



The Transportation Revolution:

The Impact of Ride-Hailing and
Driverless Vehicles on Real Estate



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Driverless Vehicles on Real Estate



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ULI's interdisciplinary membership represents all aspects of the industry, including developers, property owners, investors, architects, urban planners, public officials, real estate brokers, appraisers, attorneys, engineers, financiers, and academics. Established in 1936, the Institute has a presence in the Americas, Europe, and Asia Pacific regions, with members in 76 countries.

The extraordinary impact that ULI makes on land use decision making is based on its members sharing expertise on a variety of factors affecting the built environment, including urbanization, demographic and population changes, new economic drivers, technology advancements, and environmental concerns. Peer-to-peer learning is achieved through the knowledge shared by members at thousands of convenings each year that reinforce ULI's position as a global authority on land use and real estate. In 2016 alone, more than 1,700 events were held in 250 cities around the world.

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Executive Summary

Beyond the IRR Model

- Real estate investors typically do a great job assessing intermediate-term cash flow prospects
- Effort wanes on what might happen after that; uncertainty in the distant future is high
- However, thoughtfully derived long-term growth estimates are critical
- Issues extending beyond a typical 7-year IRR model are often ignored, resulting in mispricing

Transportation Revolution

- Ride-hailing (e.g. Uber) is in its early innings but is impacting driving habits
- Driverless vehicle development, led by auto and tech companies, is progressing rapidly
- Many hurdles remain, but 2045 is a reasonable bet for driverless vehicles mass adoption
- Key hurdles include regulation and social concerns; millions of jobs could be affected
- Transportation costs, time, and stress will be reduced
- Vehicle ownership should decline, led by two-vehicle households and those in urban areas

Real Estate Implications

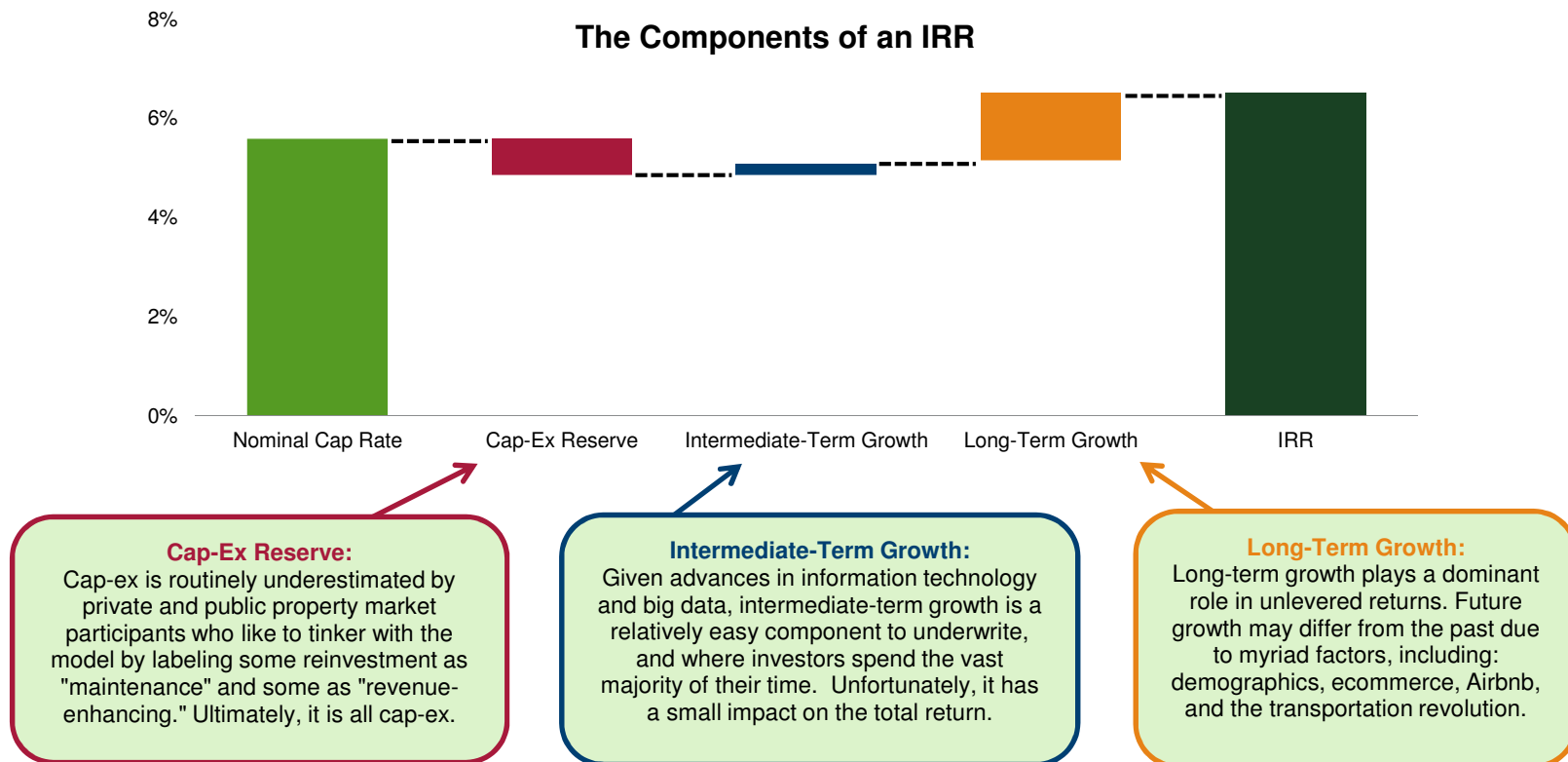
- The transportation revolution will be a game-changer for most real estate sectors
- The U.S. has roughly one billion parking spaces, equal to four for every vehicle
- Studies suggest that parking needs could decline by 50% or more, creating much excess land
- The impact of newly available land is broadly negative for several real estate sectors
- For other sectors, the impact is largely asset-specific
- The impact doesn't show up in underwriting today; many assets may already be mispriced

