ASECAP DAYS

COSTA NAVARINO 2019

47TH ASECAP STUDY & INFORMATION DAYS

The Future of Urban Mobility - false myths and true challenges

Costa Navarino, Messinia, Greece
29-31 May 2019

www.asecapdays.com

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TECHNOLOGICAL & MOBILITY TRENDS: CONTEXT

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TRANSPORTATION INFRASTRUCTURE BUSINESS:

- How will the growth in collaborative economy services such as car-sharing and ride-hailing affect congestion?
- How are doorstep delivery and telecommuting changing the way people and goods move?
- Will autonomous vehicles radically change the way we get around?

A RIGOROUS LOOK AT THESE TRENDS SHOW:

- New trends and technologies increase car use and congestion
- Confusion due to misunderstanding of the behavioral impact of new trends and technologies

COLLABORATIVE ECONOMY - DEFINITION

- **VERY DISTINCT CONCEPTS:**

1. **CAR-SHARING**: **same car used by successive users** in successive trips promising a reduction in fleet sizes in our cities:

2. **TRIP-SHARING/ CARPOOLING: several users sharing the same ride** for work or other purposes hence potentially increasing the number of passengers per vehicle and reducing the number of vehicles on the roads.

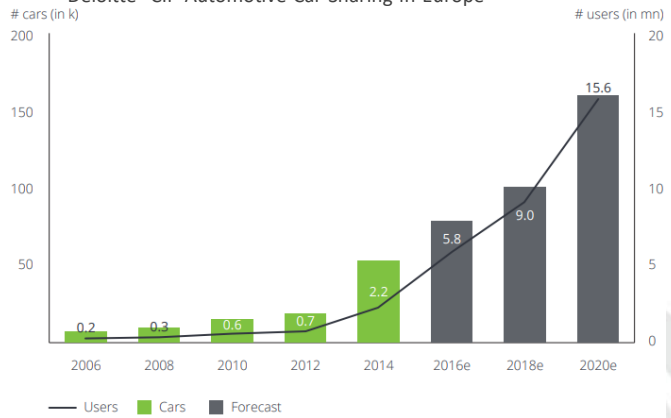
3. **RIDE HAILING: collaborative ride services** by individuals subscribed to a s/w platform as a way to “complement” incumbent taxi services.

COLLABORATIVE ECONOMY AND CONGESTION - I

CAN THEY SOLVE CONGESTION?

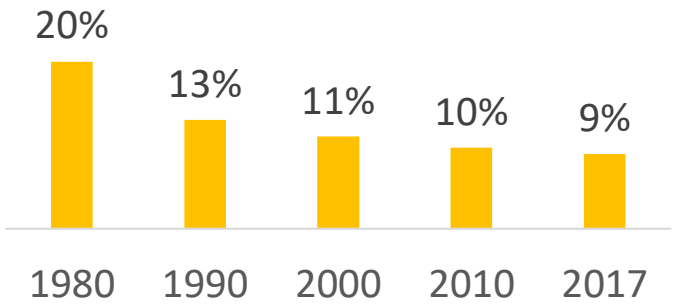
1. **CAR-SHARING**: **same car used by successive users** in successive trips:
   - Limited to **dense urban** environments (less effective in sprawled US cities), it is expected to triple between 2015-2020
   - Change in ownership model will indeed **reduce vehicle fleet (as much as 20%)**, as well as parking needs and car usage costs
   - However, it will **increase road traffic** and road congestion, as those vehicles will have much **more usage (x3-x5)**

Fig. 3 – Car sharing market development for Europe* (2006–2020):
Deloitte "CIP-Automotive-Car-Sharing-in-Europe"



European 2016 car-sharing users: 3,5x 2010

2. **TRIP-SHARING: several users sharing the same ride** (High Occupancy Vehicle or traditional Carpools)
   - Actual US data shows ride-sharing decline over time:



KEY FACTORS BEHIND THE REDUCTION IN CARPOOL:

- Increased affordability and ease of car use
- Social changes: increase in "trip chaining"
- Value of privacy and comfort[iii]

COLLABORATIVE ECONOMY AND CONGESTION -II

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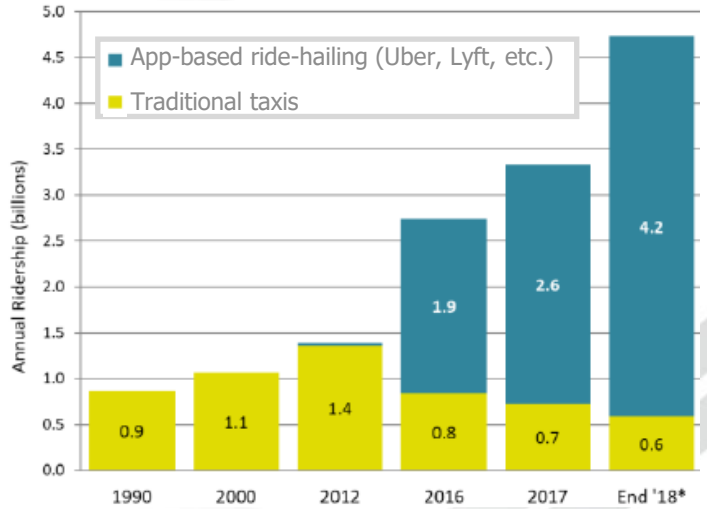
3

- **Ride-hailing: collaborative ride services** by individuals subscribed to a s/w platform
  - 29% adults living in main US urban neighborhoods use regularly ride-hailing
- **Ride-hailing market is still <1% of VMT but booming** –US ride-hailing ridership: +37% in 2017, +60% (projected) in 2018 and expected to be as much as 10% of total miles travelled by 2030.
- **Significant concerns in terms of congestion**
  - Ride-hailing trips mostly **substitute walking, biking, public transport** and as much as **22%** are **new trips that would not have occurred otherwise**
    - Public transport ridership dropped 4.4% in the US in 2014-2016 and a further 3% drop in 2017
    - In London (UK), in 2017 there was a 5% drop in rail journeys; 6% in bus passengers and 2% in subway ridership compared to 2016 according to TfL
  - Even when substituting cars (less than half of all trips), the impact on congestion is negative, since ride-hailing companies put 2.6x more miles due to miles between trips
  - Overall impacts on VMT range between 50-200% increase in miles on the road for the same trips that are being subsituted, and between 8-22% overall

