MOBILITY SHIFTS IN COMMERCIAL REAL ESTATE

Implications of Ridesharing; Autonomous Vehicles; Micro-mobility and Electric Vehicles

Part 3 of the Tech Disruptor Series

FEBRUARY 2019

CUSHMAN & WAKEFIELD

Top 10 Takeaways

MOBILITY SHIFTS IN COMMERCIAL REAL ESTATE

1 RIDESHARING, AVs, E-SCOOTERS CHANGING CONSUMER BEHAVIOR

Ridesharing is already reducing the use of public transit and increasing miles traveled and congestion. Trends will accelerate with widespread AV use, but will also free up commute times for work and play.

2 INDUSTRIAL LOGISTICS AND MANUFACTURING FIRST ADOPTERS

Due to safety concerns, early widespread use in industrial – particularly freight and trucking in sparsely populated areas.

4 FREES UP LOTS OF SPACE— REPURPOSE OR RISK OBSOLESCENCE

34% or 61 billion sf of existing parking and 140,000 gas stations at risk by 2040-2050.

3 PRIVATE CAR OWNERSHIP SURVIVES – FOR NOW

Parking demand for residential developments will continue until ridesharing impacts ownership.

5 EXPLODING DEMAND FOR SPACE DRIVEN BY MOBILITY TECHNOLOGIES

Data centers, cloud computing, high-tech manufacturing, entertainment content, cybersecurity and OEM. Mobility companies in the Bay Area occupied roughly 6 million sf in 2018.

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6

MORE LOCATION FLEXIBILITY BUT LOCATION STILL MATTERS

Less stress during commute times puts suburban locations more in play, increasing sprawl. As AVs reach full capability, expect redensification of urban core.

7

POTENTIAL TO ERODE TRANSIT-ORIENTED DEVELOPMENT (TOD) PREMIUMS

However, public transportation systems could be revitalized by self-driving buses or trains.

8

DENSELY POPULATED CITIES WITH EXPENSIVE PARKING EARLY ADOPTERS

Gateway cities as well as San Jose, Denver, Seattle and Philadelphia likely to be MaaS early adopters, unlike car-centric cities like Phoenix, Orlando and Las Vegas.

9

WIDESPREAD ADOPTION OF MOBILITY CHANGES A DECADE OR MORE AWAY

Regulatory and environmental factors, declining travel demand and other mobility options inject significant uncertainty into the trajectory and direction of change.

10

COMBINE CONSTANTS WITH DATA, FLEXIBILITY AND EFFICIENCIES

Occupiers still want the talent that flocks to urban centers. Amenities and technologies that offer hospitality and data collection from buildings and occupiers are smart bets. Ability to adapt to mobility changes is key by focusing on flexibility and efficiencies.

Introduction

Mobility shifts are expected to disrupt commercial real estate (CRE) both the near- and long-term. In part three of our Tech Disruptors series, we outline the various mobility disruptors and analyze which sectors and cities will be most impacted. Investors, owners, operators and occupiers will need to factor in the changing mobility landscape. We review opportunities to plan for the implications of these shifts.

DEFINITIONS

Ridesharing (RS): Includes single and pooled rides. Excludes traditional taxis.

Micro-mobility: Generally refers to single occupant modes of transportation such as bikes and electric scooters (e-scooters)—ridesharing network built out at scale.

Mobility: Covers RS, autonomous vehicles, and electric vehicles and micro-mobility.

Wayfinding: Navigating a building or an environment.

OEM: In relation to auto, OEM refers to the manufacturer of the original equipment, i.e., the parts assembled and installed during the construction of a new vehicle.

Mobility as a service (MaaS): Integrates various modes of transportation, shifting ownership towards mobility solutions that are consumed as a service.

BOPIS: Buy online, pick-up in store.

LEVELS OF AUTOMATION:

Level 0: Human driver does all the driving.

Level 1: Computer assistance for either steering or speed control. Human work and monitoring essential.

Level 2: Steering and speed controlled by Advanced Driver Assistance System in defined use cases. Human monitoring essential at all times.

Level 3: "Automated Driving Systems," with vehicle monitoring environment to make decisions. Human control available to intervene, for example, in adverse weather conditions.

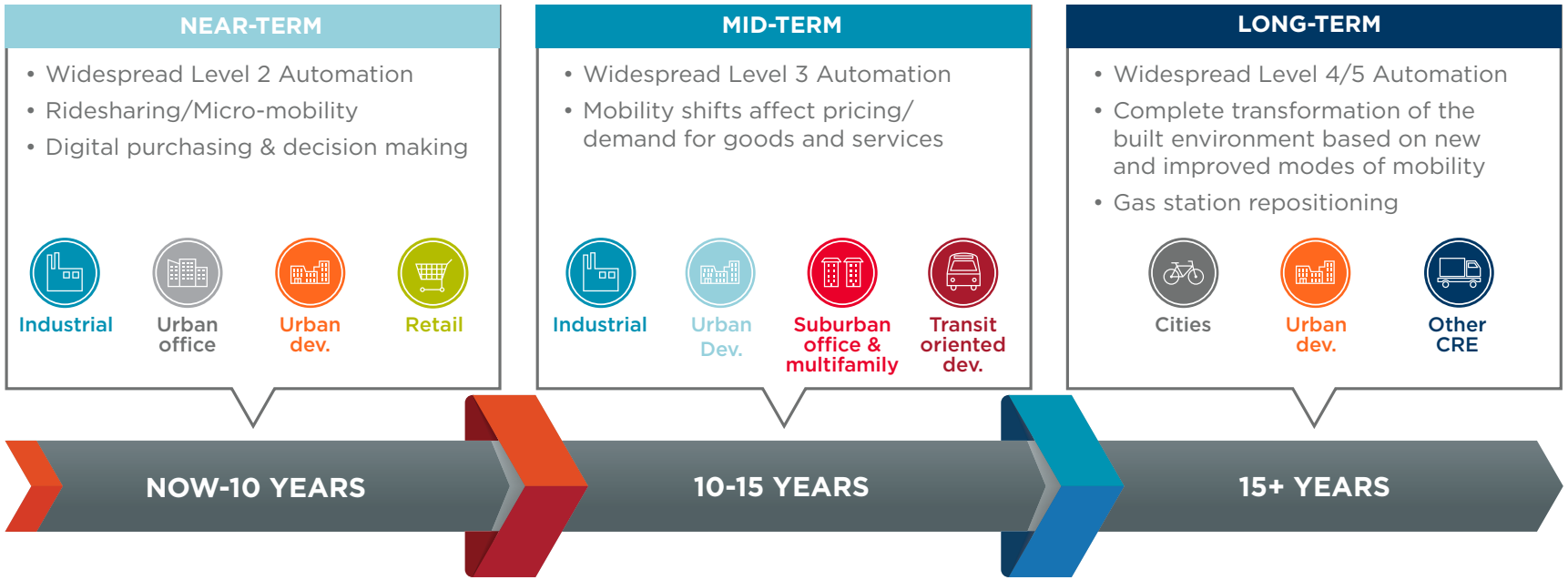
Level 4: All safety-critical driving functions are automated within Operation Design Domain (ODD). This technology is applicable to driverless shuttles operating in private or managed environments such as worksites.

Level 5: A vehicle requires no driver either for tasks or monitoring environment, in any domain.

