Parking as a tool to reduce carbon emissions

Introduction

"Because Planners are confused, parking requirements are often confusing"

- Donald Shoup, The High Cost of Free Parking (2005)

In most developed countries, the 1950's saw the widespread uptake of the private motor vehicle with a consequential decreasing mode share for other forms of transport. A direct impact of the improved mobility of people have been sprawling land use patterns. In turn this has made public transport, walking and cycling comparatively inefficient, unaffordable, and impractical (Donovan and Genter 2008), and resulted in increased carbon dioxide emissions.

Central government and municipalities have explored a wide range of planning mechanisms to reduce urban sprawl, increase the attractiveness of the public transport and therefore reduce carbon emissions. However well intentioned but poorly founded planning regulation in conjunction with a distorted market economy, means that the mechanisms themselves can undermine these objectives.

In this respect, central government and municipalities have overlooked one of the principal drivers of urban sprawl, low land use densities and high energy use - and therefore carbon emissions: minimum parking requirements.

How do we define carbon emissions?

Greenhouse gasses are identified as an important contributor to climate change. In turn Carbon Dioxide is the most important greenhouse gas and is projected to account for around 70% of radiative forcing of climate by the end of the century (IPCC, 2001). Therefore this paper focuses on Carbon Dioxide as a source of carbon emissions, with an emphasis on those emissions from the burning of carbon based fuels.

What are the principal causes of carbon emissions?

Carbon emissions relative to population levels vary widely around the world as shown below in Figure 1.

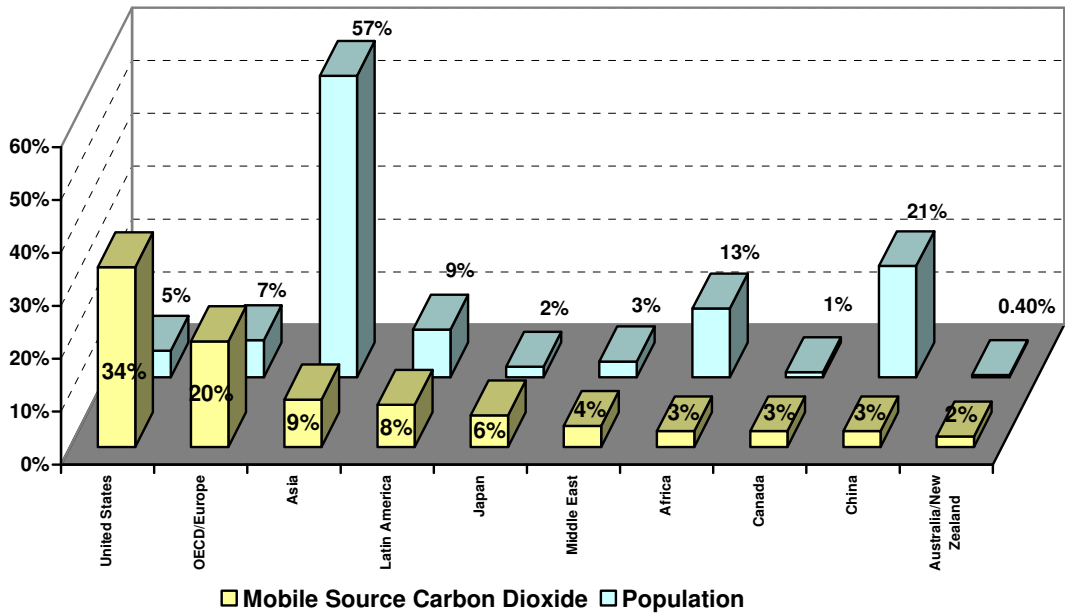

Figure 1: Mobile source carbon dioxide emissions and world population (Adapted from Gillham, (2002): p113)

As can be seen from this graph, New Zealand, Australia and the United States contribute disproportionately to the amount of carbon emissions, with the US being the largest contributor both in quantum and relative to population levels, and accounts for some 34% of the world's emissions.

