



How will autonomous vehicles change parking?

It's simply a matter of time until driverless cars start to radically change the way we travel, and the way we park (or don't park)

Steer Davies Gleave and KPMG teamed up to produce a series of articles that seek to better understand the potential impacts of AVs on parking demand, location, operation and revenues. **Anita Mauchan** and **James Long** from Steer Davies Gleave, have worked with **Andrea Holmes** from KPMG Canada to consider potential outcomes, timings and alternative futures

66

Understanding the potential impact of autonomous vehicles on parking assets is important for planners, private and public sector car park owners

99

The mass adoption of autonomous vehicles (AVs) could radically change the way we travel and have a significant influence on the evolution of the urban and non-urban landscape. Without the need for human supervision or operation, every person will be a passenger, and cars will be able to drive with no occupants at all. This will give drivers more leisure time, widen mobility to citizens currently unable to drive and improve road safety. One often overlooked, yet promising, benefit is the possibility of reclaimed parking space.

In reality, the automation of vehicles will be a gradual process involving a mix of autonomous, semi-autonomous and manual vehicles over a period of time. Partial automation (e.g. cruise control, and traffic and parking assist) is already widely available. The speed of AV deployment on our roads is subject to much debate, which makes accurate predictions for mass adoption difficult. However, even if the precise timing remains uncertain, the automation of vehicles is inevitable.

Rethinking the role of the car

Imagine this scenario: every two weeks, your grandmother orders an autonomous vehicle service which drives her from her suburban home to the downtown core to get her hair styled. After she is dropped off at the hair salon, the vehicle continues next door to pick up an individual from the local coffee shop and drives them across town – no parking necessary.

Or imagine an alternative scenario where you use your own private autonomous vehicle to travel to work in the downtown core. While you are at work, your vehicle drives to a less expensive

The impact of AVs on parking: three scenarios

Impact	Scenario 1: Private	Scenario 2: Shared use, single occupancy	Scenario 3: Shared use, multiple occupancy
Number of car parks	Equivalent to today, subject to whether vehicles can re-position themselves in different locations on the public road network.	Lower than Scenario 1. Fewer vehicles require parking and duration of stay reduces.	Significantly lower than Scenario 1. Significantly fewer vehicles require parking.
Location	Basic autonomy will permit drop-off and parking, and car parks still need to be located near destination. Higher autonomy will allow drop-off at destination and parking located elsewhere.	Car parks could be located in cheaper, out of town locations during periods of lower demand.	Car parks located at key destinations with high demand to provide spare vehicles and servicing centres.
Parking revenues	Same as today or greater.	Reduced due to less time spent in car parks and fewer parked vehicles.	Significantly reduced due to less time in car parks and significantly fewer parked vehicles.
Type of facility	Same as today. Opportunity to widen service offer.	Car parks transformed to become service centres and waiting areas until AV is requested by 'user'.	Car parks transformed to become service centres and waiting areas until AV is requested by 'user'.
Operational capacity	Capacity optimised (more vehicles, same space).	Fewer spaces needed than Scenario 1.	Significantly fewer parking spaces needed than Scenario 1.
Rate of change/Implementation	Gradual implementation of AV floors (e.g. one floor at a time).	Big bang (i.e. once Uber decide to do this it will happen quickly).	Subject to local market conditions and familiarity with ride-sharing.

Predicting the impact on parking

Predicting the impact of AVs is a multi-faceted challenge given the uncertainties surrounding potential ownership models, market acceptance and the public policy response, as outlined above. Various studies have attempted to model the impact of AVs on parking demand considering only the shared ownership model. We are interested in understanding the impact of all three.

Therefore, we have chosen to present a qualitative review of future parking demand based on a set of three potential scenarios for worlds where AVs are: privately-owned; shared with single-occupancy; and shared with multiple occupancy. A summary of the potential impacts of each scenario on parking demand is presented in this table.

car park on the outer edges of the city. Since it is easily moved, vehicles are closely packed together; many blocking one another; fitting a large volume of vehicles into a smaller parking space – resulting in the relocation of parking and leading to potentially cheaper parking fees.

While a lot has been written about AVs, the impact on parking has received relatively little attention. KPMG and Steer Davies Gleave have teamed up for this three-part series in order to better understand the potential impacts of AVs on parking demand, location, operation and revenues.

Why does this matter? Understanding the potential impact of autonomous vehicles on parking assets is important for planners, private and public sector car park owners, as well as emerging AV fleet operators – all of whom can begin to identify future opportunities and threats to their current business models now.

How will AVs change parking?

With the uptake of AVs, the need to park near one's destination will no longer be necessary, potentially re-shaping land use on a massive scale:

- There may no longer be a need for businesses, residential buildings, or any other facility to provide adjacent parking
- Car parks could be relocated to cheaper spots on the edge of town
- The capacity of car parks will increase, cars will be able to park efficiently nose to tail, side by side or stacked closely on top of each other
- AVs may not even need to park, simply driving around until they are needed, or parking on the edge of roads, taking advantage of AVs needing less road width to pass safely
- Car parks may evolve from their current form into servicing centres, where AVs are recharged, valeted and maintained.

What are the opportunities?

With less requirements for parking, local authorities should have the opportunity to design shared community spaces or cities and towns with more green space and space devoted to cyclists and pedestrians. On the other side of this coin is the fear that AVs carrying greater numbers of non-drivers will lead to higher levels of demand, add to traffic congestion and exacerbate the problems already caused by non-AV vehicles.

Owners and investors of car parks may be able to increase revenues by leveraging the additional capacity that AVs create. Relocation of car parks to the suburbs could release valuable real estate in the city core. As car parks potentially evolve into servicing centres, there may be opportunities to negotiate deals with AV fleet operators, providing a welcome alternative revenue stream.