TAKEAWAYS FOR REAL ESTATE OCCUPIERS AND INVESTORS

(Click to expand)

Source: Cushman Wakefield Research



SECTOR LEVEL TAKEAWAYS
CRE IMPACT OF WIDESPREAD ADOPTION

Near-term impact | Mid-term impact | Long-term impact

	Ridesharing (RS)	Micro-mobility	Autonomous Vehicles (AV)	Electric Vehicles (EV)
Industrial	• Fewer employee parking requirements lead to increased efficiency of last mile and close in warehousing designs.	• Increased demand for manufacturing capabilities.	• Trucking AV will change industrial warehousing requirements. Larger more remote locations outside cities, with last mile locations increasing in size. • Drive demand for high tech AV manufacturing facilities, automotive supply chain component parts and R&D.	• Increased need for EV manufacturing facilities, and component parts such as batteries for OEMs.
Office space/ Office design/ Amenities	• Office space for ridesharing companies increases. • Suburban office parks renaissance.	• Office space for last mile companies increases.	• Office space for AV companies increases. • Increased need for cybersecurity, AV related support, data processing and entertainment material drives office demand. • Offset through densification and telecommuting. • Redesign entrances for AV pickup/ drop-off.	• Increased office demand from OEMs. • Consolidation of office space demand by oil companies. Oil dominant CRE markets will need to strategize.
Retail	• Increased foot traffic to stores although offset by increased use of ridesharing for grocery delivery.	• Increased BOPIS, moves more traffic through stores.	• Large parking structures around malls and shopping centers less critical. • AV retail/eCommerce/food delivery.	• NA
Data centers	• Increased need for data processing.	• Increased need for data processing.	• Cloud and cyber security requirements result in increased need for data centers. One AV can produce as much as 30TB of data per day[1]. Current systems are not equipped to handle this and will need to evolve once more AVs are on the road.	• NA
Parking/ Gas stations	• Street parking converted to pick-up, drop-off areas. • Decrease in parking use will result in conversions: multifamily for freestanding structures, retail, last mile delivery for ground level parking on office buildings.	• Landlords to offer bike/scooter storage in offices along with general bike and scooter street storage. • Bike/scooter parking needs access to the office similar to many office parks' car garage access to the main entrance.	• City center parking and gas stations decreased as AVs can self-park and refuel/recharge themselves in cheaper locations outside the cities.	• More gas station conversions will result as EVs gain market share.
Transit oriented development	• Premiums for transit oriented leasing, construction eroded as transit use decreases.	• Positive impact as public transit users typically enhance their commute with scooters and bikes.	• Reduced need for truck stops and amenities along highways. For passenger drivers, there will still be a need for rest stops. • Hotel and motel demand affected dramatically.	• NA

Source: Cushman & Wakefield Research

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1. Road Mobility Market Overview

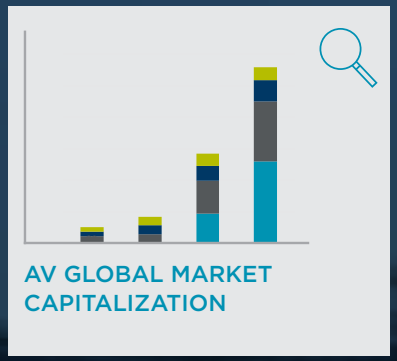
It is almost universally acknowledged that widespread adoption of auto technologies such as ridesharing (RS), autonomous vehicles (AV), electric vehicles (EV), electric scooters and bikes is causing and will cause profound shifts in mobility. That in turn is affecting and will affect commercial real estate (CRE). The ridesharing, AV, EV and micro-mobility markets are increasingly interconnected, with large companies in each space driving technology development and adoption in related areas. Overall, AT Kearney estimates that the market value of the connected AV mobility marketplace will skyrocket to over $555 billion by 2035.

The adoption and market growth rates for each category are:

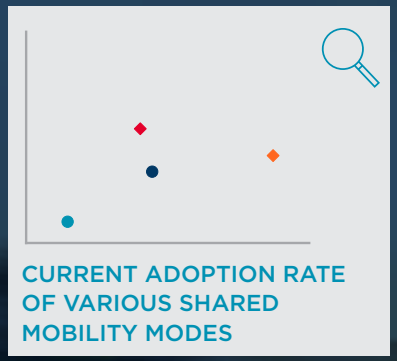
- Ridesharing is already widely adopted (at 21 percent in major markets) in the U.S., with 2018 revenue at approximately $15.6 billion[2] and forecast to grow to $26.3 billion by 2023. Ridesharing companies are particularly invested in AV technology since drivers account for 50 percent[3] of ridesharing costs. Eliminating the driver is the path to profitability.
- The AV market—which includes hardware, software and specialized equipment—is estimated to reach a 17 percent market capitalization by 2035 globally.[4] Additionally, BCG estimates that global autonomous and semi-autonomous vehicle sales penetration could reach 25 percent by the same year.

The ridesharing, AV, EV and micro-mobility markets are increasingly interconnected, with large companies in each space driving technology development and adoption in related areas.

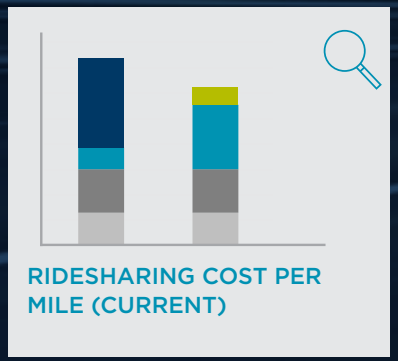
- The EV market is still tiny, accounting for just one percent[5] of new car sales in the U.S., although that share increases to five percent in states such as California that offer incentives and subsidies. AVs with self-driving systems require more power to run,[6] and gas-powered AVs would increase emissions by 3-to-20 percent, depending on the size of system deployed in the car. There are also concerns about more vehicle miles traveled due to ridesharing and this will spur EV technology. Several city governments have issued requirements for ridesharing companies to decrease their carbon footprint.
- An important addition to the market is micro-mobility options—i.e., e-scooters and bikes—which have seen their adoption increase dramatically due to infrastructure investment and vehicle sharing. This is not surprising since 46 percent of car trips in urban areas are less than three miles,[7] and micro-mobility options are often more convenient than taxis, public transportation or walking. Since launching in 2017, e-scooters have already captured a 3.8 percent market share in the markets where they operate, disrupting ride-hailing services for short trips. CB Insights estimates that the total market value for e-scooters and bikes will be $6 billion by 2020. They are also cheaper—Quartz estimates that a Lime scooter ride is is $3 - $4 cheaper per ride for a 1-2 mile trip[8] compared to a similar ridesharing trip.[9]



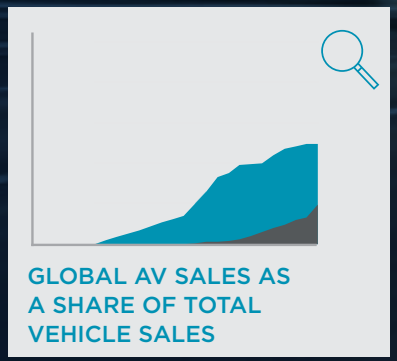
AV GLOBAL MARKET CAPITALIZATION



CURRENT ADOPTION RATE OF VARIOUS SHARED MOBILITY MODES



RIDESHARING COST PER MILE (CURRENT)



GLOBAL AV SALES AS A SHARE OF TOTAL VEHICLE SALES

2. Changing Consumer Behavior

The intersection of ridesharing, AV and EV technology deployed in fleets would radically change consumer behavior. Indeed, ridesharing is already reducing the use of public transit and increasing the number of vehicular miles traveled, thereby increasing congestion and pollution.

