## The Disruptions of Driverless Mobility

"Affordable Living"

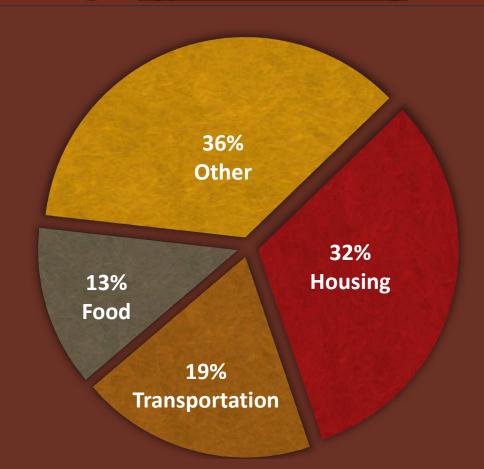
Auto-optional, sustainable, mixed-use communities



### Not just Affordable Housing—Affordable Living

Transportation and housing consume half of the average family's disposable income

Today, we'll focus on transportation



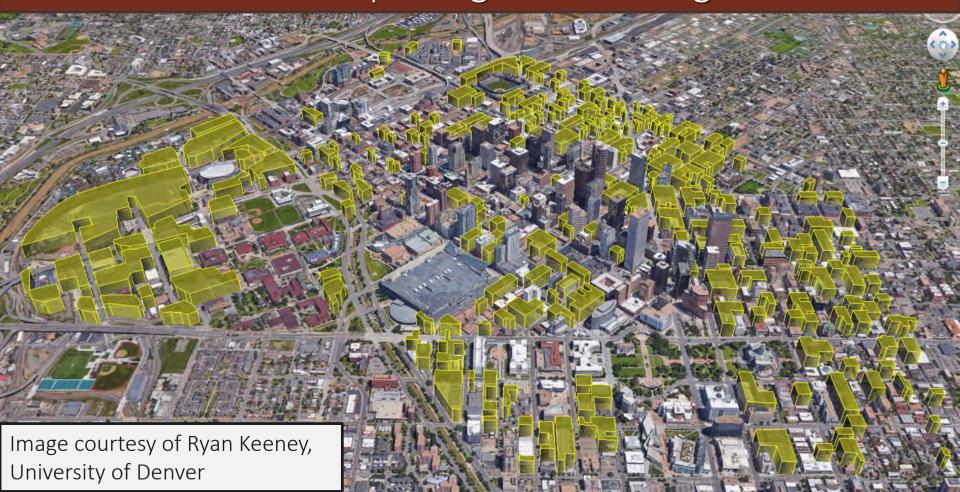
Source: <u>Federal Highway Administration</u>

### Auto-optional lowers housing cost

- Cars sit parked 95% of the time
- America has a billion parking spaces for 250 million vehicles—enough to pave Connecticut
- Up to 30% of our downtown cores are used for parking

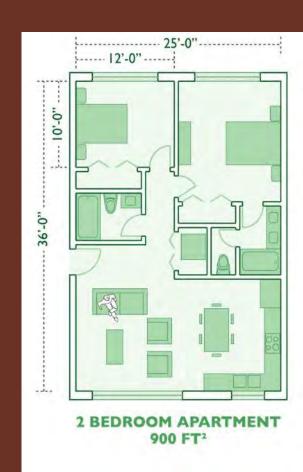


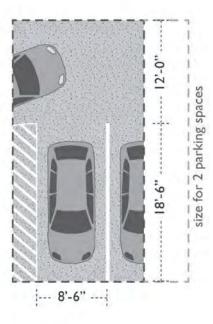
### Denver: 237 acres of parking—let's reimagine our cities!



### Auto-optional puts money back in tenants' pockets

The median two-bedroom U.S. city code requirement of 1.5 parking structure spaces consumes about half the area of a typical two-bedroom condo and adds about \$375 per month to its rent or mortgage payment.





1.5 PARKING SPACES INCLUDING AISLES 488 FT<sup>2</sup>

# The shift away from personally-owned vehicles has already begun

### Are we *really* willing to give up our cars???

April 2017 Reuters/Ipsos poll: Of the nearly 25% of American adults who sold or traded in a vehicle *in the last 12 months*, 9% are switching to ride-hailing services (mostly Uber and Lyft) as their main way to get around.