Sector-Level Thoughts

- Self-storage will likely be challenged as significant residential garage space frees up
- High-quality infill malls with low floor-to-area ratios are potential winners
- Ecommerce's 'last mile' challenge could be solved, causing commodity retail to suffer
- Driverless trucks could alter industrial location selection
- Commutes will be faster, cheaper, and less stressful, resulting in incremental suburbanization
- Upon easier commutes, employers could be better able to justify CBD office space
- Transit-oriented assets should see rent premiums diminished
- Billboards should suffer as commuters focus on work or entertainment while en route

Beyond the IRR Model

Long-Term Growth is Often Overlooked: Real estate market participants typically do a great job assessing cash flow prospects over at least the next seven years when valuing properties, though effort wanes on what might happen after that. To some extent, this makes sense, as uncertainty in the distant future is high. However, considering that the value of a property seven years hence comprises roughly two-thirds of its current value, thoughtfully derived estimates of long-term growth are critical. Because issues that extend beyond the seven-year window often employed in IRR models are usually ignored, mispricing can result.



Beyond the IRR Model (cont'd)

Who Cares About the Distant Future?: For investors able to gain an edge on the underwriting of long-term growth, the opportunity is significant. But, uncertainty is huge, so humility is in order. The coming revolution in transportation appears inevitable and powerful. As such, it warrants incorporation in the real estate investment and city-planning process.

Humility is in Order

A healthy dose of humility is in order when it comes to forecasting long-term growth rates, particularly when a disruptive force is on the horizon.

Sometimes, Even a Good Crystal Ball Doesn't Help

Since the death of the mall was proclaimed in '98, the shares of the largest owner, Simon Property Group, have performed magnificently, even inclusive of recent underperformance. Shares of REITs owning low-quality mall assets have languished.



Adoption is Very Difficult to Forecast

The pace of adoption of new technology is notoriously difficult to forecast. In the early-80's, AT&T commissioned McKinsey to estimate how many cellular phones would be in use in the world at the turn of the century. McKinsey concluded that the total market would be 900,000 and persuaded AT&T to pull out of the market. Cellular phone adoption soared, McKinsey's estimate proved to be less than 1% of the actual figure, and AT&T missed a monumental opportunity.

The Coming Revolution in Transportation

"The mobility revolution is here."

- Bill Ford, Ford Motor Executive Chairman

Ride-hailing, via services such as Uber and Lyft, is here but still in its early innings. In addition, fewer consumers have experienced vehicles with autonomous features. It is too early to tell how the coming revolution in transportation will unfold, but the impact should be the most dramatic since the advent of the automobile more than a century ago. Some suggest that we may ultimately be prohibited from driving.