Interestingly, ridesharing does not seem to have reduced the appetite for car ownership. Ninety-one percent of ridesharing users have not made any change regarding car ownership,[10] at least not yet. However, ridesharing apps have much higher usage among millennials compared to older generational cohorts, and vehicle ownership is declining in this group. The largest group of car buyers is between 35 and 54 years old. As young people age into these car-buying segments, in the cities where MaaS is a low-cost, widespread reality, there is a real possibility that they will buy fewer cars.

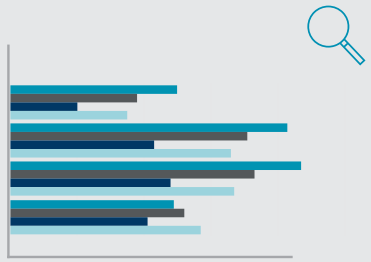
AV adoption may also disrupt car ownership in the U.S. However, Goldman Sachs forecasts annual sales of private cars will increase an estimated 7.9 percent by 2030 from 2016 levels.[13] This increase is larger after adding in shared fleet cars, sales of which are expected to grow 13.0 percent over the same period. But once AV adoption is widespread (2035 and beyond), car ownership is expected to transform into a shared car environment, in which AV purchases will be driven by fleet companies.

Individuals will either share cars via a MaaS model or share AVs.

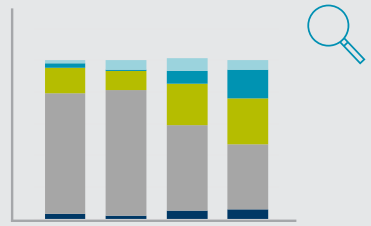
Some level of personal car ownership will nevertheless persist despite AV adoption due to the complexity of ownership behavior that goes beyond transportation requirements. Car ownership can be aspirational: owning a car often represents social or economic status. The familiarity afforded by a personal car (ability to store private items, personal space, etc.) is an ingrained behavior that will persist.

Widespread adoption of AVs is likely to cause more profound changes by freeing up time during commutes to either do more work (thereby increasing employee productivity) or to consume entertainment and news content (thereby creating demand for these services). McKinsey estimates that we will have as much as 50 extra minutes per day for work or relaxing because we won't have to drive ourselves to or from work.[11] Productivity gains could be as much as $507 billion annually in the U.S.[12]

Imagine that after your commute, you were dropped off at your office door—no wasted time parking or walking several blocks to your office. The car could park itself robotically, using much less space than traditional parking. Or, if the vehicle is part of a fleet, it just keeps going, moving people, deliveries and drop-offs, stopping only to recharge/refuel or for maintenance. It does, however, add to congestion.



VEHICLE PURCHASE PER 100 PEOPLE BY YEAR



CHANGE IN VEHICLE OWNERSHIP BY RIDESHARING UTILIZATION RATE

The intersection of ridesharing, AV and EV technology deployed in fleets would radically change commercial real estate.

AS AV ADOPTION INCREASES CRE IMPACT MORE WIDESPREAD

Partial driver substitution increases suburban sprawl but potentially some reversal as complete self-driving capabilities develop as prime parking space in cities is repurposed

LAG IN REAL ESTATE IMPACT

CRE IMPACT

LONG-HAUL FREIGHT, LOGISTICS, STORAGE AND ONLINE RETAIL

LIMITED INCREASE IN SUBURBAN SPRAWL. EXPLOSION IN DATA CENTERS & CYBERSECURITY

PARKING IN PRIME INNER CITY REAL ESTATE RECLAIMED

CAR OWNERSHIP SHIFTS TO "PAY-PER-MILE." ENTIRE ECONOMY REMAPPED

AV TECHNOLOGY DEVELOPMENT

TECHNOLOGY DEVELOPMENT
LEVEL 2

Limited to backup system.

Requires licensed driver with full legal responsibility.

Safety concerns.

PARTIAL DRIVER SUBSTITUTION
LEVEL3

Requirements for legally responsible operator likely to be relaxed.

Driver can multi-task.

COMPLETE SELF-DRIVING
LEVEL 4/5

Vehicle can maneuver and self-park robotically with less space usage per car.

Driver retains ability to intervene in emergency or system failure.

WIDESPREAD PENETRATION
LEVEL 5

Completely self-driven.

Driver control over car limited or none.

3. Implications for Commercial Real Estate

SECTOR LEVEL IMPLICATIONS

NEAR-TERM: Now-10 years

First adoption in industrial, logistics and manufacturing: As safety concerns about AV technology continue to dominate, initial widespread use is likely to be higher for industrial uses — particularly in freight and trucking. (For an in-depth analysis of automation on industrial real estate look for our next paper in this series.) Warehousing, manufacturing and storage facilities will likely relocate to lower-cost areas. The subsequent decline in distribution costs may make online retail relatively more attractive.

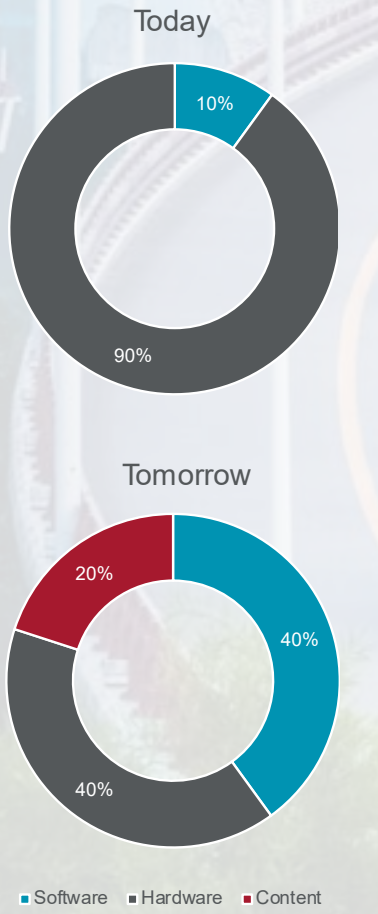
Low-cost, unmanned vehicles will permit manufacturers to consider less expensive locations that are not as reliant on air and sea ports or train lines. The reduced and/ or eliminated labor costs associated with moving materials will allow companies to take advantage of lower real estate costs that come with less- convenient locations. This will, of course, dramatically impact the trucking industry as driverless vehicles are able to carry freight 24/7 with reduced labor involvement. Tesla is developing a long-haul, all electric semi-truck with autonomous driving capabilities that moves in "platoons" and automatically follows the direction of the lead vehicle.[14]

The automotive industry's high-level design requirements are combining to generate a surge in the development of next-generation manufacturing product in key markets nationwide. GM is redeploying a previously idle plant in Detroit to manufacture AV/ EV cars.[15] Tesla's gigafactory in Nevada and Lucid Motors' $700 million factory in Arizona are other examples. In addition, the automotive supply chain will change dramatically, as will the R&D process—all of which will drive demand for more space.

However, the real estate requirements may complicate and delay the process of rolling out manufacturing locations. First, few available and existing auto plants can accommodate the evolving specifications of this sector. Second, the overall supply of better-quality industrial buildings is not keeping pace with demand.

Explosion in CRE-related data center, cybersecurity, entertainment and OEM office demand: The car itself will morph into a different type of vehicle. Morgan Stanley predicts that 40 percent of an AV's value will come from hardware, 40 percent from software and 20 percent from content that streams into the vehicle.[16] This will include games, shows, advertisements and news enabled by the software, with an ecosystem of apps growing around all of these facets. The increased need for cybersecurity, AV-related support, data processing and entertainment material is likely to lead to an explosion in office demand. In the Bay

THE VALUE OF AUTOMOBILES



Source: Cushman & Wakefield Research, Morgan Stanley Research

AUTOMATION WILL ACCELERATE ECOMMERCE TRENDS IN LOGISTICS

Per Cushman & Wakefield's forecast, ecommerce will grow from 9.6% of total retail sales in 2018 to 12.0% in 2020

AV solutions mean that larger warehouses can be located in remote cost-viable locations with smaller, limited inventory ones in the urban core.