In the U.S, carbon emissions can be broken down into the following sectors (figures taken from 2007 Stats, Table 6, Energy-Related Emissions):

- Residential – 20.86%
- Commercial – 18.15%
- Industrial – 27.37%
- Transportation – 33.62%

Transportation then, contributes the majority of carbon emissions in developed countries such as the US, but the same situation also applies in the developing world. By way of example, a World Bank (2008) report on China states;

> *Transport is the fastest-growing source of emissions, thanks to moderate success in controlling emissions from industrial and energy sources. The most powerful driver of the fast growth in transport CO2 emissions is rapid motorization, particularly in China's urban areas. The International Energy Agency estimates that CO2 emissions from China's light-duty transport fleet will rise from 65 MT in 2005 to nearly 300 MT in 2020, an increase of 290 percent. Most of this growth will be from urban transport..."*

Therefore irrespective of whether a developed or developing country is being analysed, then the transportation sector is a key area to target. Developed countries because they already contribute disproportionally to carbon emissions, and developing countries because they are experiencing the most rapid growth in carbon emissions.

Why focus on car parking?

The contribution that land uses and specifically car parking make to the transport environment, has been a hidden factor to many, as highlighted by Shoup (2005). Car parking actually has a fundamental impact on transport and land use patterns.

Litman (2006) prepared the following diagram to highlight the role that parking has to play in transport and land use patterns and the self reinforcing cycle that accompanies it. (Figure 2)

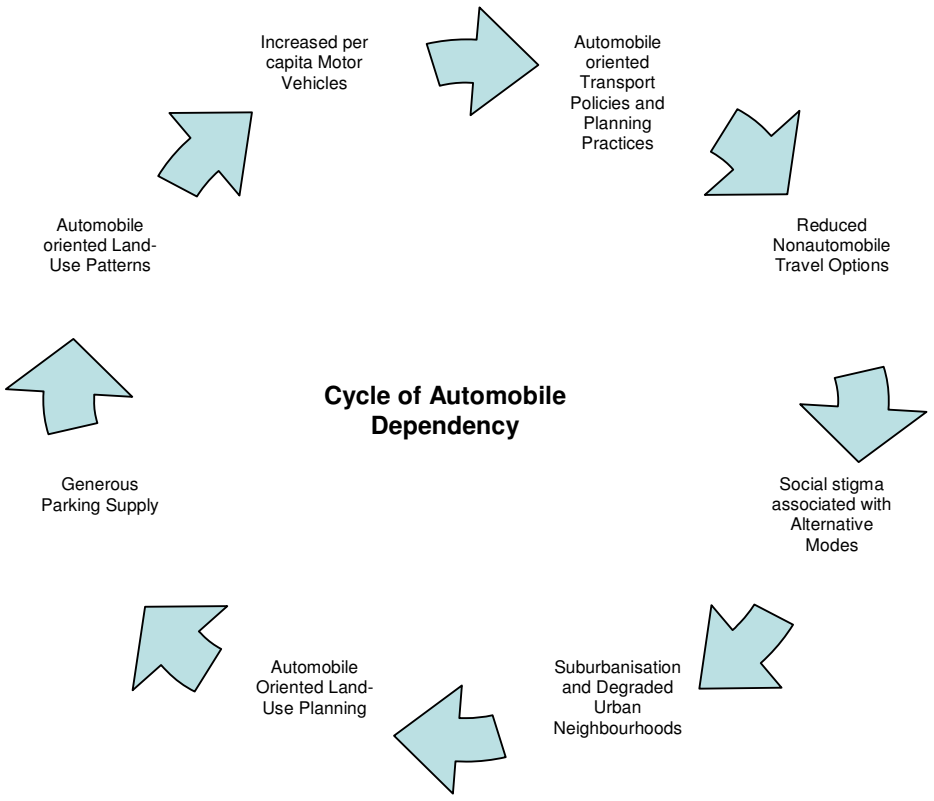

Figure 2: Cycle of Automobile dependency, adapted from Litman (2006): p6

Therefore parking has a profound impact on;

- The spatial form of cities
- Land use densities
- High energy use through reduced uptake of alternative transport modes and increased reliance on the private motor vehicle.