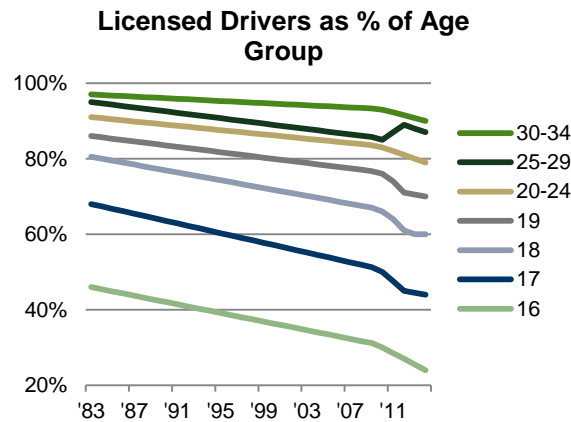
Ride-Hailing is Already Here

The Clock is Ticking: Ride-hailing marks the beginning of the transportation revolution. It is in the early innings, but services such as Uber and Lyft are having a big effect on consumer behavior around the world. The impact on the taxi and car rental businesses has already been devastating. In urban areas, households are cutting back on ownership and the propensity to get a driver's license continues to decline. San Francisco, where ride-hailing originated, is leading the way.

UberPool and Lyft Line - the more efficient and cheaper car-pooling units of Uber and Lyft - are increasingly popular. Both companies are experimenting with suggested pick-up locations to create a bus-like experience.

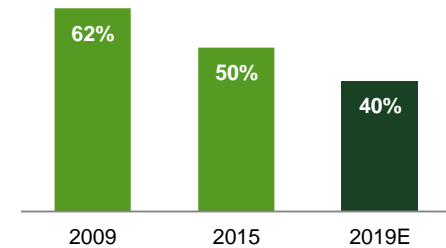


The proliferation of ride-hailing services is contributing to the continued decline in the propensity to obtain a driver's license.



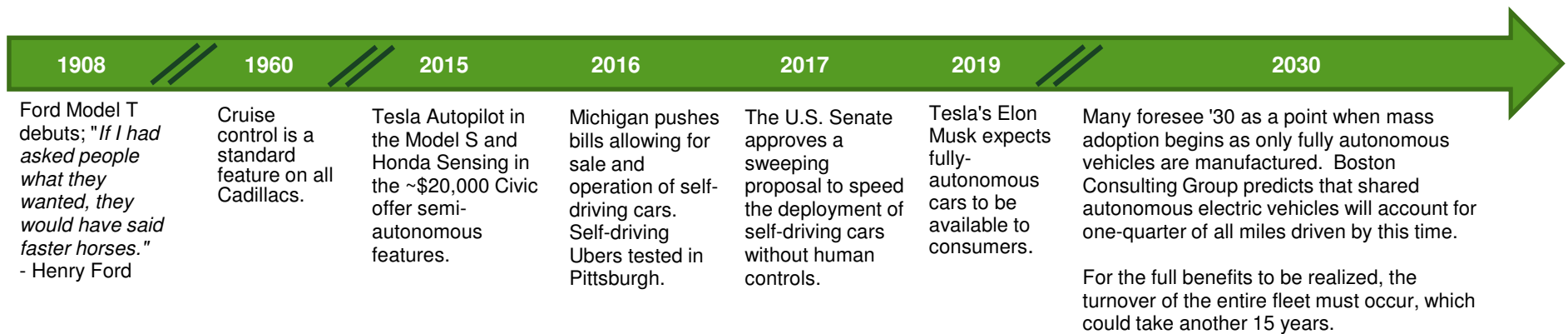
The impact of ride-hailing is most evident in San Francisco, home of Uber, Lyft, and early consumer adopters.

San Francisco Auto Trips in Single-Occupant Vehicles




Driverless Vehicles are Closer Than They Appear

Setting a Base Case: Many potential roadblocks exist and the timing is unknowable, but recent technological and regulatory progress suggests a favorable outlook for the arrival of driverless vehicles. A reasonable base case upon which to center an analysis of the impact on real estate is that of a mass adoption of driverless vehicles beginning around 2030 and completed about 15 years later. Driverless vehicles will be both owned by households and utilized by ride-hailing services.