DC: Distribution Center
RDC: Regional Distribution Center
TL: Full Truck Load
3PL: Third-party Logistics

SERVICE LEVEL MIGRATION

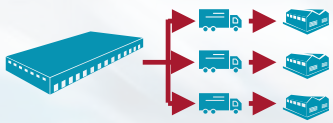
BIG BOX

- Larger eCommerce DC
- Highly automated, land and labor leveraged
- Remote cost-viable location

PARCEL/ROUTE

TIERED MODEL: RDCs

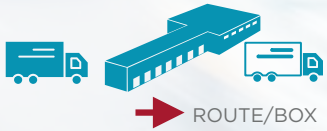
- Larger replenishment DC – less remote
- Highly automated; significant receiving, stocking, picking and shipping activities
- Big Box shipping to multiple RDCs



TL RDCS

CROSS DOCKS

- Receiving TL
- Full of labeled orders
- Some A level inventory
- Higher cost location (5 mi radius)
- Less staffing, limited automation
- Possibly a 3PL or multi-tenancy



ROUTE/BOX

DEPOTS

- Service level depot
- Urban core, 10-40K SF
- Some stocking & picking, but less automated
- Limited inventory, A+ only
- Possibly a 3PL or multi-tenancy

LTL BOX/ROUTE/CAR/ UBER/ETC

URBANIZATION IMPACT

3. Implications for Commercial Real Estate

Area alone, mobility companies occupied just under 6 million square feet in 2018.[17]

As EVs gain traction, there might be possible consolidation of office space occupied by oil companies; oil-dominant CRE markets will need to strategize. However, some of this is expected to be backfilled by other industries and technologies associated with changing mobility.

As safety concerns about AV technology continue to dominate, initial widespread use is likely to be higher for industrial uses – particularly in freight and trucking.

Cloud storage will be critical for AV adoption as self-driving vehicles are anticipated to send and receive large amounts of data on a real-time basis. One AV can produce as much as 30 terabytes of data per day. 5G connectively is also vital to process and transmit this data.

MID-TERM: 10-15 years

Potential to erode transit- oriented development (TOD) premiums: Ridesharing has led to a six percent reduction in public transit use in major U.S. cities,[19] with associated implications for the real estate premiums that TODs currently enjoy. As AV deployment accelerates, TOD premiums will abate or perhaps even disappear over time. This may be good news for suburban office parks and retail locations not currently served by public transportation.

On the other hand, public transportation systems could be revitalized in the form of self-driving mass transit buses or trains. This is particularly relevant since ridesharing is increasing congestion, a trend likely to continue, particularly in major urban markets.

LONG-TERM: 15+ years

Frees up parking – lots of it: Estimates of the amount of parking freed up by driverless vehicles vary significantly: from 34 percent (61 billion square feet) of current parking inventory by 2040 – 2050[20], up to 90 percent of current parking inventory in 15 years.[21] Whatever the ultimate tally, there is no doubt that a large proportion of the approximately 6,500 square miles of parking in the U.S.[22] will be affected.

Ridesharing is already making an impact. A recent survey on ridesharing conducted by the University of California/Davis reveals that parking is the primary reason why people rideshare (cited by 37% of survey respondents).[23] Parking is costly for commuters, averaging $183 per month per parking spot, up 6.4 percent nationally in 2017; parking costs are expected to continue to increase, albeit at a slower rate.[24] Paid parking does, however, provide income streams for landlords, municipalities and parking garage operators. Unsurprisingly, the cities where ridesharing is most prevalent are also those with the costliest parking.[25]

As the industry evolves towards true self-driving capability, we expect to see a dramatic reduction in parking. Some parking will still be needed for automated fleets but at vastly reduced space usage due to robotic parking. A recent analysis showed that, for a given number of cars, a well-designed AV parking lot could accommodate 62 – 87 percent more cars than a conventional garage.[26]

On-street parking will also be a casualty. An OECD[27] analysis indicates that self-driving fleets will obviate the need for on-street parking. The freed-up road space is likely to be reconfigured for more AVs, dedicated roadways and lanes, e-scooters and charging stations for EVs. It will likely result in increased congestion. Some cities may adopt "smart landscapes" with better designed roads that allow for walking and dedicated biking and scooter lanes.

In the future, buildings will have less or no parking and much larger pick-up and drop-off areas. This will present myriad challenges and opportunities for developers, owners and occupiers. A recent survey of 233 Americas-based corporate real estate executives, conducted by Cushman & Wakefield and CoreNet, found that corporate occupiers,

THE AUTONOMOUS VEHICLE ECO-SYSTEM DRIVES INDUSTRIAL

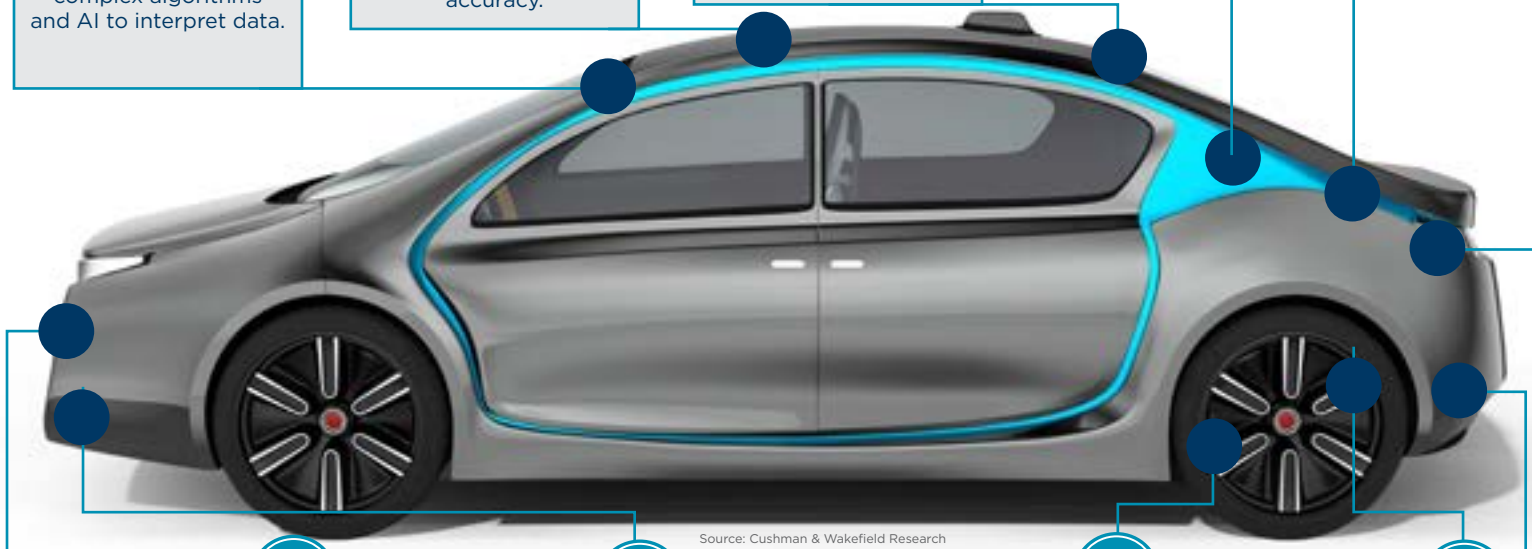
The automotive supply chain will change dramatically, as will R&D process, driving industrial and OEM demand for industrial space.

