Who’s Driving This Thing?
Planning for Livable Communities in the Driverless Future

THE NATIONAL WALKING SUMMIT
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Chris Hermann, AICP
Principal, MKSK
How do Autonomous Vehicles Work?
Three Elements of Autonomous Driving?

Sensing
- Environmental Model
- 360 Awareness

Mapping
- Localization at High Accuracy (10cm)
- Drivable Path

Driving Policy (Planning)
- Negotiating in a Multi-Agent game
- Strategy
AV PRIMER

What is the Difference Between AV & CV?

• **Autonomous Vehicles** control their movement through internal sensors and GPS.

• **A Connected Vehicle** is one that exchanges digital information between the vehicle and the world around it (other vehicles, signals, infrastructure).
AV PRIMER

The Ultimate Goal is a Connected Automated Vehicle

- **Connected Vehicle**: Communicates with nearby vehicles and infrastructure; Not automated
- **Connected Automated Vehicle**: Leverages autonomous automated and connected vehicles
- **Autonomous Vehicle**: Operates in isolation from other vehicles using internal sensors

Image Source: Thinkstock/USDOT
How Fast Will AV Be Adopted?

Global EV predicted cumulative sales (millions) to 2025, including self-driving and fully autonomous.

EV sales data 2012-2014 @InsideEVs

@ProfRayWills forecast

http://www.raywills.net/rtwtechadopt.html
Uber CEO Dara Khosrowshahi said that he doesn’t expect Uber’s ride-hailing service to be fully driverless for at least 15 years. “No drivers? I think it will be 15-plus years,” he said in an interview at the Economic Club of Washington. “I think it’ll take a long time.” June 11, 2019
Disruptive Change in Transportation
Automated/Connected Vehicles Can Improve Our Quality of Life

1. Autonomous vehicles can **greatly improve safety** (Vision Zero) – both for occupants as well as pedestrians, bicyclists, etc.

2. AV can **greatly expand autonomy & mobility** for the elderly, handicapped, children, & those who can’t afford a vehicle.

3. AV/CV can **increase our existing road capacity** and infrastructure efficiency.

4. AV can improve supply chains and **lower delivery costs**.

5. AV can **greatly improve air quality** w/electric motors.

6. AV could **reduce the need to own a car** and provide options for those without a car.

7. AV/CV could **reduce the need for parking** at each use/site.
BUT... UNINTENDED

Downtown Columbus in 1921
BUT ... UNINTENDED

Downtown Columbus in 2001
What we didn’t fully understand…

1. Accelerated travel speeds led to vast acceleration of sprawl.
2. Vehicle affordability meant great majority had their own car.
3. So many individual cars required substantial expansion of road network.
4. So many cars necessitated creation of off-street storage.
5. Street, site, & building design changed to emphasize cars over all else – the built environment substantially changed.
7. The rise of door-to-door/drive-thru convenience led to a reduction in willingness to walk.
8. People without access to a car were left behind.
“My whole career, people have been saying: We wish we could have known the social costs of driving, we would have done this differently,” says Samaras of CMU in Pittsburgh, where self-driving Uber cars hit the streets earlier this year. “Policymakers have to think about this now, because the decisions they make affect the landscape for a century.”

Costa Samaras, assistant professor and civil engineer at Carnegie Mellon University in Pittsburgh

Overarching Question:
What Potential Impacts Should Planners Be Considering in the Age of AV/CV?

How do we plan ahead and help shape the direction so that the positive benefits of autonomous vehicles are accentuated and the negatives are minimized?
Six Questions About Potential AV Future
Here Are Six Questions We Want To Ask Today…

1. Will Autonomous Vehicles (AV) increase or decrease driving?
   This will impact the need for more or less roadways.

2. Will AV be able to overcome American’s love for driving?
   This will impact the efficiency of our road network.

3. Will AV help focus growth or encourage sprawl?
   This will impact the shape of our regions & communities.

4. Will AV enhance or kill transit?
   This will affect the density of our cities.

5. Will AV reduce the need for parking?
   This will affect the spatial arrangement of our towns.

6. Will AV be as safe and effective as we think?
   This will affect the adoption of AV & streetscapes.
“As long as they share the road with pedestrians, bikes, and human-driven vehicles, self-driving cars will not be able to reach their full utility. The question is, what would cities have to sacrifice to unlock that utility?”