Dozens of firms are investing heavily in driverless vehicle technology. Nearly all traditional auto manufacturers are racing to build self-driving vehicles. Fierce competition from new entrants has heightened the stakes. Opportunities continue to include vehicle-to-vehicle and vehicle-to-infrastructure development.





Regulations Will Shape the Landscape

The Good and the Bad: The arrival of driverless vehicles will carry positive and negative implications, many of which will be debated and addressed via regulation. The regulatory environment is thus far favorable for driverless cars, as evidenced by the Senate's recently approved bill. The trucking union was successful in its effort to have driverless trucks excluded from this initial legislation.



Benefits

- **Safety:** '16 traffic fatalities: 40,000 in U.S. and 1.3 million worldwide; human error causes 94% of crashes
- **Cheaper transportation:** ownership of little-used cars will decline (urban areas and two-car families)
- **Reduced traffic:** upon mass adoption, cars can travel rapidly and close together
- **Convenience:** commuters will be productive



Challenges

- **Regulatory:** many laws must be changed
- **Social:** three million driving jobs (2% of employment) are likely to be cut and several million more will be at risk
- **Security:** hackers will target driverless networks
- **Adverse driving conditions:** driverless cars aren't yet proven in poor weather
- **Skeptical consumers:** American car culture is strong

The Regulatory Debate Has Only Begun

Can hacking be prevented?

How will lost revenue be replaced? Massachusetts and Tennessee are considering a "zombie tax."



Job losses will be massive if driverless trucks are permitted. Should commercial driverless vehicles be taxed as an offset?

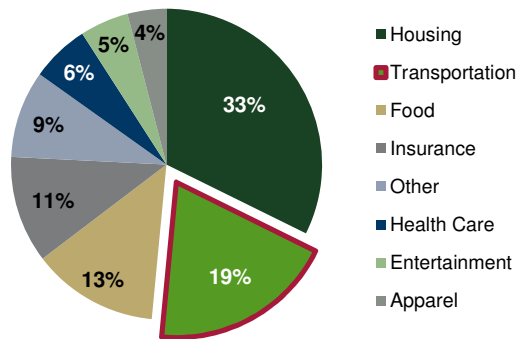
How will a driverless vehicle decide between hitting one obstacle on the road and another?

Vehicle Ownership to Decline

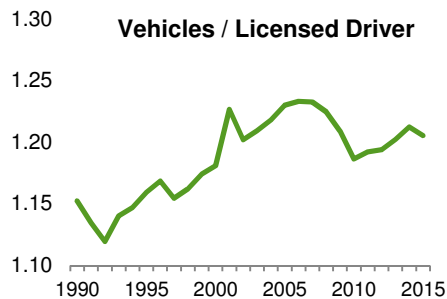
Dude, Where's My Car?: A vehicle is a large household asset that goes unused roughly 95% of the time. Vehicle ownership may have peaked last decade due in part to urbanization and changing preferences amongst millennials. While many will still own driverless vehicles, two-vehicle households and owners residing in urban areas should be the most likely to find driverless ride-hailing to make much more economic sense than ownership.

Transportation is the #2 Household Cost

U.S. Average Household Expenses



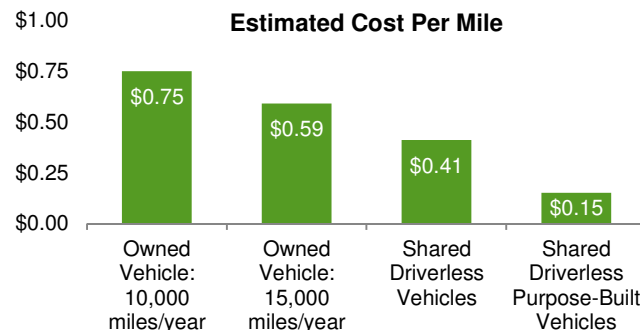
Vehicle Ownership May Have Already Peaked



Uber Aims to Take Share From Ownership

"When there's no other dude in the car, the cost of taking an Uber anywhere becomes cheaper than owning a vehicle. So the magic there is, you basically bring the cost [of Uber] below the cost of ownership for everybody, and then car ownership goes away." - Travis Kalanick, Uber Co-Founder

Driverless Ride-Hailing Will Be Affordable



Who May No Longer Own?