INS: INERTIAL NAVIGATION SYSTEM
Improves GPS accuracy with gyroscopes and accelerometers.

FORWARD FACING CAMERA:
Collects images, utilizes complex algorithms and AI to interpret data.

GPS: GLOBAL POSITIONING SYSTEM
Combines with tachometers, altimeters and gyroscopes to improve locational accuracy.

LIDAR: LIGHT DETECTION AND RANGING
360° sensor bounces pulses of light off surroundings to measure distance of objects and detect lane markings.



Source: Cushman & Wakefield Research

DSRC:
Dedicated Short-Range Communication for vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) systems to send and receive critical data. DSRC enables platooning.

CENTRAL COMPUTER:
Processes sensor and systems data.

INFRARED SENSORS:
Detects lane markings, pedestrians and bicycles. Low light and adverse weather.

FRONT RADAR SENSORS:
Monitor the position of other vehicles. Currently used in many adaptive cruise-control systems.

ULTRASONIC SENSORS:
Measure the position of objects very close to vehicle, such as curbs.

ODOMETRY SENSORS:
Complement GPS.

REAR RADAR SENSORS

Key convergence with technology and infrastructure

- 5G Connectivity: Current 4G networks are insufficient to provide the seamless communication required by AVs. 5G essential for the vast quantities of data transmission by AVs.
- Road infrastructure: Dedicated power and communications.
- Complex computers will replace road signs and traffic signals that are readable by AVs.

3. Implications for Commercial Real Estate

in particular, are well aware of this: 65 percent of respondents expect to be less focused on parking in the future. One-third of respondents expect to have a difficult (and/or costly) time repurposing parking facilities in their portfolio that become obsolete with the implementation of AV technology. There are some in the industry already leading the way. For instance, the garage at 1111 Lincoln in Miami Beach features floor heights varying from 8 to 34 feet. It is also mixed use with retail, penthouse and event space in the garage.[28]

Demand for parking in multifamily developments and for single-family homes seems poised to continue for now, particularly in developments targeted to older age groups. However, this too will change with demographic shifts. Millennials use ridesharing apps more than older generational cohorts. In addition, vehicle ownership is declining among younger people. This suggests that multifamily developers may be able to tailor parking offerings in developments targeted to different age groups by offering access to subsidized ridesharing services.

In 2017, 69 condos at 388 Fulton in San Francisco's Hayes Valley sold without any structured parking indicating demand for such developments.[31] Many cities across the country have significantly reduced their parking requirements for development or eliminated them completely. New York and San Francisco do not have parking requirements for development, while Chicago and Los Angeles have specific zones that removed parking requirements.

1111 Lincoln, Miami Beach

Washington, DC is in the process of finalizing zoning updates that will reduce some parking minimums. Seattle and Austin have also eliminated parking minimum rules.

Gas stations obsolete: Should EV penetration in the U.S. expand to account for more than the current 1.0 percent of new auto sales,[32] it would reduce the need for some of the 140,000 gas stations in the country[33] – although some of them would likely be replaced by (albeit fewer) charging stations. (Note: most daily charging will take place at an EV owner's home.) In Manhattan[34] and San Francisco[35], over 54 stations have been converted to mixed-use properties over the last eight years.

Retail and Hospitality transformed: Ridesharing increases foot traffic to stores, although, any increase is likely offset by increased use of ridesharing for grocery and retail delivery. Uber Eats, launched in 2014, is currently the largest food delivery service in the world outside of China. The increased mobility that driverless cars afford senior citizens may revitalize secondary retail in suburban locations. Large parking structures around malls and shopping centers will become less critical as fully driverless cars become a reality.

In addition, changing traffic patterns and the ability to sleep in cars due to AVs will affect hotels and motel demand.

PARKING FLEXIBILITY IS KEY

IMPLICATIONS	
Development costs and space	• Parking adds 25 percent to the cost of development.[29] Any reduction makes development more affordable and profitable. • However, tenants need to become comfortable with lower parking ratios before parking can really be eliminated. Assess tenant demand via surveys and monitor success of developments with reduced parking. • Reducing need for parking frees up space but potentially reduces income from a building. Affects building revenue and in some cases valuations depending on whether the excess parking can be put to alternative profitable use.
Repurposing/ redesigning parking	• De-link parking from the commercial real estate through shared parking services. • Paying the option premium — which can be steep — for flexible parking spaces with higher ceiling heights and flat floor plates (instead of the typical slanted design) and putting the ramps on the outside of the structure. • Allows easier repurposing to other uses: office, retail, last mile distribution centers, additional building amenities such as micro-mobility storage. • Modify ingress / egress of buildings to accommodate mass use of AVs, drop offs and waiting areas. • Mixed-use popular due to flexibility.
Occupiers	• Reduced development costs of parking likely passed onto occupiers. • Commuter benefit programs[30], such as TransitCheck and Wageworks, allow employees to use pre-tax dollars on ridesharing expenses for Uber and Lyft. Some companies may also provide employee commuter benefits for Lime, Bird etc. and perhaps micro-mobility as well.

*Source: Cushman & Wakefield Research

4. Implications for Cities

CITY LEVEL IMPACT OF MOBILITY VARIES

Densely populated urban centers with expensive parking, pollution concerns and relatively wealthy residents will see the biggest change. Ridesharing has experienced the most growth in New York, San Francisco, Washington, DC, Boston, Chicago and Los Angeles,[36] with 21 percent of adults in these cities using the service.[37]

Cushman & Wakefield Research evaluated cities against key factors that would influence auto mobility take up to arrive at a group that would be most likely to see changes. The cities where change to auto mobility could be strongest—and happen quicker—are classified as "early adopters." They are, in general, gateway cities, as well as Denver, Seattle, San Jose and Philadelphia. Some of these cities are also piloting AV technology and are likely to be the first to use MaaS. On the other hand, car-centric cities such as Phoenix and Orlando, are likely to see less change from mobility shifts.

Primarily still urban, but watch for suburban impact with AV development. In the longer term, provides more location flexibility. Within early adopter cities, there is currently an urban bias: urban usage levels of ridesharing apps is at 29 percent, compared to only 14 percent of suburban adopters. We expect similar patterns for initial adoption of AVs and MaaS. However, as AV technology develops to enable full or partial driver substitution, it will free up commute time, possibly leading to consumers tolerating longer daily commutes. This will make it increasingly less important to live close to one's workplace for some employees. It may also result in some increase in suburban sprawl, increasing demand for suburban housing, and with it, supporting retail. More importantly, companies could open offices more easily in less expensive suburban locations and thus draw from a larger talent pool as CBD locations become less critical.

Yet, the dream of suburban utopia has its challenges. The extent of suburban sprawl is limited by the fact that commute times tend to remain relatively stable. Wherever we live and work—and whatever the changes to transportation options—the average one-way commute remains roughly 30 minutes, termed "Marchetti's Constant." Indeed, currently the average commute time for workers in the U.S. is 26.6 minutes.[38] Only eight U.S. cities have average commute times longer than Marchetti's Constant: New York City, Washington, DC, San Francisco-Oakland, Boston, Chicago, Riverside, Philadelphia , Atlanta, Miami, Los Angeles and Baltimore. These cities account for 32 percent of the national gross domestic product and 38 percent of office space, nationwide.[39]

As AVs reach full self-driving and parking capability we expect some reversal of suburban sprawl as parking spaces and gas stations are redeployed to other uses and city centers redesigned. But that is far in the future.