What will influence the future?

The degree of impact that AVs will have on mobility and the urban landscape will depend on a number of influencing factors:

- Ownership model: The parking needs of privately-owned AVs will differ from shared AV fleets. Currently, the average privately owned vehicle in the United States is only utilised 5% of the time, while shared vehicles are estimated to have a utilisation rate closer to 40%. The private ownership model is likely to prevail during the early stages of AV take-up, resulting in relatively minor changes to parking demand. But if shared ownership takes off, or private vehicles are leased to others while not in use, it is likely that parking demand will significantly decline as AVs spend more time on the highways than parked in garages.
- Public policy: Central and local government has the potential to restrict or promote AV development. It might be the case that restrictions could be introduced that prevent AVs from operating in the city core, or vice versa. AVs might be allowed in the core for



reasons such as: reducing emissions; improving pedestrian safety; or managing traffic congestion. Promotion will accelerate take-up of AVs and, with complementary planning policies, improve the urban realm.

- **Market acceptance:** The attitudes of different customers and the marketing strategies of the major manufacturers will have a large impact on overall market acceptance. We would expect to see millennials embrace AVs more quickly than older generations, especially in regard to shared services and valuing the convenience, time and money that an affordable rental system of self-driving cars will bring.

The size and timing of the impact of AVs on parking will be directly related to the ownership of these vehicles, how public authorities chose to promote or restrict AVs, and their acceptance by the general public. Autonomous vehicle trials have already taken place on the streets of the UK, Sweden, USA, Japan and Singapore. It is simply a matter of time until AVs start to radically change the way we travel and the way we park (or don't park).

New ownership models

The precise nature of the AV transformation will be directly influenced, among other things, by the ownership model favoured by users, be it shared or private, and the market acceptance of this new and continuously improving technology. The uncertainty surrounding these influencing factors makes predicting their impact on parking and transport demand a multi-faceted challenge.

While other articles have attempted to understand and model parking demand based on the shared ownership model, Steer Davies Gleave and KPMG have looked at the impact of three ownership and market acceptance scenarios that may shape the future demand for parking in an AV world.

- Private ownership
- Shared ownership: single occupancy
- Shared use: multiple occupancy

Why future ownership matters

Why will the ownership of AVs, whether private or of shared-use, affect parking demand? If AVs simply replace the volume of privately owned, non-autonomous vehicles on highways today, the demand for car parking may not change significantly in the future: the average car utilisation today is 5%. The number of vehicles on our highways, and the need to park them, would likely remain constant. There may, however, be potential to relocate car parks to cheaper land away from the city core, and possibly accommodate more vehicles in the same amount of space.

If we envision a 'Mobility as a Service' (MaaS) or 'fleet' model of ownership – where users hire an AV to make a trip (either by themselves or through ride-sharing) and on completion of that trip, the vehicle is hired by another user – the need for parking may be limited to the waiting time between pick-ups. In this case, car parks may transform themselves into service centres where fleet vehicles are maintained and fuelled/charged in preparation for their next hire.

The reality is that we expect to see the co-existence of AV ownership patterns – with AVs privately owned initially and shared increasingly by users who opt to hire AVs from fleets. It is also

possible that private owners will surrender their cars when the car is not in use, encouraged by car manufacturers keen to maximize the owner's return from a highly depreciating asset. Fleet companies will not be able supply enough vehicles to service all potential demands, particularly in rural areas, and users underserved by fleets will want to own an AV to guarantee mobility.

But will we accept AVs?

The level of acceptance of AVs – and thus demand for parking – will vary by factors such as age, income, geography, level of mobility, generational culture and cost. AVs will offer enhanced mobility to particular groups, such as those who are currently unable or unwilling to drive (the elderly, infirm or those without driving licences). Those users will be able to access services in a different way, and if they own the vehicle themselves, there may initially be an increase in the level of demand for parking to accommodate these 'new' road users.

Different demographic groups will accept AVs more willingly than others and be keener to ride-share. UberPool and Lyft Line, the rapidly expanding ride-share services, are popular with Generation Z and millennials – who in general, are more accepting of shared transportation options than other demographic groups. In San Francisco and New York City, customers using Lyft Line already outstrip demand for single-occupancy Lyft vehicles. Varying levels of acceptance will mean that certain types of parking assets could be more vulnerable to change than others, for example, parking facilities on university campuses.

Will public policy hinder or support AVs?

The public sector has the opportunity to determine where and how AVs shape our urban environment, promote social inclusion, directly influence the market acceptance of AVs, and limit the negative consequences of AVs on the transport network, for example by ensuring that AVs and public transport co-exist effectively to promote mobility.

It is easy to imagine a future scenario where a city authority decides to enhance their urban realm by prohibiting car parking in the city core, immediately freeing up on-street parking spaces and permitting the space to be used by pedestrians and cyclists. Or the public authority sees the potential for AVs to increase the capacity of congested highways into the city core.

Two key questions to ask are:

- Where will the car parks of the future be located?
- How much capacity will they need and what will their function be?

As we have explored, the adopted ownership model and the acceptance of ride sharing could have a significant impact on the answer to these questions. The impact of private ownership on parking will be limited, but if the shared ownership, multiple occupancy model takes off, the impact on parking demand will be enormous; more people will be transported in fewer vehicles that will rarely need to be parked.

ABOUT THE AUTHORS



Anita Mauchan is a director and James Long is a principal consultant at Steer Davies Gleave. Andrea Holmes is a senior consultant at KPMG Canada.

Steer Davies Gleave is a consultancy that combines commercial, economic, technical and planning expertise to find powerful answers to its clients' complex challenges.

KPMG is a global network of independent member firms offering audit, tax and advisory services.

Next time: How parking industry stakeholders can prepare for the increasing adoption of AVs.