The large cost savings associated with forgoing car ownership will be compelling for many. The greatest savings opportunities will be for two-vehicle households, which may shift to a one-vehicle family. Also, urban vehicle owners, who use vehicles infrequently and pay for parking, will be tempted to go carless.

Semi-Autonomous Feature Costs

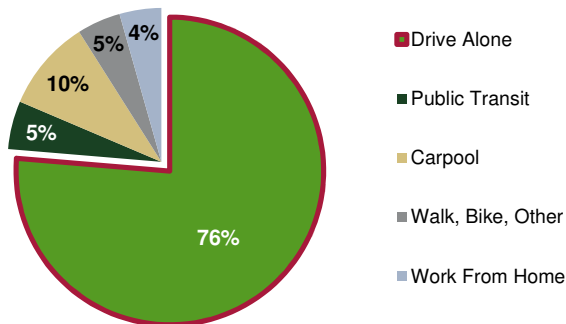
For those that continue to own, the cost of driverless technology should decline over time, similar to other innovations. For example, flat screen TV prices have fallen by more than 80% over the last 15 years. Today, semi-autonomous features can be added to a variety of vehicles for a few thousand dollars.

A More Tolerable Commute

A Game-Changer: Commuting is costly, time-consuming, and stressful. Driverless vehicles, whether owned or used via ride-hailing services, will alleviate these headaches by making commutes more affordable, faster, and more pleasurable. Therefore, commuters may be inclined to live further out in the suburbs than they do today. A consequence could be a reduction in the use of mass transit, which driverless vehicles will bypass. Should mass transit investment be reconsidered today?

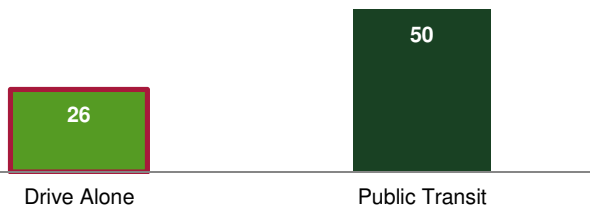
Most Americans Drive Alone to Work

Method of Commute - U.S. Average



Daily Driving Commutes Take Nearly 1 Hour

One-Way Commute Time - U.S. Average (minutes)



The Driverless Commute

✓ **Less Stress:** Compensation and commuting are tied as workers' top job stressors. In driverless vehicles, commuters can relax or be productive.



✓ **More Time:** Upon mass adoption, driverless vehicles will travel faster and closer together. Workers could live further away and/or avoid mass transit. Traffic would improve dramatically. It is estimated that a 90% penetration of self-driving vehicles would equate to a doubling of road capacity and cut delays by 60% on motorways. Vehicles will communicate with each other so traffic signals would no longer be needed upon mass adoption.

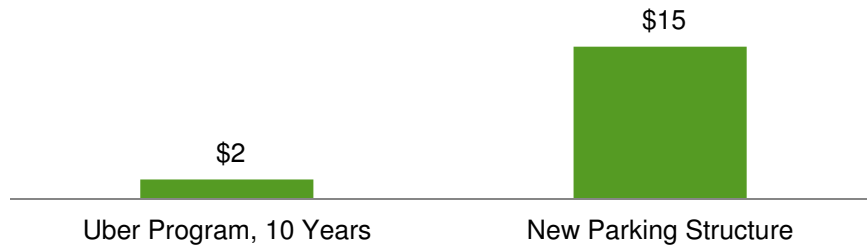
✓ **No Parking Hassles:** The time and effort spent looking for a parking space will be eliminated.

✓ **Commuting is Expensive:** The average U.S. worker spends thousands of dollars annually on commuting. The potential cost savings outlined on the preceding page are significant.

