

Officer Report: Overview of research on the relationship between parking availability and private car use (October 2022)

Introduction

The revised **Parking Standards for New Developments** was scheduled to go before Cabinet on 20th September 2022. The report and supporting documentation were deferred, to be presented again at Cabinet meeting on 18th October 2022. The report was deferred by the Leader to 'allow further work on targets for this very important policy as part of the aim of reaching net zero by 2050'. It was also agreed that the issue should go before Place Overview & Scrutiny Committee.

The Place Overview & Scrutiny Committee subsequently convened an extraordinary meeting on 7th October 2022 to review the **Parking Standards for New Developments** document. The Committee agreed a number of recommendations, including that:

Officers review the evidence available on the relationship between both residential and non-residential parking availability and private car use and report to the Cabinet and Place Overview & Scrutiny Committee.

In response to this recommendation officers have produced this report, which provides an overview of some of the research into the relationship between parking availability and private car use. Additionally, it considers these two matters in the context of their interrelationships with car ownership, the availability of sustainable and active mode provision, and other influencing factors affecting travel behaviour.

Given the significant volume of research that has been conducted into these subjects, this report is not a comprehensive literature review of all of the available evidence. Rather it is intended to provide a suitably concise summary of the key findings from global research efforts from eighteen academic sources (which in turn draw from a far wider range of literature), focusing on the past ten years in order to capture contemporary perspectives on parking provision.

The report concludes by considering what implications these findings may have for the potential revision of the **Parking Standards for New Developments**.

Research overview: residential parking

A study of the introduction of new policies towards restricting parking requirements in a residential area of the city of Gothenburg, Sweden (Antonson, Hrelja, and Henriksson, 2017, p.213), showed the importance of adopting a holistic approach, ensuring that such policies should be introduced in combination '...with other measures, such as raising parking charges and decreasing the number of public parking spaces.', along with coordinating such reductions with other urban planning functions.

The study area was 2.3km from the city centre and at a transport node where trams and buses connect. The development consisted of 509 apartments, with 0.57 parking spaces per apartment. According to an attitudinal survey of residents (ibid., p.218), '25% responded that they drive less frequently, 55% had not changed their driving habits and 3% reported that they drive more often', because of the parking provision. However, the research observed that, in real terms, parking provision had a relatively small impact on car ownership and use when taking account of other influencing factors.

De Gruyter, Truong, and Taylor (2020) have studied the connection between public transport provision and car parking demand (i.e. car ownership) in Melbourne, Australia. In a study of residential apartment buildings in the city they found that, where apartments were within 800m of public transport, average car ownership of each household reduced as public transport service frequency increased. Although this was found to be statistically significant, the authors noted that (ibid., p.7):

The results indicate that a 10% increase in public transport service supply in the AM peak (within 800 m) is associated with a 0.9% reduction in car ownership across all apartments (and a 1.1% increase in zero car households), with similar results for <3 bedroom apartments (1.2% reduction in car ownership and 0.8% increase in zero car households) and 3+ bedroom apartments (1.0% reduction in car ownership and 1.4% increase in zero car households).

...as such, the effect of proximity to public transport and its frequency on reducing car ownership was shown to be very modest.

Two separate studies conducted by Guo (2013a and 2013b), looked at residential car parking provision and its relationship with car ownership and usage respectively in the New York City region, United States. In the former study, it was found that residential parking availability had a greater influence on car ownership than household income and demographic characteristics. Meanwhile, the latter study showed that the relative convenience of residential parking availability, i.e. on-plot parking versus on-street parking, resulted in higher levels of car use.

Leibling (2014, p.259) undertook a study into the supply and demand of residential car parking across inner and outer London, UK in order to, 'to determine whether policies designed at controlling car ownership by restricting residential parking are effective.' The study found that, in contrast to the study by Guo (2013a), that household structure, income, tenure, and alternative travel options (i.e. public transport availability and provision for active modes) exerted a stronger influence on car ownership than parking availability.

The author (ibid., p.286) warned that restrictive parking policies can result in, 'unsightly and dangerous parking on streets not designed for parking or illegal parking on footways' and notes that there is only a weak negative correlation between car parking supply and car ownership.

In Marsden's (2014, p.12) review of parking policy in the UK, the author notes that:

If parking policy is to work well as part of an overall package of demand restraint, it needs to be applied in conjunction with land-use planning. In transport terms, this means connecting parking policy to non-car accessibility. If the overarching land-use and transport accessibility policies are right, then there is a greater possibility for other parking management policies to be effectively applied and integrated in broader transport strategies.

Marsden advocated an approach where parking availability in residential developments is reduced where non-car accessibility is high, that locating the appropriate kinds of development in the appropriate places is fundamental to minimising parking demand and its associated impacts on travel and noted that overspill effects may result where limitations to parking provision are imposed.

Sprei, *et al* (2020) undertook a comparative assessment of sixteen predominantly residential developments from Sweden, Austria, Germany, Switzerland, and the UK with parking requirements ranging from 0 to 0.8 parking spaces per dwelling.

