own our vehicles.

July 16, 2017 12:44 p.m. ET

As always, the market is all about the urban dweller ("The End of Car Ownership," Journal Report, June 21). Those of us in rural areas, well, we can't hail a car willy-nilly. We will need to own our vehicles, and we will drive them on our poor rural roads. So the car makers, like the broadband providers, will ignore this part of the population. But remember, we do count. We are the ones who drive the Electoral College.

Business Model: Intel's Passenger Economy 2017



Final Thoughts...

- Urban Mobility interacts with a lot of stakeholders, who move at different paces with differing agenda:
 - City authorities
 - Interest groups
 - Public perception
- Urban Mobility priorities vary globally:
 - Trust
 - Transit
 - Accessibility
 - Connectivity
 - Data
- Urban Mobility will be made up of different modalities - don't underestimated the interactions
- And all of this will happen under the microscope of social media commentary, and against the backdrop of litigation that previous technological advances did not endure. If they speed approvals, they will be accused of playing fast and loose with lives, bowing to cavalier corporations. If they don't, they will be accused of obstruction and old fashioned favouritism.
- Don't forget the lack of familiarity with the tech outside of SV and testing towns

Thank You! And Good Luck!!

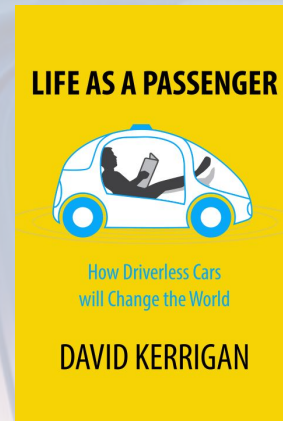
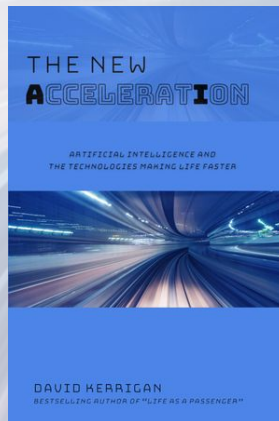
Contact

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<http://david-kerrigan.com>

medium.com/@david.kerrigan

<https://www.linkedin.com/in/davidkerrigan>



Further Reading

<https://connectedautomateddriving.eu/library/>

<https://hackernoon.com/autonomous-car-pricing-will-turn-your-town-into-a-science-experiment-a7b797734df6>

https://issuu.com/sasakiassociates/docs/shifting_gears_20180531_-_issue

<https://sidewalklabs.com/blog/av-event/>

<https://ixn.intersection.com/with-autonomous-vehicles-its-not-about-the-journey-it-s-about-the-destination-6bdc821fa92b>

<https://assets.kpmg/content/dam/kpmg/xx/pdf/2019/02/2019-autonomous-vehicles-readiness-index.pdf>

<https://www.gov.uk/government/publications/future-of-mobility-urban-strategy>

<https://nacto.org/publication/bau/blueprint-for-autonomous-urbanism/>

RECENT PUBLICATIONS

Arup

"Future of Highways"

Bloomberg Associates

"Taming the Autonomous Vehicle: A Primer for Cities"

Buro Happold Engineering

"Global Design Sprints: How to Reimagine Our Streets in an Era of Autonomous Vehicles"

HR&A, Arcadis Design & Consulting, Sam Schwartz

"Driverless Future: A Policy Roadmap For City Leaders"

IDEO

"The Future of Automobility"

WSP | Parsons Brinckerhoff

"Driving Towards Driverless: A Guide for Government Agencies"