USDOT: Almost half of today's 16 to 19 year-olds do not have a drivers license.

The driver is currently over half the cost of an Uber: What happens when autonomous electric vehicles cut that cost/mile by well over half?

# Automakers are anticipating their own disruption: Electric and autonomous vehicle investments

Daimler: \$30 billion

VW Group: \$84 billion

Intel: \$15 billion Baidu: \$6 billion+

Ford: \$11 billion GM: \$8 billion+

Tesla: \$1 billion/year Waymo/Uber/Lyft/etc=?

# In California alone, there are over 60 companies testing autonomous vehicles







### Google's Waymo is now commercially available in Phoenix

Eight-passenger driverless service, some with no one behind the wheel

Waymo has ordered 63,000 Pacifica vans

Morgan Stanley just valued Waymo at \$175 billion, more than GM, Ford, and Tesla combined



Source: Waymo CEO John Krafcik, 10/31/18



#### Google Waymo: Same software, same electronics, many vehicles

Implemented on 5 passenger vehicles plus Peterbilt semi's

10 million miles of driverless testing on public roads plus 7 billion on simulators



### Volkswagon Group: 50 pure electric models by 2025





### China is poised to dominate the global EV market

Over a million EVs were sold in China in 2018, an increase of 83% from 2017 and three times as many as were sold in the U.S.

Bloomberg New Energy Finance projects that China will produce 70% of the world's electric-vehicle batteries by 2021.

With about 100 EV startup companies, China is positioned to supply much of the world with reasonably-priced EVs



Source: OilPrice.com, Nikkei Asian Review

Here are just two examples of different kinds of potentially disruptive driverless vehicles





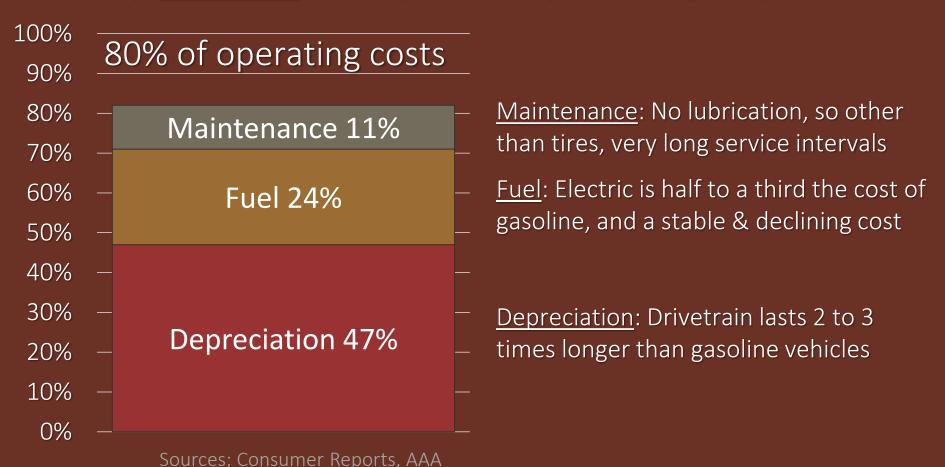
# Here's why the future of personal mobility will be <u>Autonomous</u>, <u>Electric</u>, and <u>Shared</u>

# Why <u>Autonomous?</u> Because it costs less and saves lives...

The driver is half of the cost and most of the risk:

94% of crashes are due to distraction, driver errors, drowsiness, or drunkenness

# Why *Electric*? Very low operating expenses



# And why *Shared*?

# Because that's the only way we'll beat congestion!

The leading cause of congestion isn't accidents or road repairs... it's driving alone!

9 of 10 of rush-hour autos are *single-occupancy*.