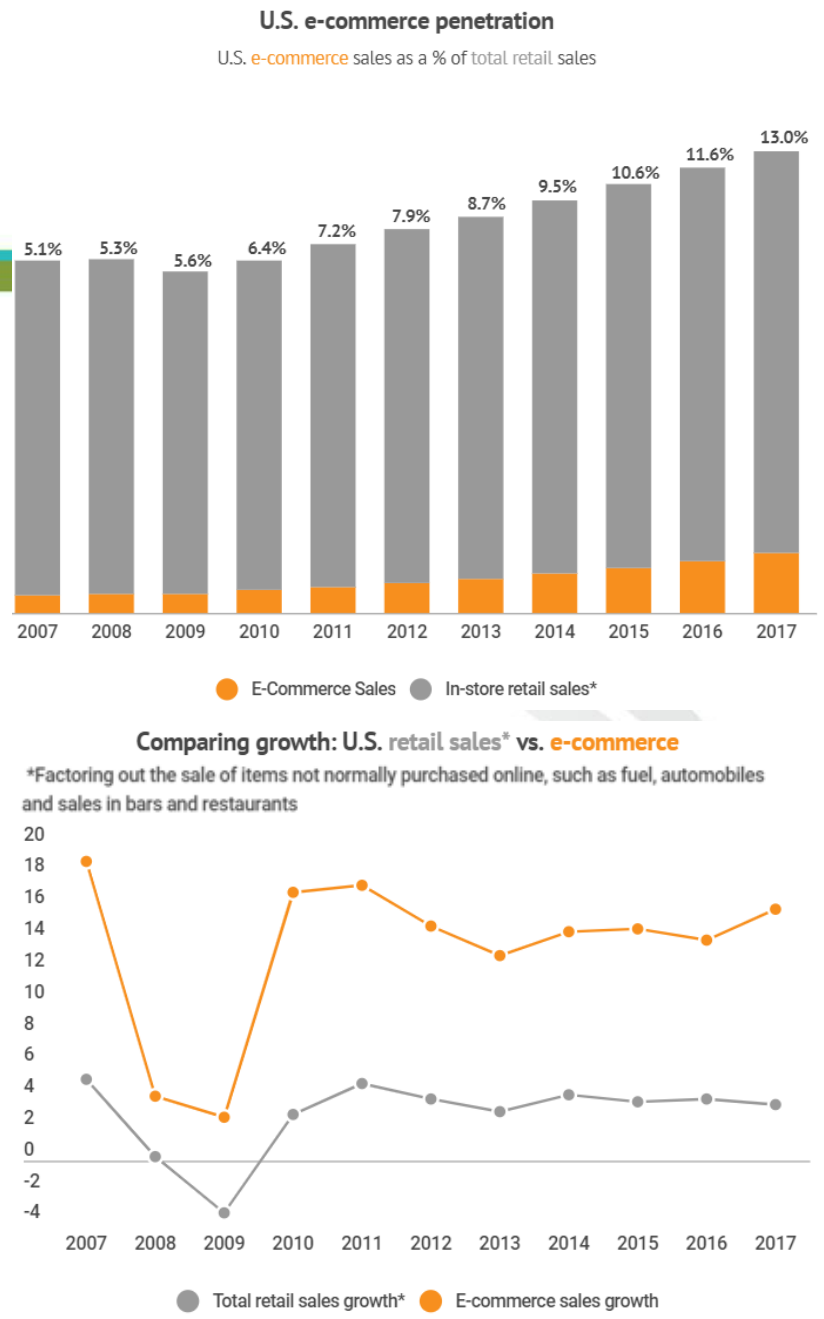
Figure 1. TNC and taxi ridership in the U.S., 1990-2017
(annual ridership, in billions)



CAR SHARING AND RIDE HAILING ARE INCREASING URBAN CONGESTION WHILE TRIP SHARING IS DECLINING

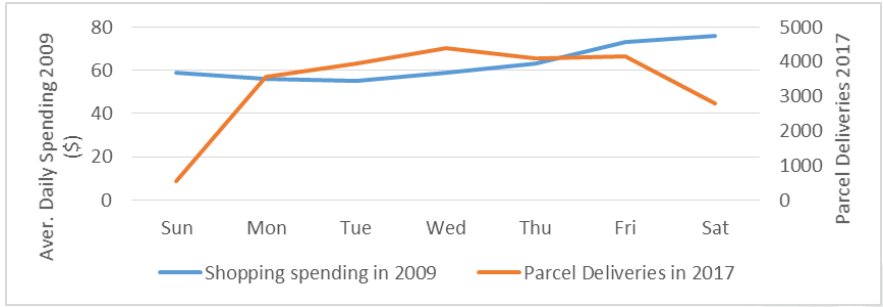
DOORSTEP DELIVERY - BOOMING

- Online retail sales to consumers in the U.S. crossed $453 billion in 2017: share of **e-commerce on total retail sales from 5.1% in 2007 to 13% in 2017**
  - 67% of Millennials and 56% of Gen Xers prefer to shop on online rather than in-store. (Big Commerce)
  - 95% of Americans shop online at least yearly, 80% of Americans shop online at least monthly, 30% of Americans shop online at least weekly, 5% of Americans shop online daily. (Big Commerce)
- Growth expected to continue, with retail e-commerce sales projected to reach $700 billion by 2022, with a **CAGR of around 15%** in the last 8 years [ii]
- Early studies of the mid 2000's argued that **Internet delivery of grocery would dramatically reduce car traffic for grocery shopping through trip-bundling** (as much as 70% in veh-km) with consequent benefits in terms of congestion.
- Looking at the last 10 years, this theory has been proven to be wrong, as explained in the next slide