Summit, NJ is an Early Microcosm

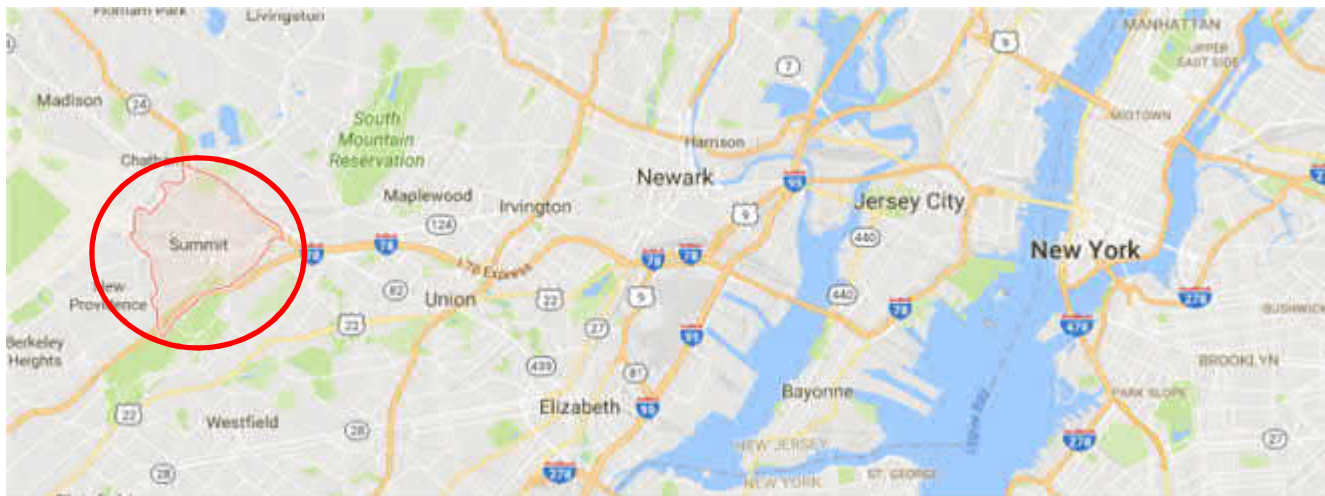
Uber's Impact: Summit, NJ's new partnership with Uber is a microcosm of the transportation revolution. Rather than building a needed parking garage near the train station, the city partnered with Uber to subsidize residents' rides to and from the train station. The savings are significant even before contemplating less expensive, driverless Ubers.

Cost Comparison
(\$ in millions)



Implications

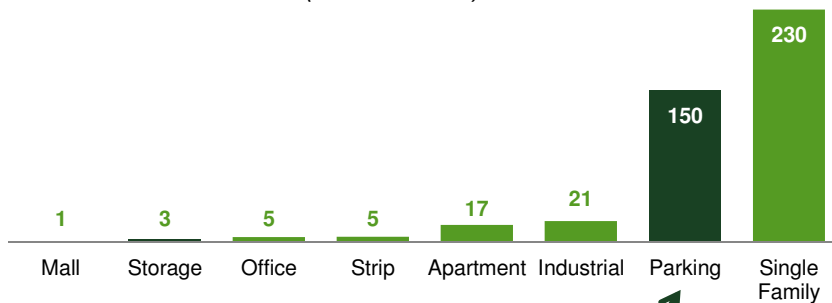
- ↓ Vehicle ownership
- ↓ Transit-oriented walkability premium
- ↓ Parking supply
- ↓ Self-storage demand



Parking Needs Will Decline

No Parking Here: The approximately one billion parking spaces in the U.S. account for 15-30% of urban land area. Some experts suggest that parking needs could decline by as much as 90% upon mass adoption of driverless vehicles. However, many will still own vehicles, so an ultimate 50% reduction in 30 years seems like a reasonable outlook for real estate investors to consider. The impact will be highly asset-specific, but the surge of new land should negatively impact values where higher-and-better uses are lacking. A handful of municipalities have already lowered or eliminated parking requirements in response to lower parking needs.

Total Occupiable Square Feet
(\$ in billions)



Parking spaces measure 150 square feet, but total parking area required per space is much greater at roughly 300 - 350 square feet.

Parking Space Forecasts

“ Each ridesharing vehicle could replace up to a dozen regular cars. If an entire city was shifted to autonomous cars, it would need a staggering 90 percent less parking than it needs today. ”

- **Dr. Kara Kockelman**,
University of Texas

“ Of the 93,000 parking spaces in downtown Atlanta, driverless cars could allow for a reduction of between 40% and 90%. ”

- **Ellen Dunham-Jones**,
Georgia Institute of Technology

Recent Parking Requirement Changes

Buffalo is the first major city to eliminate minimum parking requirements

Santa Monica eliminates minimum parking requirements on new downtown developments

DC reduces parking requirements at new buildings near metro and bus lines

Parking Needs Will Decline

Typology Matters: The outlook for the reduction of parking space varies by typology. Surface lots are the easiest to replace, particularly in desirable areas where the land has a higher-and-better use. Stand alone parking garages could potentially be converted into alternate uses one level at a time or scrapped when the entire structure is ultimately not needed. Above grade or podium parking, as traditionally built, is toughest to convert.

