Thinking beyond the technology

How autonomous vehicles will change everything we know about cities
/Who are we?/

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Urban Mobility Research Center (UMRC)
/what your day will be like/

Do any of these people sound familiar?
young and urban/

- No car needed
  - Shared mobility service
  - Huge cost savings
- Live anyplace
  - Mobility options make density even easier

Image source: www.fiscaltimes.com
suburban families/

AV tech context
* In the near term, may reduce cars per household
  * Two car to one
  * Better mobility for regular trips (work, school, etc.)

* Large potential change in development patterns
/older populations/

AV tech context
Many living options
  * Stay in existing house
  * Location not limited by mobility choices

Visit family and friends
  * Despite loss of vision or diminished physical mobility

Remain active
  * Mental and physical
/today’s message/

We’re nearing the end of a 70-year experiment...
... with a new era about to begin:

* We need to be ready:
  * There will be winners and losers
  * Cities have a lots to gain
    * Must be prepared
    * Must embrace change
  * Autonomous Vehicle technology is part of a global shift toward automation
You’re already in trouble if...
You have lots *(pun intended)* of retail

* Typical “suburban-style” design
  * Over-parked
  * Large surface lots
  * Big Boxes and strip malls
* High quantity of per capita retail
* Sectors most sensitive to on-line sales competition

Image credit: www.strongtowns.org
Job base with high automation factor

McKinsey Data: [https://public.tableau.com/profile/mckinsey.analytics#!/vizhome/AutomationandUSJobs/Technicalpotentialforautomation](https://public.tableau.com/profile/mckinsey.analytics#!/vizhome/AutomationandUSJobs/Technicalpotentialforautomation)

Un-adaptable public investments
No worthy destinations or “sense of place”

* Ease of access less vital
  * Many legacy businesses to become obsolete
* Highway visibility far less important for many uses
* Wanting to be at a destination will be more vital than all other factors
What is going on now?
* 2014 – 32,675 deaths (US)
* 2015 – 38,300 deaths (US)
* 2016 – 40,000+ deaths (US)

* 94%+ caused by human error
Driving is not the priority anymore...
Where have we seen this before?

* Smartphone adoptions rates in US

Source: http://www.asymco.com
/real-world implementation/

AV tech context
* Computing speed upgrades:
  * Intel chip 2014
    * 37.5m transistors per square mm
  * Intel chip 2017
    * 100m transistors per square mm
  * Will dramatically shrink the “brain” for AV

Source: Intel Senior Fellow Mark Bohr interview comments

Image source: www.phys.org
/LEVEL 5 – full autonomy/

Video – View at link below:
https://www.tesla.com/videos/autopilot-self-driving-hardware-neighborhood-long
/how it’s all gonna change/

Fundamental impacts for land use, development, infrastructure and life as we know it.
What is the size of a parking space?

9x18, 10x20
+/- 200 s.f.
How many parking spaces can you get per acre of land?

+/- 100 spaces
How many parking spaces would be needed for 1,000 square feet of retail?

3-4 spaces
-or- 1,740 square feet
How many square feet in an acre?

43,560 square feet
Given one acre of land, how much retail can be developed?

10,000 square feet
What does this mean?

Parking is THE #1 constraint for development in almost any context.
/development impacts/

0% Autonomy

6.6 ac Parking

135k s.f. Building Area

+ 14 ac. site area
development impacts/

10% Autonomy

6.0 ac. Parking

0.5 ac. Unused

14 ac. site area
Development impacts:

- 20% Autonomy
- 5.3 ac. Parking
- 1.2 ac. Unused
- 14 ac. site area
/development impacts/

- 30% Autonomy
- 14 ac. site area
- 1.8 ac. Unused
- 4.6 ac. Parking
40% Autonomy

4.0 ac. Parking

2.5 ac. Unused

14 ac. site area

development impacts/
development impacts/

50% Autonomy

3.3 ac. Parking

3.2 ac. Unused

14 ac. site area
Development impacts/

- 60% Autonomy
- 14 ac. site area
- 3.8 ac. Unused
- 2.7 ac. Parking
development impacts/

70% Autonomy

14 ac. site area

4.6 ac. Unused

2.0 ac. Parking
/development impacts/

80% Autonomy

5.0 ac. Unused

1.3 ac. Parking
/development impacts/

90% Autonomy

14 ac. site area

+ 6.2 ac. Unused

0.7 ac. Parking

135K s.f. Building Area
/development impacts/

95% Autonomy

14 ac. site area

444k s.f. Building Area
development impacts/

95% Autonomy

14 ac. site area

740k s.f. Building Area
/development impacts/

95+ % Autonomy

14 ac. site area

∞ s.f.
Building Area
350 acres

Uses:
* Office
* Residential
* Hotel
* Restaurant
* Theater
development impacts/

350 acres

Uses:
* Office
* Residential
* Hotel
* Restaurant
* Theater

case study
development impacts/

Roadway
14 acres
4%
/development impacts/

Roadway
14 acres
4%

BLDGs
31.5 acres
9%

case study
/development impacts/

Greenspace
112 acres
32%

Roadway
14 acres
4%

BLDGs
31.5 acres
9%

case study
development impacts/

Roadway
14 acres
4%

BLDGs
31.5 acres
9%

Greenspace
112 acres
32%

Parking
192 acres
55%

case study
case studies/

Locational characteristics that drive change
*Franklin County, OH*

*Residential vulnerability*
*Franklin County, OH*

* Residential most vulnerable
*Franklin County, OH

* Example area
*Franklin County, OH

* Example area
*Franklin County, OH

* Commercial vulnerability
*Franklin County, OH*

*Commercial most vulnerable*
*Franklin County, OH

* Example
*Franklin County, OH
* Example
* Atlanta Region, GA

* Residential Vulnerability
* Atlanta Region, GA

* Residential most Vulnerable
*Atlanta Region, GA
* Example
* Atlanta Region, GA
  * Example
* Atlanta Region, GA

* Commercial Vulnerability
*Atlanta Region, GA

* Commercial most Vulnerable
* Atlanta Region, GA
  * Example
*Atlanta Region, GA
* Example
/more questions/

What else is going to happen?
What will “cars” look like?

