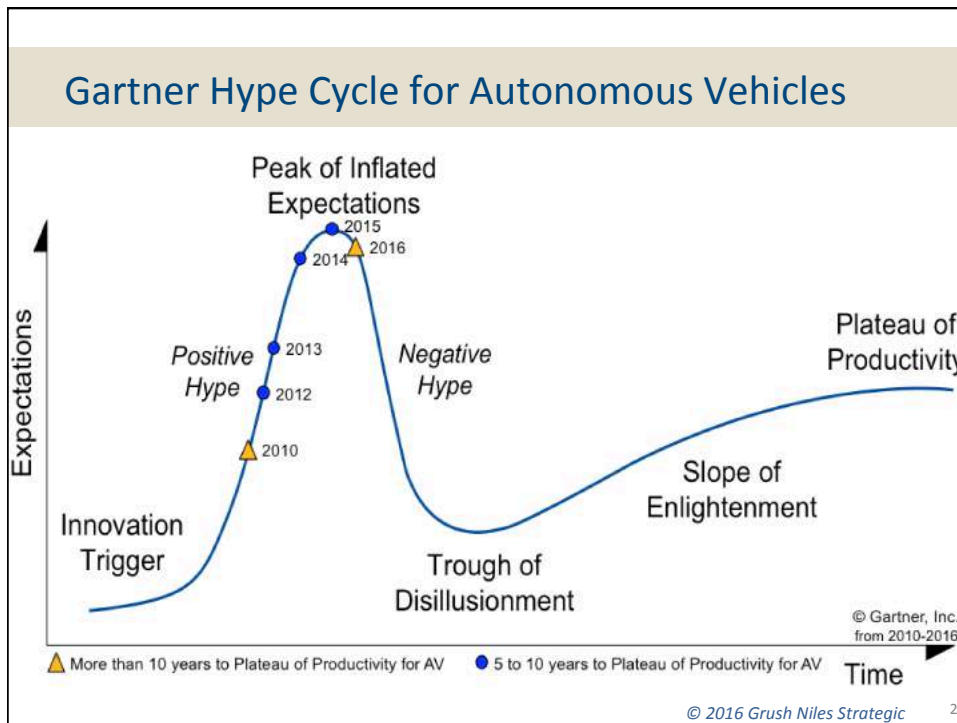


# Automated Vehicles: Virtue or Vice?

Transportation Association of Canada  
September 27, 2016 — Toronto

Bern Grush  
Grush Niles Strategic


**GrushNiles**  
Pathways to Transformation as a Service



## Key Findings

RCCAO report October 2016:  
*Preparing Ontario for  
Vehicle Automation  
— Are we ready?*

- Mobility Digitization
- Two markets for automation
- Market competition
- Infrastructure challenge
- Massive system change
- Threat to transit

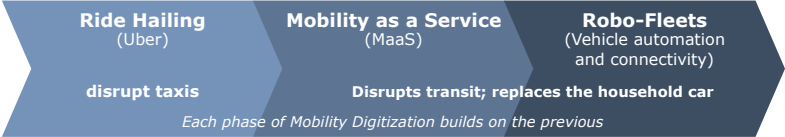


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RCCAO Report

## Finding: Mobility Digitization

What digital technologies have done for music, print, broadcast, hotels, entertainment and others has started to happen to **automobiles and trucks and transit**



2010+
2016+
2020+

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## MaaS: Critical step toward robo-taxi fleets

*“MaaS makes it easier not to own a car.”*

- One aggregator
- One scheduler
- One navigator
- One payment
- All modes



*RCCAO Report*  
**Finding: Two markets for automation**



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- **Consumer market** dominated by semi-automation
  - Purchase vehicles
  - More VKT, PKT, sprawl, parking
  - Sustained intrusion of vehicles on urban form
  - Peak in mid-2030s