PARKING STRUCTURE TYPOLOGIES PROJECTED FOOTPRINT REDUCTION

SURFACE

- Smaller stalls
- Narrower aisles
- Elimination



35–100%
footprint reduction

STAND ALONE

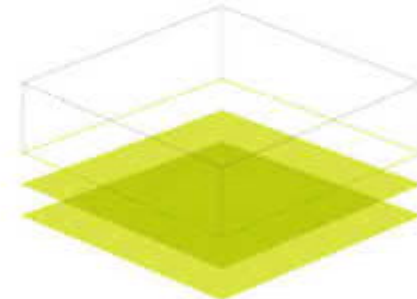
- Smaller stalls
- Narrower aisles
- No vertical connections
- Optimized structure
- Stall stacking



60%
footprint reduction

ABOVE GRADE

- Smaller stalls
- Narrower aisles
- Pour flat surfaced garages with higher ceilings
- Optimized structure
- Stall stacking



25–35%
footprint reduction

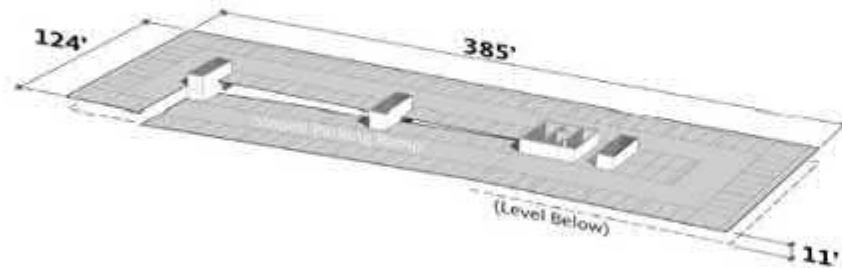
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Parking Needs Will Decline

Preserve Future Optionality: Given the outlook for the transportation revolution, many developers are considering building parking differently today. Suggested changes include flat floors with either helical or speed ramps, more capacity for charging stations, and wider driving lanes at building entrances to better accommodate pick-up/drop-offs and queuing of driverless cars. However, greater optionality in the future comes at a higher cost today.

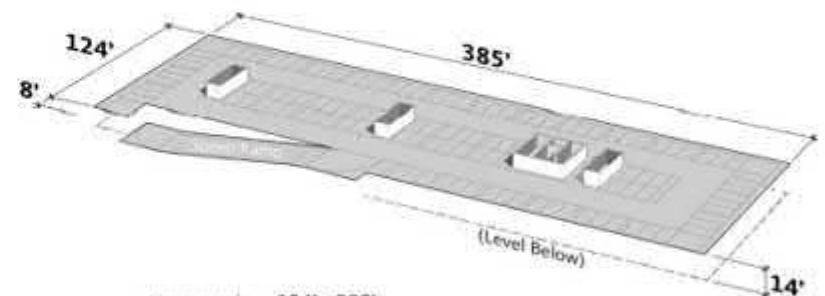
HYPOTHETICAL COMPARISON

STANDARD LAYOUT *Sloped Floors act as ramp



Horizontal: 124' x 385'
 Vertical: 11' Floor-to-Floor
 Typical Level SF: 47,800 sf
 Typical Parking per Level: 134 stalls
 Efficiency: 357 SF / Stall
 Cost-Per-SF: \$65 / SF
 Cost-Per-Stall: \$23,300