### Uber's Fatal AZ Crash

Uber's software failed to recognize the cyclist until 1.3 seconds before crash

Automatic braking was turned off due to too many false alarms

The "Safety Driver" was watching <u>The</u> <u>Voice</u> on Hulu since leaving the garage

Uber doesn't monitor all Safety Drivers

This Safety Driver had served four years for armed robbery

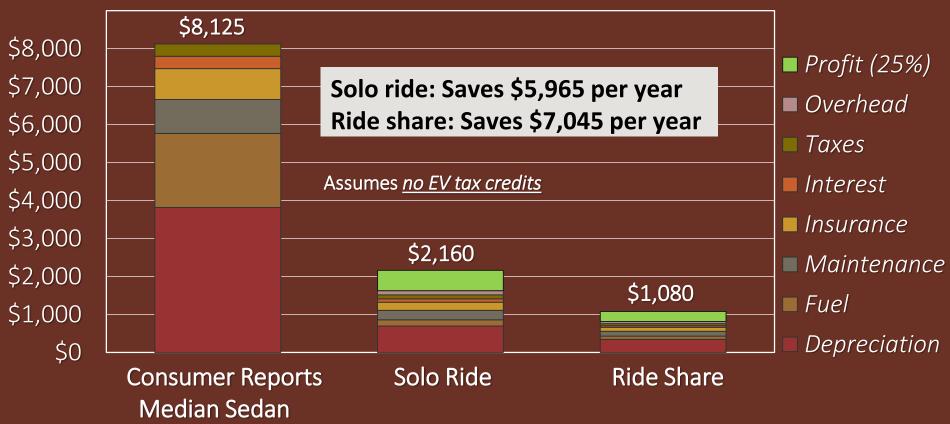


### By 2027, mobility for a dime a mile per passenger

- Cost of electric driverless mobility services
  - > 2 seat vehicle: 18¢/mile
  - > 4-5 seat vehicle: 24¢/mile
  - > 10¢/mile if you share a ride
  - > prices include a 25% pre-tax profit for the operator
- Barclays Capital estimates 8¢/mile with ride sharing

### Projected <u>2027</u> annual mobility service cost





Sources: Consumer Reports, <u>Our Driverless Future: Heaven or Hell</u>

## Trading car ownership for personal mobility

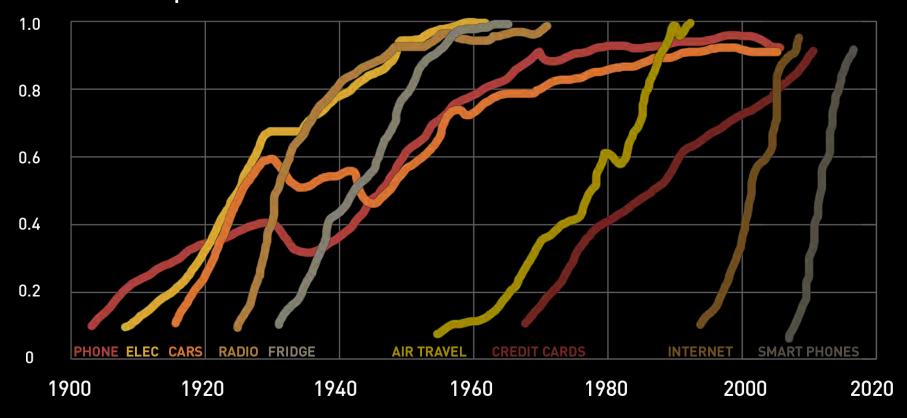
Want a car? Get a driver's license, choose a car, negotiate with dealers, qualify for a loan, make the down payment and monthly payments, pay registration, maintenance, fees, taxes, tires, insurance, inspections, parking fees, then wash and fuel your car...

Or summon a RoboTaxi, or grab a scooter and catch a lift to a bus or light rail, and save thousands!

# A Tipping Point

Zero 'entry cost' and the desire to save money and simplify our lives will combine to drive the rapid adoption of autonomous electric ride-hailing and micro-mobility services, making new Affordable Living communities appealing places to live.

### Tech adoption rates – faster than ever



### Affordable Living: How to save over \$10,000 per year

- \$5,000/year: Uber/Lyft/Waymo or transit instead of car ownership
- No downtown parking plus 50 free commute minutes/day
  - > \$1,700/year: Median cost of U.S. downtown parking
  - > \$2,000/year: Freed up time during commuting—240 days times 50 minutes/day times \$10 per hour
- \$4,500/year: Not needing a garage space saves \$375/month on rent or mortgage payments, or \$4,500/year

#### Total savings: \$13,200/year

### Parking-optional creates a larger pool of eligible buyers

- <u>No parking</u> lowers condo prices
- Mobility means no car payments
- More people can qualify for loans
- Thus, a bigger pool of eligible buyers!