## Two markets for automation

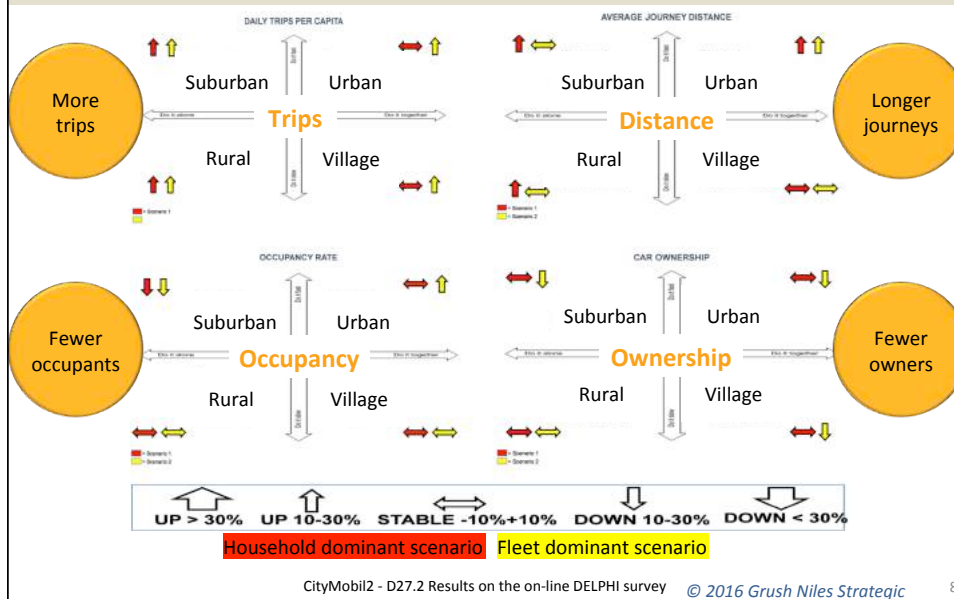
- **Transit-Taxi-Ride market** dominated by full automation
  - Purchase rides (MaaS is key enabler)
  - More VKT, PKT
  - Fewer registered vehicles
  - Reduced intrusion of vehicles (less parking)
  - Peak after mid 2040s

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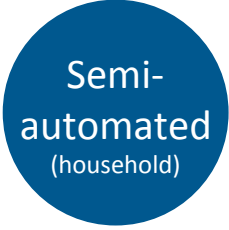
7

89 experts

## CityMobil2 – Survey of expert opinion




8



**Semi-automated**  
(household)

- Goes anywhere a licensed human can drive
- Household/consumer use
- Initially preferred over fully automated vehicle
- Operator in seat (not driverless")

## Two markets for automation

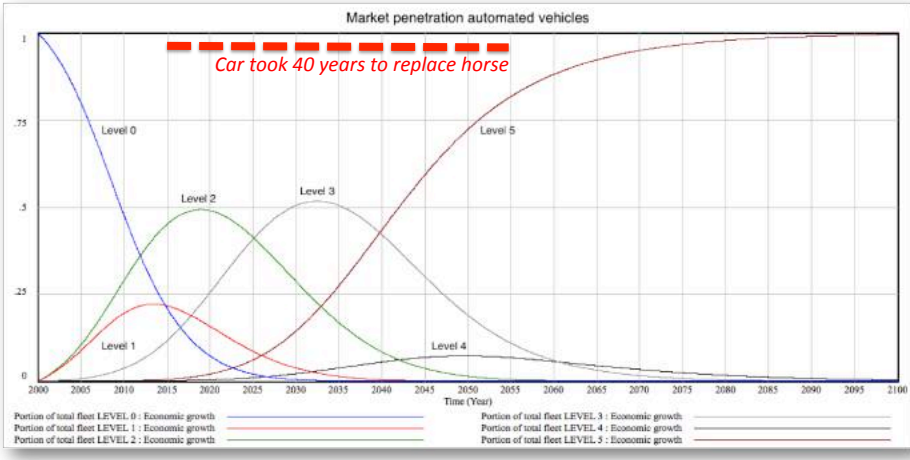


**Fully Automated**  
(public service)

- Managed use  
Constrained locations  
Scheduled operations  
Controlled situations  
Prepared routes
- Robocab | Robotransit
- Level 4: stewards & strong video surveillance

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## Diffusion of Automated Vehicles



Diffusion of Automated Vehicles: A quantitative method to model the diffusion of automated vehicles with system dynamics. TIL Masters Thesis, Jurgen Nieuwenhuijsen. 2015, TUDelft.