DOORSTEP DELIVERY - IMPACT ON TRAFFIC AND CONGESTION

- While trip bundling does occur (1 of your packages shares ride with other packages) experts agree that door step delivery is contributing to congestion in major cities due to:



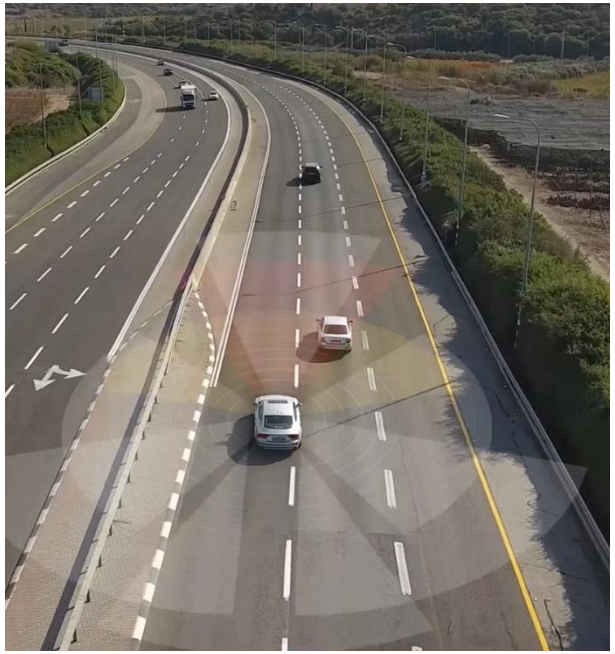
  - **Shift of trips from off-peak and Saturdays to peak period**
  - **More individual purchases and deliveries per capita/per business Items purchased online transported by larger vehicles (trucks), doing frequent stops and causing more emissions**
  - Creation of **new road trips** due to:
    - **Substitution of trips by foot** at nearby establishments
    - **Deliveries to** households that don't own cars, or are **mobility impaired**
    - Additional trips due to **failed deliveries and items' returns**
  - Difficulty bundling trips and optimizing routes with shorter delivery timeframes (1h deliveries etc.)
- After all, **car trips are not going down**: In Seattle, non-work car trips increased from 10.3 million trips per day in 2006 to 12.6 million in 2014, meaning that car trips are not being substituted but more trips are added on.
- In conclusion, while the reduction of non-work car trips is at best uncertain the **increase of heavy traffic in dense areas and in more congested periods is likely to contribute to further congestion.**

NEW TECHNOLOGIES

- CONNECTED AND AUTONOMOUS VEHICLES
- PASSENGER DRONES AND FLYING CARS

CONNECTED & AUTONOMOUS VEHICLES (CAVS)

- Latest forecasts suggest slower adoption of AVs than previously projected (10-to-50% of light vehicles sells by 2040)
- From the toll road business perspective, focus on behavioral impact rather than on technology