While it was found that the mobility patterns of individuals living in these locations exhibited more sustainable travel behaviours and were less likely to own a car than those in nearby areas, the authors noted that establishing causality was difficult (*ibid.*, p.10) as, '...all the studied projects had good prerequisites for sustainable mobility, such as access to public transport, a central location, mobility services, bike paths, and good access to services.' It is also important to note that almost all of the developments consisted of apartment buildings, so the density of the urban form will be likely to have had an influence on travel patterns (Tian, Park, and Ewing, 2019).

Further to this, as with other studies, the authors acknowledged that self-selection was likely to be a significant issue when establishing causality, in other words people may choose to live in a place knowing the parking availability and public transport access and therefore be more inclined towards using sustainable transport by choice rather than because of the characteristics of the place itself.

Tian, Park, and Ewing (2019, p.1555) explored the differences in trip generation and parking demand generated (i.e. car ownership), '...by different housing types in different settings, from low density suburban environments to compact, mixed-use urban environments.' from 30 diverse locations across the United States. This large-scale study supports the findings of other studies, showing that (*ibid.*, p.1568):

...areas with high population and employment densities, diverse land uses, good street connections, great transit service and high accessibility allow direct substitution of transit, walking and bike travel for automobile travel.

Also, as with some other studies in this report, they observed that car ownership does not necessarily have a direct correlation with car use, noting that (*ibid.*, p.1568):

Even those living in compact areas, who do not drive on a regular basis, may still desire the convenience of owning a car for leisure and other occasional activities.

In Kirschner and Lanzendorf's (2020) review of car parking policy and research in Europe, they noted that the literature suggests a link between parking availability and car ownership and use. However, they also highlighted the importance of considering the implementation of restrictive parking policies in the context of an integrated vision for mobility for whole urban areas, even when looking at parking in central urban locations.

The authors noted that while managing parking supply can be one tool for influencing behaviours, it needs to be implemented in conjunction with other approaches in order to effectively facilitate behavioural change. This includes ensuring that the built form, mix of uses, quality of pedestrian and cycle provision, and access to public transport are all carefully considered.

Melia's (2014) review of literature on car-free and low-car developments in the UK and Europe observes that car-free development can have a positive impact on travel behaviours but notes that the benefits of such developments will be most effectively realised in the inner areas of larger cities.

Melia undertook a case study of low-car development at Poole Quarter, UK in which the standard was for one space per dwelling. Through resident surveys it was shown that while households owning multiple cars was lower than in the surrounding areas, residents complained of a lack of parking and reported conflict with neighbours over the resultant issues. This was despite a much higher density (108 dwellings per hectare) than typical in the area, its proximity to the town centre and despite it being only 800m walk from the main train station. Melia also observed that similar problems of overspill parking in areas surrounding car-free developments in Europe had also been experienced by residents.

Nieuwenhuijsen, *et al* (2019) identify a number of prerequisites for a successful transition towards car-free development. They note various potential barriers but also advocate the numerous potential benefits of such development when implemented in the right locations and through a suitably comprehensive strategy that incorporates land-use planning and high-quality sustainable connectivity amongst other influencing factors.

Research overview: workplace and destination parking

Litman (2022, p.9) observed that parking management strategies require, 'coordinated parking, land use and transport policy reforms, which lead to changes in physical design and operations, and therefore changes in travel behaviour.'

The author also observed that there are numerous ways to determine 'optimal parking supply', which result in very different conclusions but that geographic conditions should be considered in such calculations. Further to this, they recommend 'efficiency-based standards', which ensure the optimal utilisation of car parks, avoiding over-provision. Comprehensive parking management programmes are advocated, and the author's research demonstrates that (*ibid.*, p.75), '...an appropriate combination of cost-effective strategies can usually reduce the amount of parking required at a destination by 20-40%, while providing additional social and economic benefits.'

Analysis of the Norwegian National Travel Survey from 2013/14 (Christiansen, *et al*, 2017) found that restricting parking availability at the workplace can be an effective means of reducing car trips to work and that this effect is greater through the addition of workplace parking fees. However, it also acknowledged that causal relationships are complex, with variables such as trip distance, availability of public transport, household income, amongst other factors all exerting an influence on mode choice. The authors note that (*ibid.*, p.205):

...our results show that the effect of parking restrictions decreases with increasing distance from the city centre. In other words, parking restrictions will have the greatest effect in compact cities. Access to high standard public transport reduces the odds on the decision to drive.

...and that high-quality public transport is most effective when combined with parking restrictions, thus concluding that parking policy should be implemented in conjunction with strategic spatial and transport planning efforts.

Inci (2015, p.61) also acknowledges the breadth of variables on parking demand and identifies the need for more studies, 'to translate scientific insights into detailed policy prescriptions that cities can realistically implement.'