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*RCCAO Report*

## Finding: Market Competition

- Competition between semi- and full automation
  - Behavioral biases align with semi-automation
    - Privately owned vehicles
    - Culture, habit, status, privacy, hygiene, security, convenience
  - Regional (rational) economics align with full-automation
    - Public service vehicles
    - Safety, congestion, infrastructure
    - Environmental justice
    - Transportation equity
- Impacts on public transit

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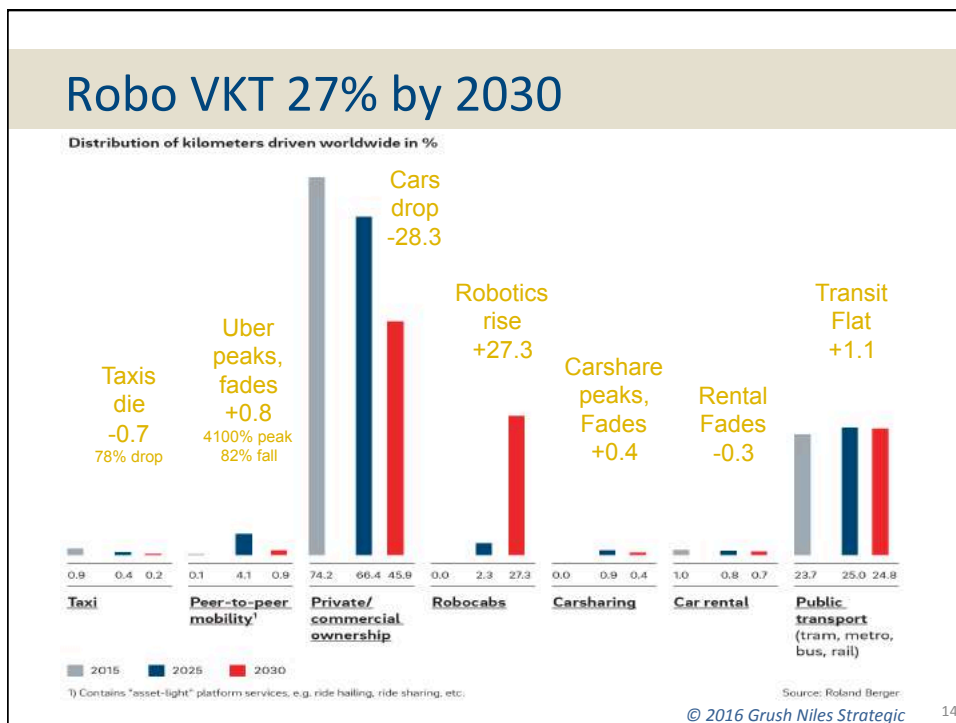
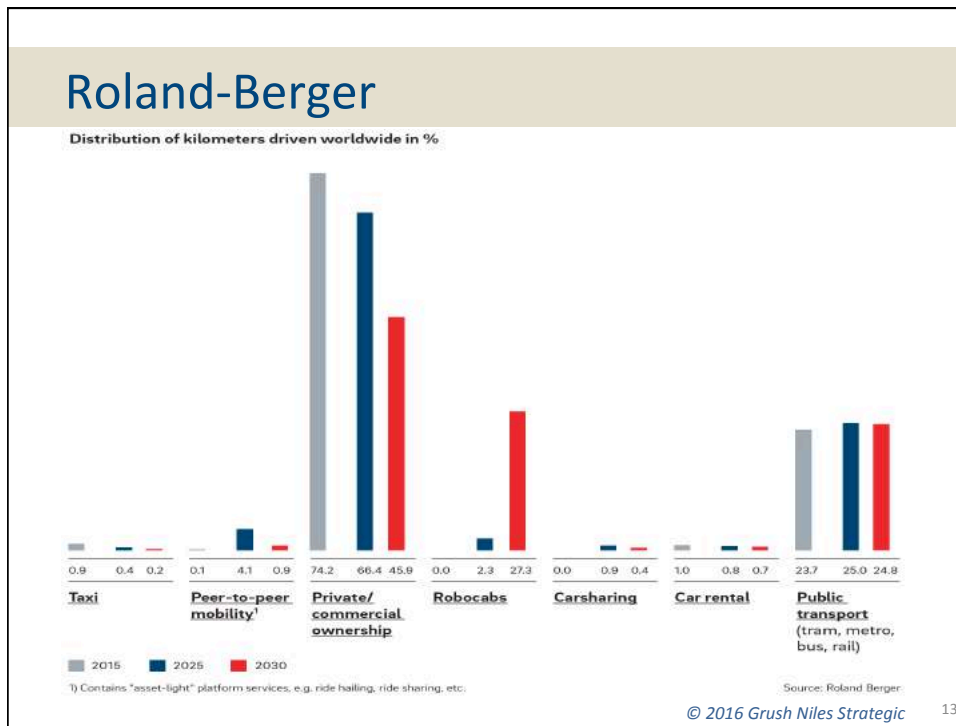
## Semi-automated: Significant household sales