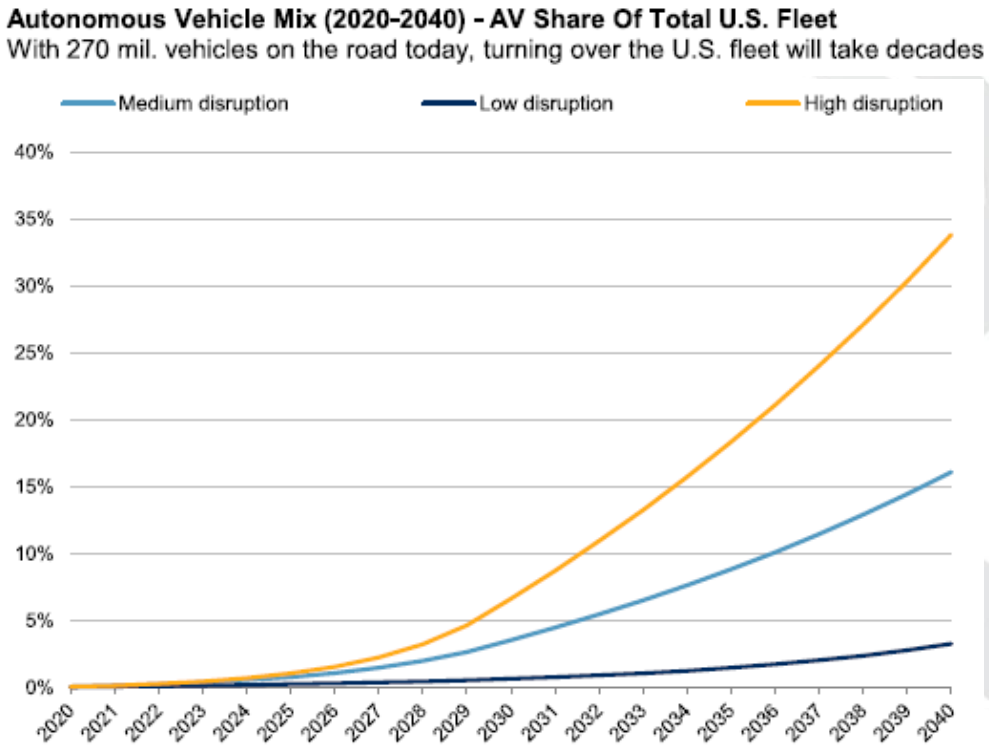


POTENTIAL THREAT TO MANY BUSINESSES

- Car manufacturers
- Parking developers
- Public authorities' revenue (Street parking, taxes)

NOT NECESSARILY A THREAT TO THE TOLL ROAD BUSINESS

- Increased congestion during transition period
- Higher VMT at full automation



FULL AUTOMATION **WILL INCREASE TOTAL VMT ON ROAD NETWORK**

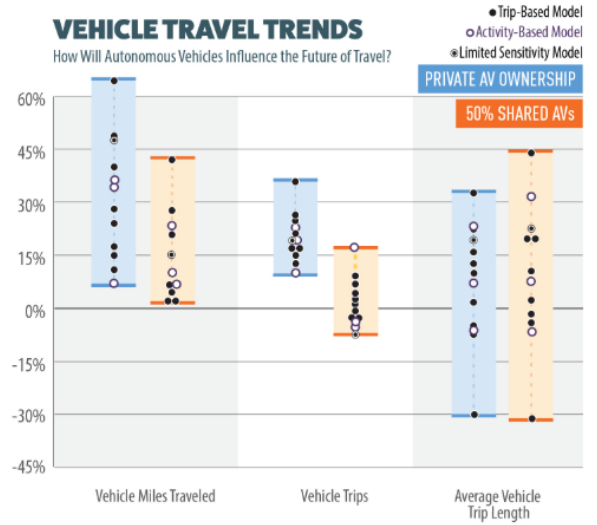
Increasing effective road capacity by as much as 25%

- Vehicles driving closer, faster; interacting more efficiently with each other (platooning)
- However, limited in mixed urban environments with pedestrians, bicycles and other factors
- Reducing the number of accidents between 60-95%

Increasing road demand by as much as 68%

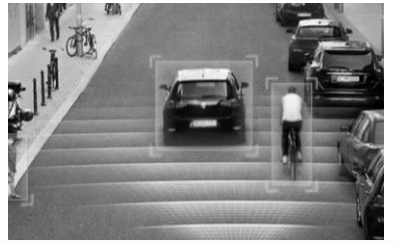
- Lower car-usage cost (capital and in-vehicle time)
- New population on the road: young, old, disabled
- Increasing urban sprawl and commuting distances
- Empty car rides
- AVs will replace public transit more than private vehicles, resulting both in the decline of ridership and an increase in traffic congestion