CONGESTION CONTRIBUTES TO SUBURBAN SPRAWL

Source: Cushman &Wakefield Research, American Community Survey

CITY LEVEL IMPACT OF MOBILITY VARIES

136	**EARLY ADOPTERS** Mobility shifts already gained traction with benign regulatory environments	San Francisco New York Washington D.C. Los Angeles Boston Chicago San Jose Denver Seattle Philadelphia
108		
106	**LIMITED ADOPTION** Mobility shifts gaining some traction but obstacles remain	Austin Portland Baltimore Miami San Diego Atlanta Houston Minneapolis Riverside Sacramento Dallas Detroit
92		
91	**AUTO-CENTRIC** Most likely not to adopt mobility shifts	Phoenix San Antonio Orlando Columbus St. Louis Las Vegas Pittsburgh Indianapolis Charlotte Tampa Kansas City Raleigh/ Durham
71		

Category - Variables	Weight
Transportation Drivers	**34%**
Parking Cost	
Pollution	
Commute Time	
Congestion (Hours)	
Congestion Index	
Auto Tech Adoption	**31%**
AV Trials	
EV Friendliness Index	
Ridesharing Adoption	
Ridesharing Regulation	
Micro Mobility	
Demographics	**20%**
Millennials Composition	
Household Income	
Quality of Life	**15%**
Walk Score	
Bike Score	
Transit Score	

Source: Cushman & Wakefield Research

5. Timelines & Adoption

Transition to widespread adoption will take at least a decade – time to prepare.

While ridesharing, micro-mobility and EVs are already a reality, widespread adoption of AVs and EVs is at least a decade or two away. A Cushman & Wakefield and CoreNet survey found that three-fourths expect AV technology to reach a tipping point by 2030.

The pace of adoption depends on three preconditions being met: 1) Acceptance, 2) Convergence and 3) Scalability. These in turn depend on a variety of factors. Regulatory and environmental factors remain wild cards (e.g., legal restrictions on ridesharing in Austin and New York, labor disputes) as do declining overall travel demand (teleworking, eCommerce), growth of other mobility options such as the e-scooter, public transportation and increased congestion. All these inject significant uncertainty into the actual trajectory and direction of change.

In the midst of all this uncertainty, some things will remain constant. Occupiers are still likely to be driven by talent, and talent flocks to innovation centers: large, dynamic urban cities driving change and creating jobs. Building-level soft amenities, i.e. services and technologies that straddle hospitality services are smart bets under any scenario. Within this framework, focus on the transition — particularly flexibility, hybrid uses that straddle asset classes as well as efficiencies. Remember, however, that the optionality that flexibility entails implies higher and more costs.

In order to determine whether it is worth paying for higher ceilings in parking garages for instance, it is critical to gather and mine data from buildings and ccupiers (for eg: via surveys), Any insights into behavior gives landlords and investors the ability to tailor services and amenities better.

Those who can position assets to adapt to mobility changes will see those assets outperform others that do not keep pace.

ADOPTION PRE-CONDITIONS

Safety, technology development & regulation will pose significant barriers to widespread adoption

	Current acceptance levels	Convergence with other technologies / infrastructure	Estimated time frame for widespread adoption
Overall Considerations	• Acceptance varies.	• Explosion in cybersecurity, big data requirements. • Computational power. • Legal issues, regulatory hurdles.	• Variable, depending on technology.
Ridesharing	• High acceptance. 21 percent in major metros,[40] mainly due to parking convenience/cost. • Affordable.	• Legal challenges, environmental concerns, increase in road congestion.	• Immediate and escalating impact.
Micro-mobility	• Medium acceptance. Safety, for both the rider and other road users including pedestrians are areas of concern. • Affordable.	• Usability in adverse weather conditions. No or limited ability to multitask (check phone, answer calls). • Curb space and parking issues due to dockless nature. • Vandalism, theft, and maintenance are still issues and the business model is yet to be proven.	• Immediate and escalating impact.
Electric vehicles	• High acceptance (in principle). • Friction between state and local regulations. Battery life area of concern.	• Lack of charging stations: Only 15 percent of gas stations in the U.S. have EV charging facilities.[41] • Suboptimal battery capacity and high cost. • Current electricity grid capacity cannot support EVs in excess of 15 percent of today's cars.[42] • Sunk costs for phasing out existing non-EV cars.	• 10+ years.
Autonomous vehicles	• Low acceptance. Safety still primary concern. Technology development in partial or conditional autonomy phase.	• 5G connectivity enabling vehicle-to-vehicle communication. • Data centers to cope with data volume. • Separating and redesign of road networks • Mapping. • Entire redesign of traffic control system—replacement of traffic lights. • Increased energy & fuel requirements. • Sunk costs for phasing out existing non-AV cars.	• At lease 10 years for widespread Level 4 automation. • 20+ years for full automation.

Source: Cushman & Wakefield Research

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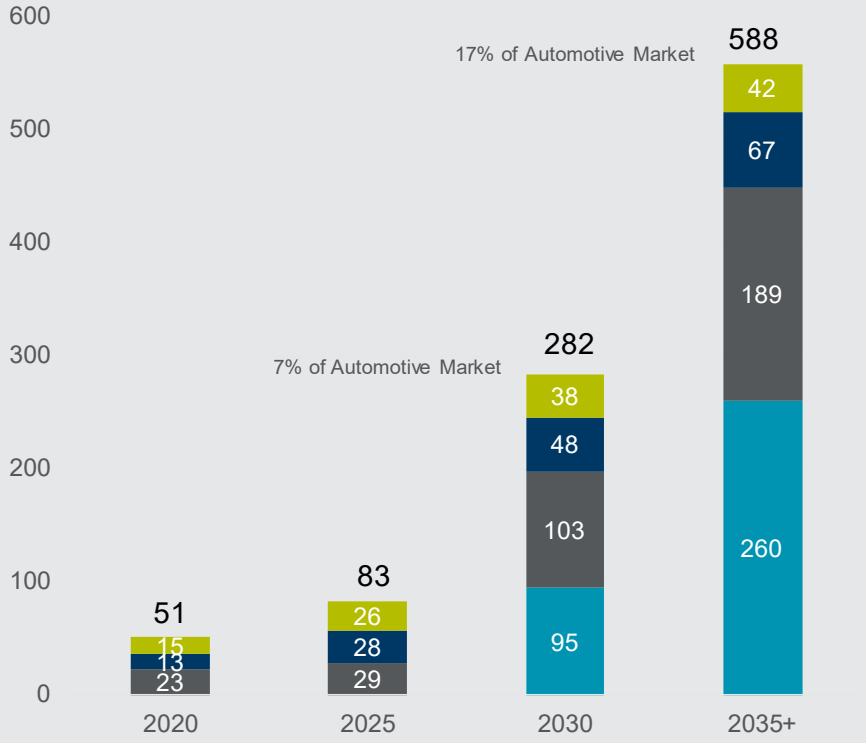
48
mph
Autonomous Mode
NETWORK
DRIVER