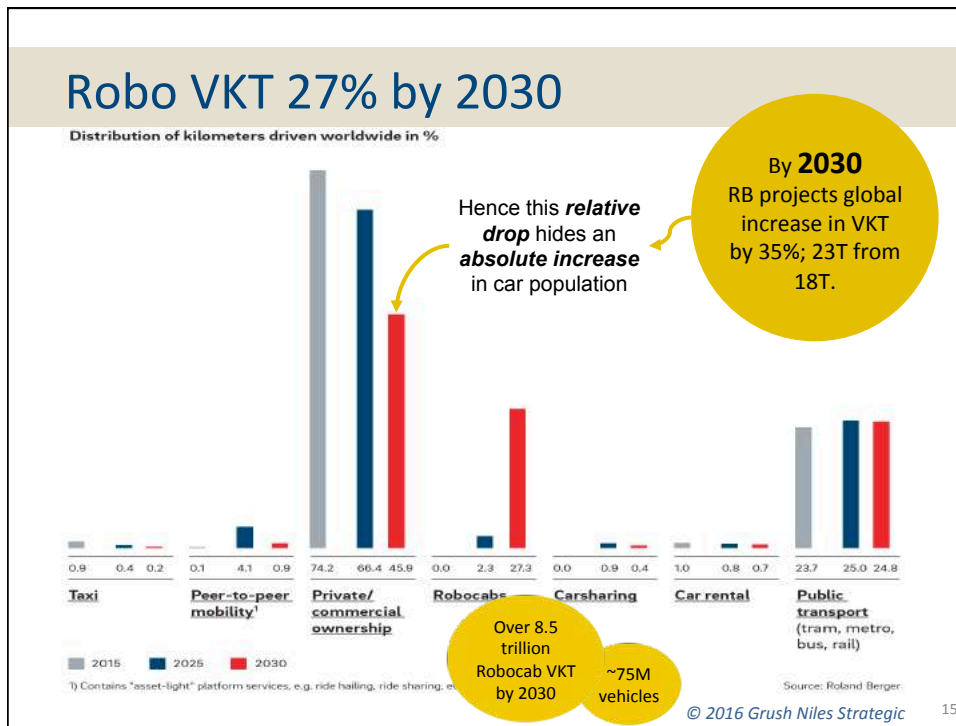
- Competes with shared-use, fully automated fleets:
  - Takes passengers from alternate modalities
  - Dilutes infrastructure funding
  - Compromises urban design
- Mixed traffic: household vs robocab, robo transit
- Encourages distance travel (sprawl)
- Perpetuates parking problem
- Interim dystopia until full automation

## Fully automated: No household sales in 2020s

<p>Not yet a “Whole Product”</p> <ul style="list-style-type: none"> <li>• Vehicle</li> <li>• Infrastructure</li> <li>• Regulation</li> <li>• Insurance</li> <li>• Acceptance</li> </ul>	<p>Access Anxiety</p> <ul style="list-style-type: none"> <li>• <i>Range Anxiety</i> slowed EV penetration</li> <li>• <i>Access Anxiety</i> will hamper AV penetration</li> </ul>
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RCCAO Report

## Finding: Infrastructure challenge

- Non-automated, semi-automated, fully-automated vehicles will share our roads for 40+ years
  - Over one quadrillion kilometers of road-sharing
    - Safety
    - Complexity
    - Planning
- Infrastructure Challenge:
  - Surface transport to change much faster than infrastructure lifecycle
  - How will this evolution play out?
  - Public and commercial partnership model?