# Targeted residential market segments

- Gen Z and Millennials who don't want the hassle and expense of owning and parking cars
- Young families who'll trade a two-car garage for extra living space and a park-like setting
- Seniors downsizing to simplify their lives
- Environmentally conscious consumers

# Targeted commercial market segments

- Retail: Grocery, convenience, specialty, electronics,...
- Companies that don't want the expense of providing parking now that it is no longer tax-deductible
- Companies that are environmentally focused
- Co-working office space companies: <u>WeWork</u>, <u>Regus</u>
- Group Living companies: <u>Common</u>, <u>Ollie</u> and <u>Outside</u>

Source: 2012 American Taxpayer Relief Act

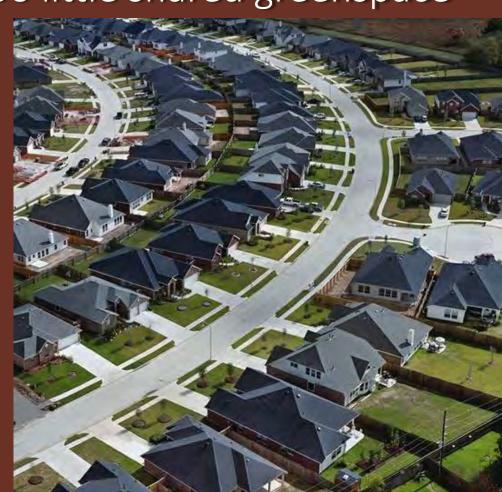
### Too much concrete, too little shared greenspace

*Instead we need...* 

Public greens rather than garages and concrete

No "free parking" but public garages and short-term car, SUV and RV rentals available

Micro-mobility Vehicle (MMV) rental is included in HOA fee or rentals—about \$15/month



### Affordable Living: Mixed residential, retail and office

Uber/Lyft/MMV Stations are located around the outside perimeter of the property and near interior commercial and residential buildings to minimize greenspace traffic

Since fewer roadways and parking structures are needed, development costs are lower with both higher density and more public greenspace and gardens



### Food Truck Service Area / Farmers or Artists Market

- A perimeter parking area dedicated to rotating-cuisine food trucks, specialty shops, and even a weekend Farmers Market or pop-up Artists Market
- On summer evenings, these picnic areas show movies or host concerts, speakers or buskers
- Schedules and menus would be shown on LED screens in buildings plus on the Village app and website



### Shared bike and scooter fleets are growing exponentially



The greatest challenge for MMV implementation:

The safety of slow pedestrians mixed in with speedy scooters and bikes

The solution: Separate Pathways



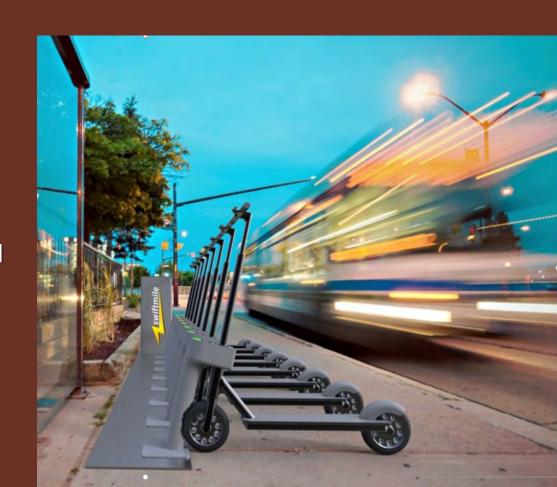
#### Separate pedestrian and micro-mobility pathways

- Family and senior-friendly pedestrian pathways
- Separate paths (with soft pavers?) for scooters, eBikes and delivery 'bots
- 15 mph maximum—with use suspended for reckless behavior
- Village scooters/bikes must be returned to a docking station



#### Not dockless! Docking controls theft and abandonment

- To rent: Scan QR code & provide biometric ID (finger/voice/face)
- If taken outside the geofenced zone, scooter locks up
- If dumped, renter gets a text and is charged a daily fee until scooters/eBikes are properly returned



#### Rules for the use of micro-mobility vehicles

- 15 mph maximum, one person per scooter
- Scooter riders must be 18 or older
- 30-day suspension for reckless use; then 90; then one year
- Must dismount when exiting MMV pathway
- Dock MMVs after use or \$10/day fine until returned

We'll provide helmets but we can't make you use them. We also won't pay for your broken bones or brain surgery.