AV GLOBAL MARKET CAPITALIZATION

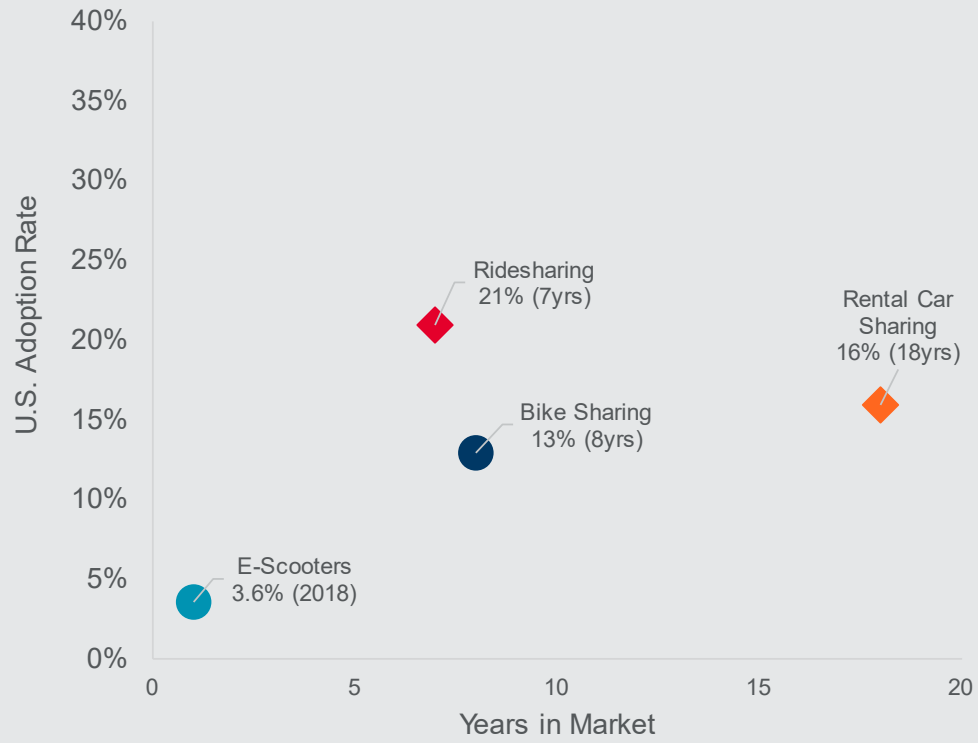
Global market for automated and autonomous driving, including related services ($billions)



Source: Cushman & Wakefield Research, AT Kearney

BACK

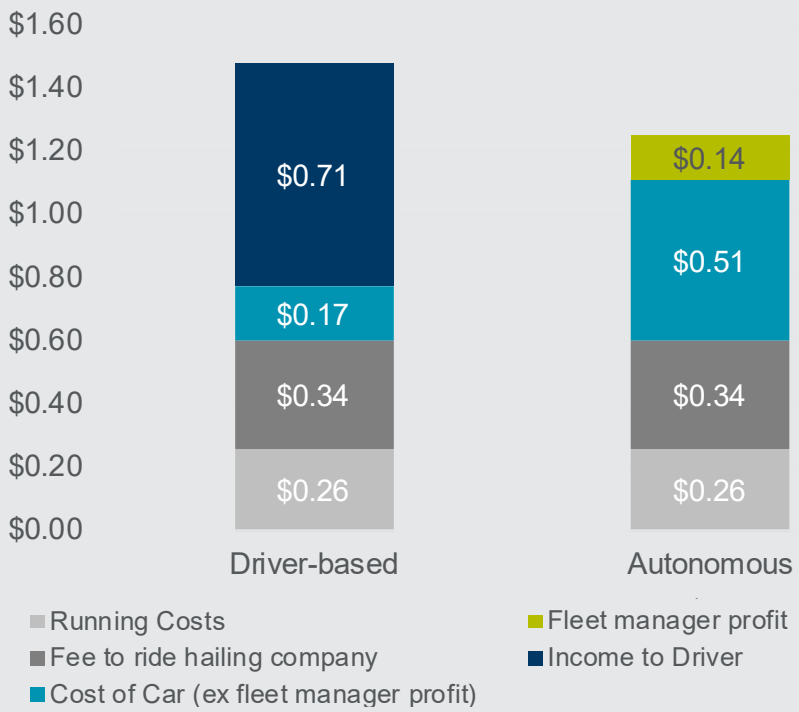
CURRENT ADOPTION RATE OF VARIOUS SHARED MOBILITY MODES



Source: Cushman & Wakefield Research, Populus, UC Davis

BACK

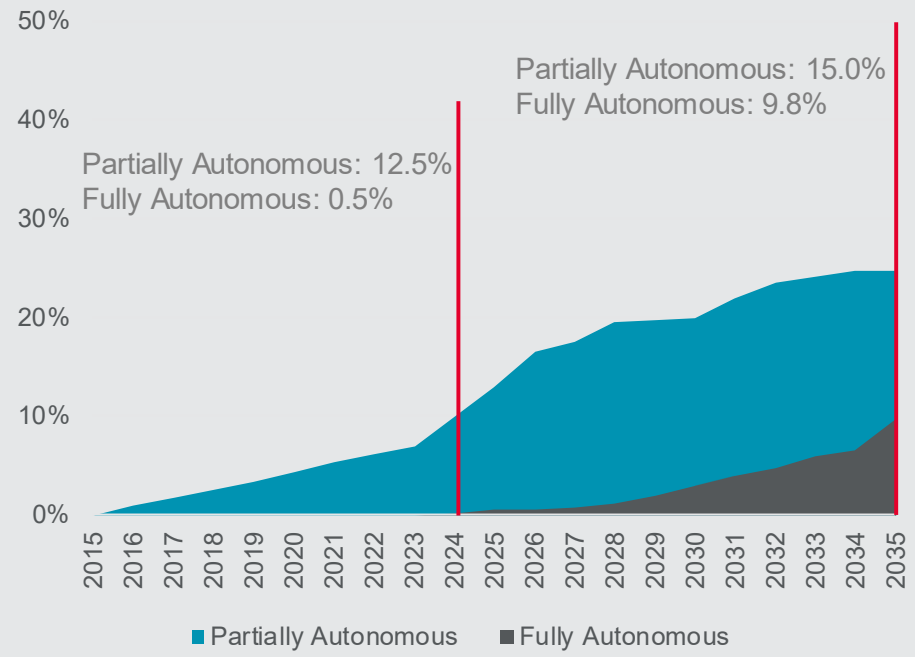
RIDESHARING COST PER MILE (CURRENT)



Source: Cushman & Wakefield Research, Goldman Sachs

BACK

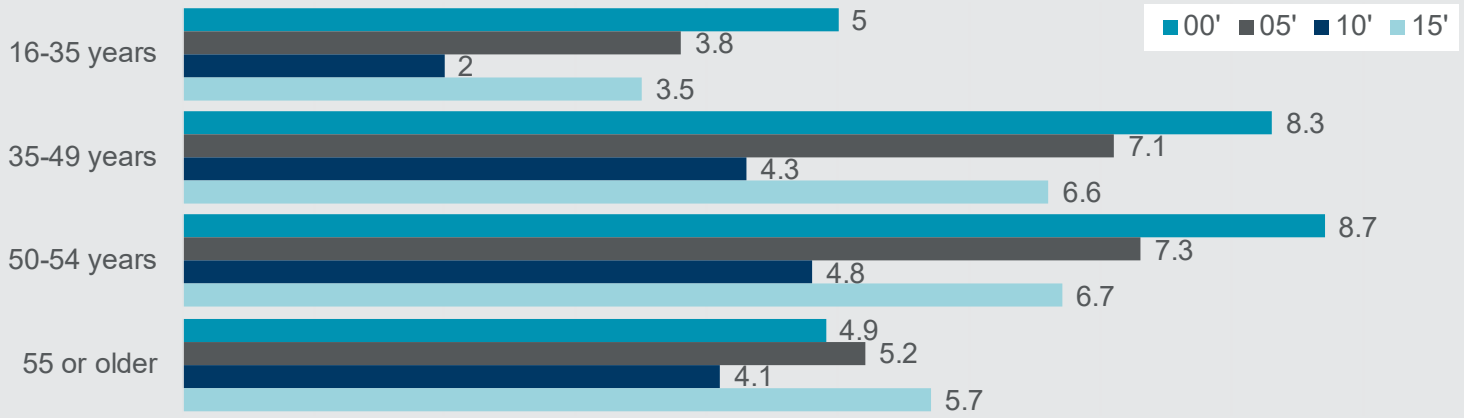
GLOBAL AV SALES AS A SHARE OF TOTAL VEHICLE SALES