A study of the influence of modifiable environmental characteristics on the choice of mode of travel to work (Dalton, *et al*, 2013) conducted in Cambridge, UK found that

journey distance and car ownership were strong predictors of mode choice. It also identified that the total absence of free car parking at the workplace was associated with a much higher likelihood of walking, cycling, or public transport use.

However, it also noted that some of its findings are likely to be context-specific and therefore the opportunities to draw generalised assumptions about travel behaviours beyond similar cities may be limited. Further to this, as with Christiansen, *et al* (2017) and Sprei, *et al* (2020), the issue of self-selection bias was acknowledged.

In a separate study into the predictors of car use in Cambridge, UK undertaken by Carse, *et al* (2013, p.68), 'The study also examines the specific correlates of modal choice for short work trips (those of less than 5 km) to examine whether there are policies that might help to promote modal shift for these trips.'

This study found that commuting distance, car ownership, and free workplace parking were the most statistically significant transport-related characteristics (as opposed to socio-demographic or health-related characteristics) contributing to travel to work mode choice. The study also noted that (*ibid.*, p.72), 'Almost 80% of cycle trips to and from work in this sample were made by cyclists from car-owning households, and in almost 25% of cases there were one or more cars available per adult in the household.'

As previously noted, one of the recurring themes in the literature is a discussion around the causal relationship between parking availability and car use. It is clear that this relationship is complex and challenging to determine. In response to this issue, McCahill, *et al* (2016) undertook a study utilising the Bradford Hill criteria in order to try to establish causality between city-wide public parking availability and car use.

Their study across nine cities in the United States looked only at off-street parking facilities with more than three spaces, which also included multi-storey car parks but did not consider parking costs. Whilst acknowledging the complexity of the relationship between parking and car use, and some flaws in their study due to the reliability of data, the study found that greater availability of car parking was a likely cause of higher levels of car use.

Echoing much of the research reviewed in this report, Yin, Shao, and Wang (2018) also noted that various built environment characteristics (density, mix of uses, public transport accessibility) and parking availability (at both origin and destination) both influenced car ownership and use, along with various household and socio-economic characteristics. They advocate the potential for parking restrictions at both origin and destination and, like others, stress the importance of this approach being conducted in combination with a strategic approach to land-use planning and the provision of transit-oriented development.

Conclusions

With respect to residential parking provision and its relationship to car ownership and car use, this report has identified research with a variety of findings. It has shown that: residential parking availability can make car ownership more likely (Guo, 2013a) and its convenience result in higher levels of car use (Guo, 2013b) in the New York City region; limiting parking does not limit car ownership in outer London (Leibling, 2014) and; restricting parking has a negligible impact on ownership and use in Gothenburg (Antonson, Hrelja, and Henriksson, 2017).

Given the complex relationship of numerous factors including accessibility of alternative travel options to the private car, characteristics of the built-form, and socio-demographic characteristics acknowledged in the literature, it is perhaps unsurprising that there does not appear to have been an attempt to calculate how a specific quantum of parking provision reduction can result in a specific reduction in car trips.

Instead, the literature has repeatedly advocated that restrictive parking policies can be a useful tool to influence travel behaviours, importantly noting that this is implemented in the context of a comprehensive approach, which includes the spatial strategy of development, improvements to public transport and active mode connectivity, amongst other factors that can be influenced by planning policy.

Connected to this multi-pronged approach being advocated, much of the research notes that because of these complex causal relationships, that car-free or low-car developments can be beneficial in encouraging more sustainable travel behaviours but that the risks of overspill parking need to be carefully managed and that locations for car-free or low-car development need to be in suitably well-connected locations.

This report has also found that people cycling to work may also be likely to own a car (Carse, *et al*, 2013) and that the link between parking and usage is not straight-forward, meaning that demand for residential parking will still exist even if people do not use their cars on a regular basis (Tian, Park, and Ewing, 2019).

Finally, the report observes that reducing parking provision at employment locations can be an effective means of reducing car use and that, like with parking provision in residential developments, this reduction is most effective when combined with ensuring that employment is well-served by public transport and high-quality walking and cycling provision.

Implications for the Parking Standards for New Developments document

This research overview appears to provide considerable support for the general approach identified in the **Parking Standards for New Developments** document.

However, the research overview has not been able to determine the opportunity to reduce parking provision by specific numbers in order to achieve a desired concomitant reduction in car use given the complexities of factors that influence private car use.

When compared with the previous standards and those of neighbouring authorities, the approach of the **Parking Standards for New Developments** document incorporates significant reductions in car parking provision for residential developments, particularly in urban areas, and allows for the consideration of car-free development within Oxford and in developments at the edge of the city, subject to suitable public transport accessibility and high-quality walking and cycling provision.

For employment and non-residential developments, the **Parking Standards for New Developments** provides expected upper limits for what may be acceptable but requires that parking levels should be determined on the trip rate reductions derived from following OCC's 'Implementing Decide & Provide: Requirements for Transport Assessments' document and that the transport user hierarchy of OCC's 'Local Transport and Connectivity Plan' has been taken into account.

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