If no regulatory requirement for ridesharing, VMT will increase by +8% to +68%



As a result of the above, the consensus is that AVs will lead more vehicle miles traveled (VMT) beyond the increase in capacity expected from them likely resulting in more congestion on the roads

TRANSITION TO FULL AUTOMATION **WILL HAVE NEGATIVE EFFECTS** ON ROAD TRAFFIC



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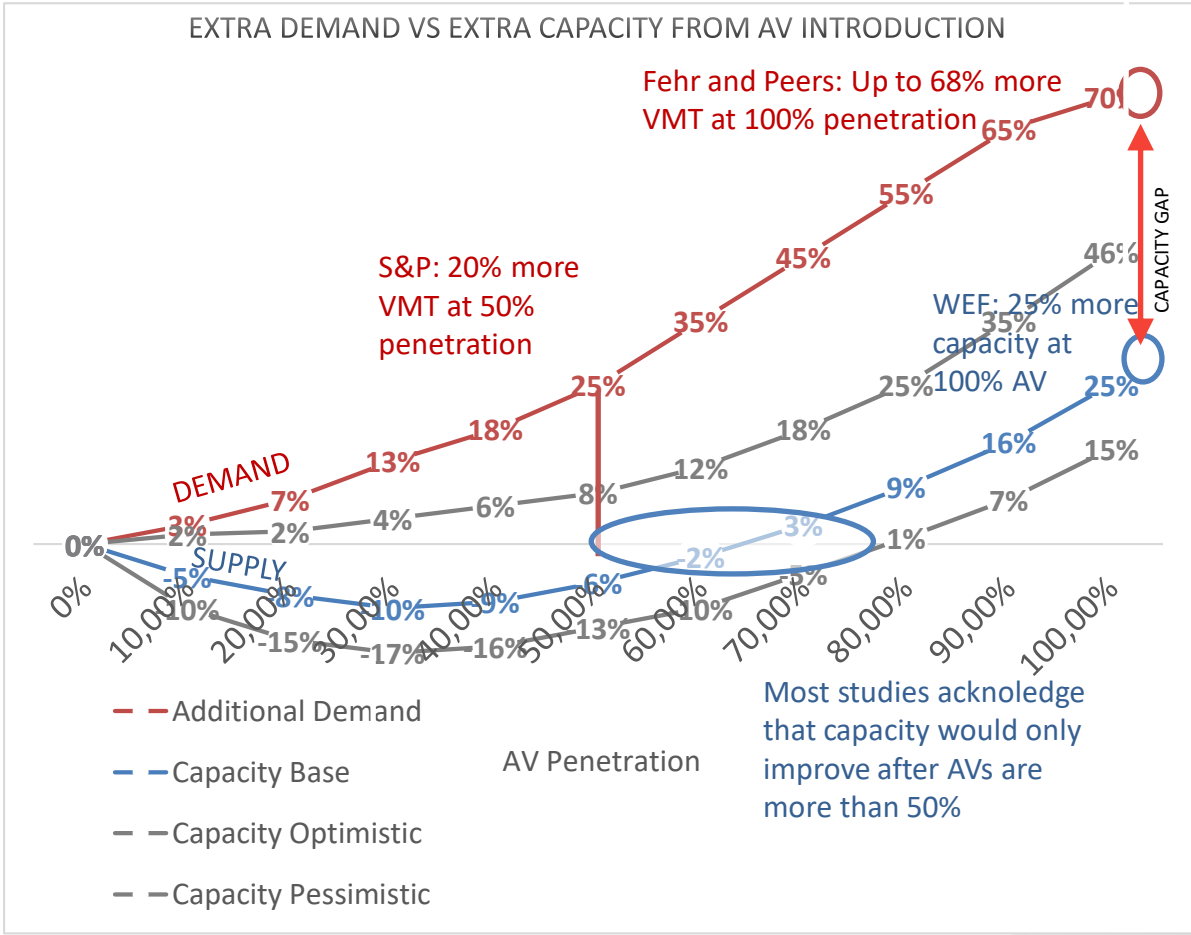
The consensus is that there will be increased congestion until a very large autonomous % is reached mainly due to:

- **Increase in demand is immediate, as are the benefits for users** (lower operational costs, comfort vs transit, longer drives, wider pool of users)

- **Lower capacity at initial stages due to challenging interaction with conventional vehicles**
  - Conventional driver interaction challenges (conflict between aggressive driver's behavior and pre-determined cautious autonomous driving)
  - Pedestrian and bike rider interaction challenges - game of chicken
  - Technical and regulatory challenges
  - Safety and liability concerns (insurance)



PASSENGER DRONES AND FLYING CARS

- **Prototypes already exist, that is true**
- **However, it's a much more complex problem than ride-hailing or AVs. Challenges:**
  - **Regulations** –pilot licenses etc.
  - **Technology Maturity** – sensors, artificial intelligence required etc.
  - **Infrastructure** – Landing zones, charging stations
  - **Integrated Air Traffic Management**
  - **Psychological barriers:** For passenger drones and flying cars to be widely accepted, they would likely have to be both ubiquitous and as versatile as an automobile—people should be able to fly the vehicle to a store or take it to the beach, and it should be able to cover longer distances safely.
- **Most optimistic views don't see real "flying cars" in our cities in the next 10-20 years, and even then it would probably be price-prohibitive, and unlikely to make a dent on road traffic.**

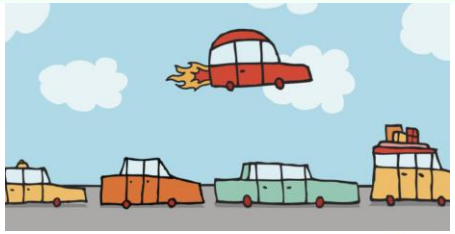


Figure 2. Current development phases of passenger drones and flying cars

MANUFACTURER/ Vehicle name	Development start	Current phase: CONCEPT/ DESIGN	PROTOTYPING	TESTING	PRODUCTION	Launch/ delivery
AEROMOBIL/ Flying Car	2010			■		2020
AIRBUS/PopUp	2016		■			2020
AIRBUS/Vahana	2016		■			2020
AURORA (BOEING)/ eVTOL	1989			■		2020
EHANG/184	2014			■		2018
E-VOLO/Volocopter	2012			■		2018
JOBY AVIATION/S2	2009		■			N/A
LILIUM/Lilium	2014			■		2019
MOLLER/Skycar	1983		■			2020
PAL-V	2001				■	2018
TERRAFUGIA/ Transition	2006			■		2019
VRCO/NeoXCraft	N/A		■			2020
ZEE.AERO/Zee	2010			■		N/A

Source: Deloitte, "Elevating the future of mobility: Passenger drones and flying cars", 2018

"There is no need to worry that the skies will be clogged with drones since passenger drones and flying cars that can take off and land anywhere are not a realistic scenario for the mid-term future. Even a megacity with five to ten million inhabitants will have no more than 1,000 passenger drones in operation by 2035" (Porsche Consulting, "The future of vertical mobility", 2018)

12

IN SUMMARY

- Need to look beyond the hype words and futuristic articles about technologies that promise to save us from ourselves.
- Mobility demand is much higher than what could be realized before these technologies came about. They fulfill a need that could not be fulfilled before.
- However, urban road capacity is the same, can not change or changes very slowly.
- Toll roads will still be used-even more- in the foreseeable future, and new ways of handling the demand on free-roads through pricing and information (& safety systems) will be required to optimize the use of existing capacity.


THANK YOU
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