Source: Cushman & Wakefield Research, BCG

BACK

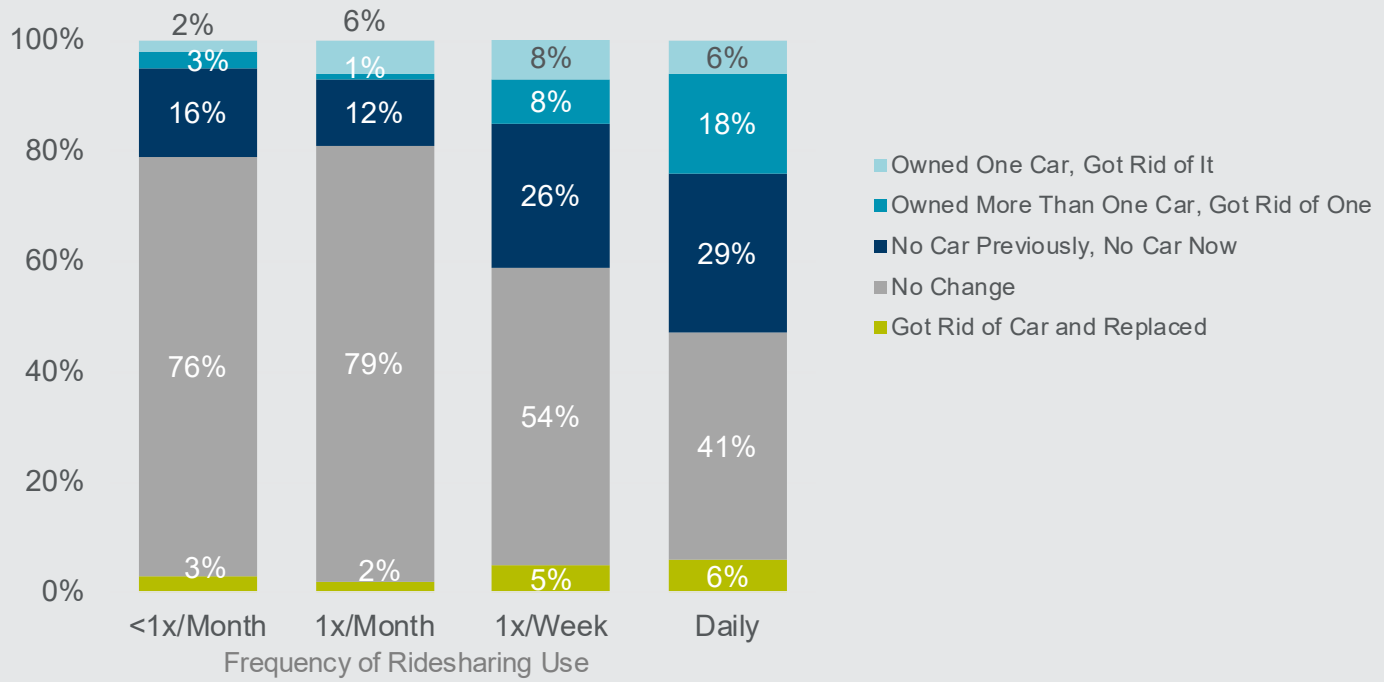
VEHICLE PURCHASE PER 100 PEOPLE BY YEAR



Source: Cushman & Wakefield Research, Census Bureau

BACK

CHANGE IN VEHICLE OWNERSHIP BY RIDESHARING UTILIZATION RATE



Source: Cushman & Wakefield Research, UC Davis

BACK

TAKEAWAYS FOR REAL ESTATE OCCUPIERS AND INVESTORS

NEAR TERM

- Widespread Level 2 Automation
- Ridesharing/Micro-mobility
- Digital purchasing & decision making

INDUSTRIAL
- Some large warehouse and distribution centers move to suburban and/or less costly options.
- Increase of infill warehouses with smaller space requirements.
- Some retail locations will have dual use with warehouse space.
- Demand from hi-tech manufacturing, data centers high.

URBAN OFFICE
- Redesign for ridesharing and micro-mobility amenities.
- Create dedicated pick-up and drop-off zones.
- Designate street-level parking for rideshare waiting areas and/or bikeshare/scooter docks.
- Dedicated parcel delivery zones to improve the flow of traffic in lobbies.
- Use enhanced wayfinding to integrate the modes of mobility.
- Occupiers exploring alternatives such as subsidized ridesharing for employees.
- Office demand from AV, EV ridesharing, entertainment, cybersecurity and cloud service companies high.

URBAN DEVELOPMENT
- Market surveys to determine parking demand critical to limiting overbuilding of parking in urban markets, particularly residential.
- Explore spending more to build flexible parking structures with flat floor plates, higher ceilings that can be repurposed – to office, last mile distribution or fitness facilities.
- Multifamily developers should tailor parking targeted to different age cohorts by offering access to subsidized ridesharing services.

RETAIL
- Strip centers and malls can repurpose some parking for rideshare holding pens similar to those at airports.
- Set up weatherproof pick-up and drop-off pavilions in inclement weather markets.
- BOPIS can result in more loading dock room and retail basement storage repurposed to last mile distribution warehousing.
- both can result in more loading dock room for rapidly moving merchandise.

MID-TERM

- Widespread Level 3 Automation
- Mobility shifts affect pricing/ demand for goods and services

INDUSTRIAL
- Repurpose some employee parking to increase efficiency of warehouse design.

URBAN DEVELOPMENT
- Suburban sprawl will increase.
- Further redevelopment of gas stations in urban markets.
- Some suburban gas station redevelopment.

SUBURBAN OFFICE & MULTIFAMILY
- Increased demand for suburban office, housing and retail.
- Repurpose some parking to provide mobility amenities for tenants, bikes and scooters for short distance needs (from building to parking, to lunch, from apartment to supermarket, etc.)
- Repurpose excess parking into EV parking/charging and bike/scooter storage.

TRANSIT ORIENTED DEVELOPMENT
- Depending on state of AV use in mass transit, TOD premiums eroded.

LONG TERM

- Widespread Level 4/5 Automation
- Complete transformation of the built environment based on new and improved modes of mobility
- Gas station repositioning

CITIES
- Cities redesigned to accommodate new mobility options
- Remap desirable locations based on new transportation networks

URBAN DEVELOPMENT
- Dedicated pick-up and drop-off zones for AV fleets.
- Roads and highways redesigned with separate lanes for AV cars.

OTHER CRE
- Need for truck stops decreases leading to opportunities for redevelopment along highways.

Source: Cushman & Wakefield Research

BACK

NOW-10 YEARS | 10-15 YEARS | 15+ YEARS

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