Eric Goldwyn, NYU’s Marron Institute of Urban Management

Source: CityLab, Do Driverless Cars Need Their Own Roads Around Manhattan?, Benjamin Schneider Jul 26, 2017
To What Level Will Our Publicly-Elected Officials Go AV-Only?

- **DEDICATED AV ROADS/AREAS**
  - HOV and Freeways?
  - Streets in Downtowns and CBDs?
  - All Public Streets County-wide?
Toyota Research Institute: Automation will increase automobile vehicle miles traveled, lengthen commute distances, and accelerate existing trends towards suburbanization of homes and jobs. The initial results of a study TRI is running suggest that long-distance driving is getting easier before urban driving does.
Will we have fewer or more auto-oriented uses?
How narrow could travel lanes get?
03: IMPACTS ON STREET

Cost of Infrastructure for Connected Streets and Vehicles

Cleveland and Myrtle Avenue, Columbus, Ohio
Early Research is Troublesome

Autonomous vehicles will only help to meet public policy goals if they come as shared fleets integrated with public transport.

Public authorities must take an active role in the roll-out of AVs to ensure their shared use with measures to encourage shared mobility and limit single car occupancy (eg. road pricing or taxation) and provide ‘Mobility as a Service’ platforms.”

Source: Autonomous Vehicles: A Potential Game Changer for Urban Mobility, UITP, Jan 16 2017
05: DROP-OFF/PICK-UP

What will morning & evening rush hour look like?
How do we manage waiting areas for AVs?
05: TOO BLUE SKY?

Impact of Drop-off & Pick-up must be carefully considered

Think of our Airports… is this our future downtown streetscape?
05: TOO BLUE SKY?

Impact of Drop-off & Pick-up must be carefully considered

Think of our Schools… is this our future downtown streetscape?
if Pedestrians Know AVs Will Stop If They Walk In Front, What Will Our Design Response Be?
If Pedestrians Intentionally Jump In Front of AVs, What Will Our Design Response Be?
“Technology doesn’t necessarily trickle down to serve those folks who are most in need. You have to put the people you’re going to focus on in the forefront.”

Jason Reece, Assistant Professor, Knowlton School, The Ohio State University
“Ten Rules for Cities About Automated Vehicles”  Jeff Speck, CNU

1. **Be Afraid.** The positives can be offset quickly if we’re not careful.

2. **Be Realistic.** In America, we have shown zero propensity to control how people buy or use their cars.

3. **Decide How Much Traffic You Want.** The right solution is to start by making the streets what you want them to be.

4. **Plan for More Sprawl Pressure.** Smart Growth policy is needed.

5. **Understand Transit Geometry.** AV is not a solution to transit.

6. **Don’t Rob Transit.** Replacing trains & buses with AVs will cripple mobility.

7. **Own the Streets and Own the Data.** AVs as business model are only viable on public streets. Sharing data is small price for companies to pay.

8. **Don't buy any urban vision that forgets urbanism.** The adoption of AVs should not be allowed to replace traditional city form with something different.

9. **Unify around a set of policy demands.** There are a number of ways that cities will need to regulate AVs if they are to be a boon and not a bane.

10. **Invest in the current technological revolution.** How can we provide the most useful mobility to the most people with the most positive outcomes for society? The answer includes cars, but also trains, buses and especially biking & walking.
CONCLUSIONS

Autonomous Vehicles will profoundly effect our cities.

As Planners & Designers, we must:

1. Realize that, as with any disruptive technology, we do not know or fully understand all of the potential impacts or consequences at this point in time.

2. Continue to monitor and seek understanding of how this technology will influence the form and operation of our cities and impact our populations.

3. Thoughtfully prepare for the varied outcomes and evaluate and adjust our plans and policies as new data and insight is gained.

4. Keep our communities and elected officials informed of the latest research and best practices.