Vehicles will transform
- Focus on mobility
- Smaller for efficiency
- Various shared vehicle forms

Many factors of today’s cars will not be needed
- Crash safety aspects
- Aspects related to ICE tech

What will “cars” look like?

* Vehicles will transform
  * Focus on mobility
  * Smaller for efficiency
  * Various shared vehicle forms

* Many factors of today’s cars will not be needed
  * Crash safety aspects
  * Aspects related to ICE tech
Reduction of Trips

Video – View at link below:

MIT New York Cab Research:
https://www.csail.mit.edu/ridesharing_reduces_traffic_300_percent

MIT New York Cab Paper:
http://www.pnas.org/content/114/3/462.abstract
*Will we own our own cars in the future?*

*Strong incentives toward shared model*

* Per mile cost
* Liability
* Urban opportunities
*Will we own our own cars in the future?

* Strong incentives toward shared model
  * Per mile cost
  * Liability
  * Urban opportunities

* Transition to shared model may be more rapid than previously expected

Rethink X Report:
https://static1.squarespace.com/static/585c3439be65942f022bbf9b/t/5912307e725e25a34efe5497/1494364316456/RethinkX+Report_050917+%281%29.pdf
*What happens with trucking?*

* Truck platooning
  * Controlled by front vehicle
  * Reduced fuel and labor costs
  * Safety increases

*Testing already underway throughout US and worldwide*
*What about sprawl?*

* Will AV adoption encourage sprawl?

* How does AV tech change individual location decisions?
  * Where will people decide to live?
  * Where will developers decide to build?

* How/where do changes in density happen in each metro?*
*Will traffic get better or worse?

* Two schools of thought:
  * Better access will drive more trips
  * More ride sharing will lessen overall trips
Intersection Improvements

Video – View at link below:


MIT Intersection Overview: http://senseable.mit.edu/light-traffic/
*What about bikers and pedestrians?*

* Planners have need to help the conversation
  * Safe street crossings
  * Cyclist interactions
  * Signalization and system-wide automation

Image source:: www.idahostatesman.com
* What about transit?

* How will different transit types interact?

* Will routes still exist for buses?
  * A total shift to on-demand?
  * How will the vehicles transform?

* How can all populations be served?
Big questions:

* What else might change in our neighborhoods?

* Will our “Main Streets” get better?
  * No longer constrained by parking
  * Urban form and uses take precedence

* What if on-street parking goes away? Do cul-de-sacs make any sense?
*What else might change in our neighborhoods?*

* Will our “Main Streets” get better?
  * No longer constrained by parking
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* What if on-street parking goes away? Do cul-de-sacs make any sense?*
what you must do/

Planners and planning must begin today
## What to expect:

<table>
<thead>
<tr>
<th>Driverless Car Adoption</th>
<th>1-3 years</th>
<th>3-7 years</th>
<th>7-15 years</th>
<th>15+ years</th>
</tr>
</thead>
</table>
| Limited adoption        | • Higher cost vehicles  
                          • Regulations evolving  
                          • Limited supporting infrastructure | Moderate adoption  
                          • Average cost vehicles  
                          • Shared model emerging  
                          • Added infrastructure | High adoption  
                          • Vehicle fleet replacing  
                          • Shared model dominant  
                          • Infrastructure updates | Full adoption  
                          • All vehicles sold  
                          • Regulations set  
                          • Integrated systems |

<table>
<thead>
<tr>
<th>Site Design Impacts</th>
<th>Low</th>
<th>Moderate</th>
<th>High</th>
<th>Immense</th>
</tr>
</thead>
</table>
|                     | • Most vehicles user-driven  
                          • Parking needs remain similar  
                          • Site and building access remain similar | • Most vehicles user-driven  
                          • Parking needs reduced  
                          • Site and building access – needed modifications | • Most vehicles autonomous  
                          • Parking needs drop significantly  
                          • Site and building access – major modifications | • All vehicles autonomous  
                          • Parking needs near zero  
                          • Site and building fundamentally changed |
What planners must do (now!):

* Include AV technology in planning processes:
  * Comprehensive/master/strategic plan processes

* Mandate code changes:
  * Require that all parking garages be adaptable to other uses
    * Adequate floor-to-ceiling heights
    * No ramped floorplates
  * Reduce parking requirements
    * Anticipate triggers in AV adoption to lower and/or abandon parking minimums

* Focus on place
  * The impact on commercial development will be felt the earliest
What planners must do (now!):

* Create overlays
  * Corridors with “never gonna leave” uses like car lots, gas stations, etc..
    * THEY ARE GOING TO BE OBSOLETE
  * Requirements and strategies for redevelopment of corner lots

* Advocate to your elected boards and fellow staff
  * Provide information to City Council, Planning Commission
  * Advocate city engineering and transportation to consider coming AV
What planners must do soon (2-3 years):

* Identify areas of your community most susceptible to change
  * New opportunities for success
  * Potential areas for failure

* Define new land use strategy for your community
  * What to do with excess retail ground
  * What to do with excess parking areas
  * What to do with excess corner lots
/questions/?/  

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