## How will AVs mix with the existing fleet?

“...just as the early 20th century had a chaotic mix of horses and cars sharing roadways, there will be setbacks as we **mix AVs and conventional vehicles** over the next couple of decades.”

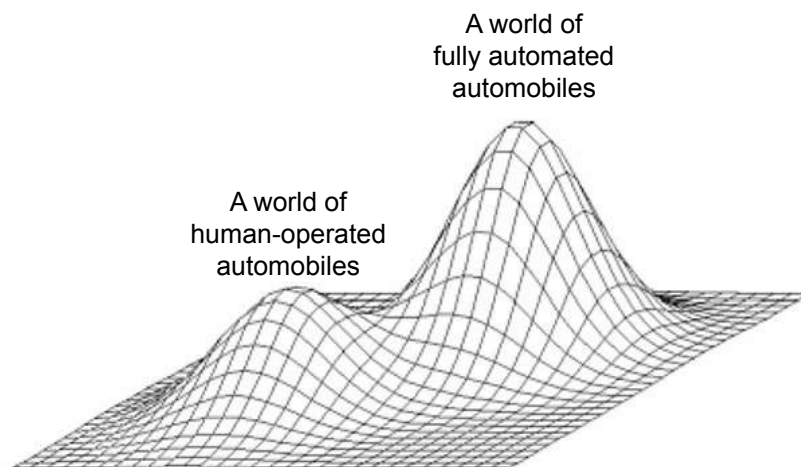
Bob Denaro, in ITS International March/April 2016

Denaro is a member of the USDOT's ITS Program Advisory Committee, and chairs TRB's Joint Subcommittee on Challenges and Opportunities for Road Vehicle Automation.

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## Finding: Massive system change



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## Finding: Threat to transit

- Digital tech makes other/new modes more attractive
  - Ride hailing apps
  - Parking finders
  - Robocabs
- New business models making other modes cheaper
  - Aggregation
  - TNCs
  - Expect many new robo-fleet ownership models to drive margins toward zero
    - Jeremy Rifkin: “Zero Marginal Cost Society”
    - Consider how Airbnb distorts housing availability
- Transit is threatened if it lags digital mobility changes

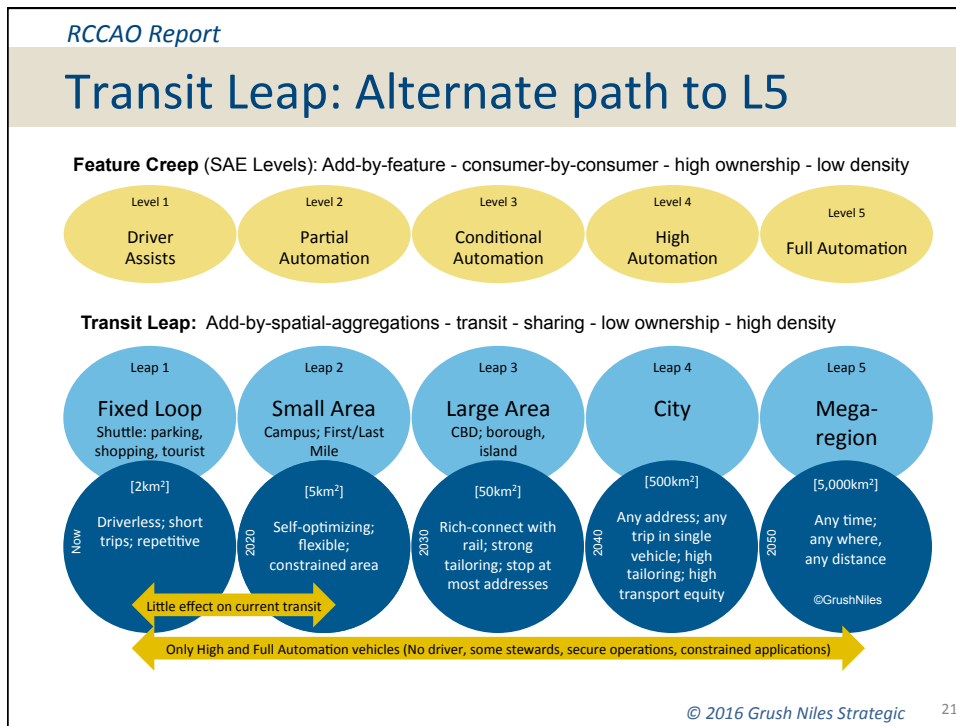
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## Automated Transit needs more attention