FUTURE-FLEXIBLE LAYOUT *Floors connected by speed ramp

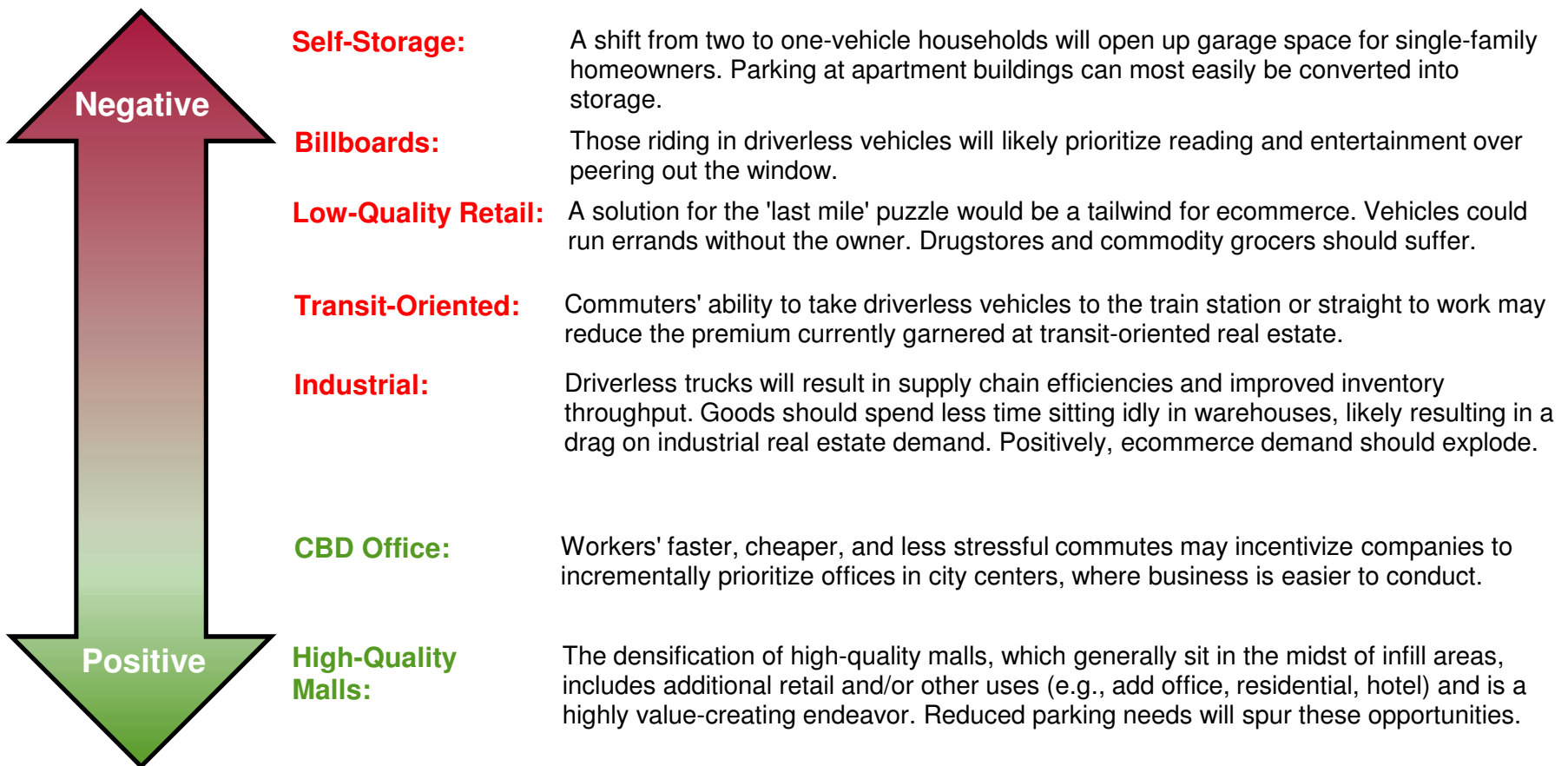


Horizontal: 124' x 385'
 + 8' x 180' Speed Ramp
 Vertical: 14' Floor-to-Floor
 Typical Level SF: 49,600 sf
 Typical Parking per Level: 117 stalls
 Efficiency: 424 SF / Stall
 Cost-Per-SF: \$76 / SF
 Cost-Per-Stall: \$34,050

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Transportation Revolution Real Estate Implications

An Early Look: It is time to think about the impact of the seemingly inevitable mass adoption of driverless vehicles on real estate. A preliminary outlook suggests that the impact on the major property sectors will generally be unfavorable. Solid rebuttals exist with regard to many of our initial conclusions, but the highest conviction ideas are self-storage, high-quality malls, and billboards.



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