## The stylish Hovding airbag helmet

- Automatically detects accidents
- Inflates in a tenth of a second
- Claimed to be 10X safer than conventional helmets, and
- It won't mess up your hair!!!
   Unfortunately, it costs \$340
   (cheaper than brain surgery)



Unfortunately, some people either can't understand or just don't want to understand even the most simple rules.



### Micro-mobility as a public transit partner

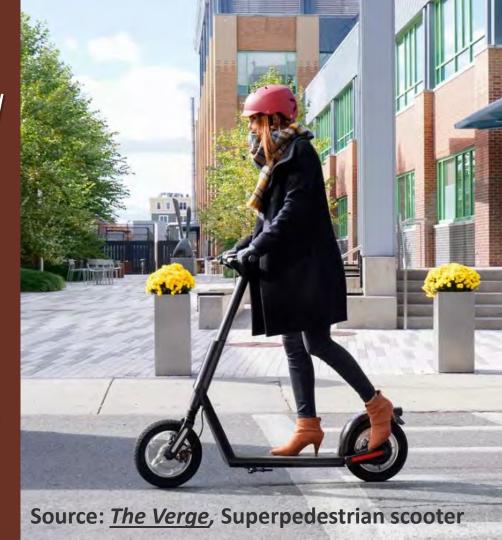
- MMVs can help address first/last mile problem—but piles of bikes near transit stations is unacceptable
- We need more bike lanes and fewer MMV's on sidewalks
- With reasonable rules, a partnership could grow transit ridership while also benefiting MMV vendors
- MMVs can also expand the radius of transit-oriented development

# Fun for all ages—but cities will need more bike lanes!



# Scooters are becoming increasingly sophisticated

- Geofenced speed governor
- Automated crash detection
- Automated parking restrictions
- Cloud-based fleet management with hardware monitoring and automated maintenance tickets



Juicers are paid to charge scooters, which can lead to problems



#### MMV battery swapping stations are increasingly common

Residents just pop into a 24/7 battery swap kiosk if the MMV needs "charging." Oneminute battery swap minimizes customer delays and reduces operating costs.



# Examples of micro-mobility vehicles (MMVs)









#### Torrot's Velocipedo enclosed scooter-car



Two passenger, 59 mph, 60-mile range, 540-lb, \$6,800, carbon fiber cage w/ seat belts, enclosed glass all-weather cabin



Swappable batteries, front and rear hydraulic disc brakes, USB charging, OTA app w/ GPS, predictive maintenance, driver analytics, crash and theft notification, fleet management

Source: Electrek.co

#### For those with moderate physical disabilities

Some folks may be able to climb onboard a threewheeler with minimum if any assistance, but we'll need to insure that all onproperty stores and restaurants are accessible and appropriately equipped with conventional wheelchairs



# Other forms of micro-mobility













Intel/Strategy Analytics estimates 2040 economic impact of driverless vehicles at \$4 trillion, delivery services at \$3 trillion



Commercial and consumer deliveries: meals, retail shopping, business-to-business, etc.





<u>©NURO/Kroger's</u>

Source: Fortune Magazine

# Continental's new delivery "RoboDogs"

At the January 2019 Las Vegas CES show, Continental debuted a new concept for doorstep package delivery using robotic dogs



Source: CNET RoadShow

#### Conclusions

- Affordable Living concepts apply to all age and income levels
- These concepts can work now using Uber/Lyft or public transit,
   but will save even more with low-cost electric RoboTaxis
- Combined commercial, retail and residential means easy access to employment, healthcare, job training, groceries and more
- The low-carbon footprint of Affordable Living will matter more and more as our planet grows warmer

# Your questions/comments