*“The potential for automated and connected buses, streetcars, and subways has been largely absent in [transit] planning and is not anticipated over the next 10 years.”*

*Automated Vehicles: Implications for the Insurance Industry in Canada, p.45*

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## Feature Creep

*“...a consensus is emerging that the journey to [full] autonomy will be a progressive one in which **small steps are made** along the way and **new features are added** to vehicles **every six to nine months or so.**”*

*Clearwater International, Cleartought March 2015*

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## Transit Leap: Definition

Transit Leap means public-use, robotic, shared-mobility applications that **start-small, expand by demand**, grow, merge, spread and **substantially transform mobility for all urban areas.**

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## CityMobil2 Driverless bus in reserved lane

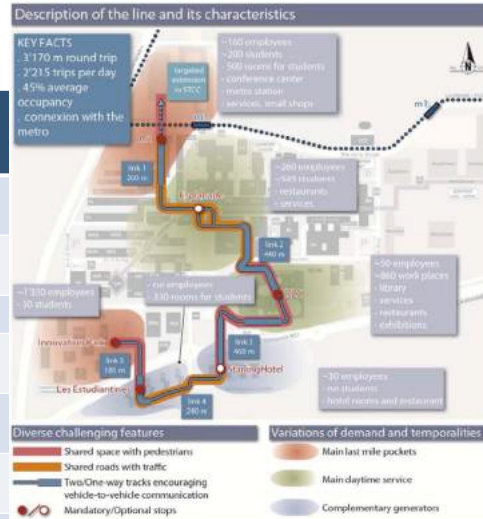


- Helsinki, Finland
- La Rochelle, France
- Lausanne, Switzerland
- Trikala, Greece

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## Transit Leap 1 example

<b>EPFL, Switzerland</b>	<b>EasyMile</b>
Environment	University Campus
Type of traffic	Ped, bike, low speed cars
Duration	Apr-Aug 2015
Track Length	2.3 km
Number stops	6
Number shuttles	6
Passengers	+6,000



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## Transit Leap 1 example

<b>La Rochelle, France</b>	<b>Robosoft</b>
Environment	City Center
Type of traffic	Ped, bike, low speed cars
Duration	Dec 2014 Apr 2015
Track Length	1.5 km
Number stops	7
Number shuttles	6
Passengers	+8,500



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## Transit Leap – Level 2 and 3

Year	AV Phase	Number of Neighbourhoods	Total Absorption (Units)	New Vehicles	Total Fleet Size (2 round-trips/day)
2017	Phase 1	2	88	40	40
2018	Phase 1	4	519	60	100
2019	Phase 2	5	1114	100	200
2020	Phase 2	5	1867	100	300
2021	Phase 3	6	2839	100	400

Vehicle estimates based on two-passenger vehicles, two round trips/day/resident with less than five-minute vehicle wait times. (From Babcock Ranch RFI, July 2016, pg. 4)

Table 3: Babcock Ranch residential and projected automated vehicle growth rates.

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## Intended Consequences

- Satisfy expected mid-century demand
  - 4-fold increase in world motorized PKT by mid-century
  - With same vehicle registration count as today
  - Current vehicle count redistributed
- How?
  - Make 80% of motorized seats = shared-service seats
    - Taxi, bus, share-car (mostly robotaxi, robo shuttle)
  - A shared-service seat averages 4x current PKT
  - Target seat occupancy at 0.4 up from 0.3
  - PKT = 4.5 current ( .2 + .8 x 4 x 4/3)

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## Virtue over vice

1. Create (don't predict) the future we want
2. Design shared fleets to address human preferences
3. Develop a shared understanding
4. Win early acceptance with first/last mile solutions
5. Leverage behavioral economics to win converts

***Thank you!***

[www.EndOfDriving.org](http://www.EndOfDriving.org)

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Pathways to *Transportation as a Service*

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