Whilst single occupant vehicle trips are commonly targeted in transport policies, they are in reality only a consequence of the spatial layout and densities of the accompanying land uses. There is therefore merit in targeting the underlying cause of these carbon emissions, rather than solely focussing on polices to reduce private vehicle use.

In this respect car parking is the "glue" between these facets of the land use and transport environment, and is a critical factor, which is relatively easily targeted by planners and their municipality plans. Therefore car parking management has an important role to play as an instrument to reduce carbon emissions.

The Path to Hell.....

Most parking in urban areas has been provided in accordance with city planning rules that require a minimum number of parking spaces. In the early 1950s, municipalities had to deal with a large increase in the number of vehicles on the road, and at times Illegal parking would at times obstruct the flow of traffic, create safety hazards, and spill over into residential neighbourhoods. This problem was defined as not having enough off-street parking (Litman 2006).

The city council's traffic engineers responded to this problem by requiring that each new development provide sufficient on-site car parks to cater for perceived demand. Demand for parking was assumed to be a constant; growth in car use could be expected, regardless of the supply of car parks or the price charged to use them. (Donovan and Genter 2008)

Planning regulations in many countries have since followed the USA's lead and have generally mandated that developments provide for the 85th to 95th percentile demand (Shoup, 2005). Put another way, by providing this amount of car parking it would only be utilised to capacity for 5% to 15% of the time.

This approach, not unsurprisingly, typically gives rise to an oversupply of car parks in urban areas. It also does this in a number of other ways;

- Firstly it links parking demand uniquely to the land use of each individual building, ignoring the supply of neighbouring developments that may have complimentary peak hours and failing to recognise the ease of access by other transport modes (Litman, 2006).
- Secondly, these provisions are based on car parking being free, with consumers not paying the true costs of their decisions to use motor vehicles.
- Thirdly, the rigour of anticipated trip generation rates that underpin minimum car parking requirements is questionable (Shoup 2005).

Given the cycle illustrated in Figure 2 by Litman, it is not surprising that over time there has been both an increased demand for, and supply of, car parking in urban areas.

What needs to change and why?

Minimum car parking requirements therefore need to be considered in light of well intentioned but poorly founded planning regulations and market distortions.

Planners preparing municipality plans and other planning documents on behalf of municipalities which have the opposite effect of their intent has been well addressed by Shoup (2005). Of particular concern with these planning regulations is that they are an important part of a self reinforcing cycle and a critical junction of both land use and transport matters, as demonstrated in Figure 2.

Market distortions are an unfortunate feature of the transport environment in general, and car parking is no exception to this. Minimum parking requirements have led to an oversupply because they are based on the demand for free parking at that development's peak hour, and they are required for each individual new building. By assuming that parking should be free and accommodate peak hour demand, it considerably undervalues the land required. This has three consequences (adapted from Donovan and Genter 2008):

1. It drives up the costs of land for dwellings, businesses and open space—

   At a time when land values in our urban areas have become prohibitive for home buyers and local authorities seeking to provide open space, minimum parking requirements drive up the costs of land and redevelopment (Litman, 2006).

2. Because of high compliance costs, it pushes development to the urban fringe where land is cheaper, thereby exacerbating sprawl—

   Therefore Minimum parking requirements are an active and considerable barrier to the type of intensification that is necessary for compact city development (Shoup, 2005).

3. It subsidises driving over other modes—

   The cost of providing parking is spread throughout the economy, in the form of higher cost for goods, services and rents (Shoup, 2005; Litman, 2006). Therefore, we are all paying for free parking, even if we choose not to drive. Free parking is a significant subsidy to single-occupancy motor vehicles, and undermines transport strategies and policies that seek to reduce reliance on private vehicles (Shoup, 2005).

Because these costs are effectively hidden or borne by the community in general, minimum parking requirements, unfortunately have been one of the most "successful" planning regulations in terms of their wide spread adoption and application. This is evident when one considers that vast expanses of parking lots that go unoccupied for all but a few hours each day.

Reform of parking management therefore offers an opportunity to reduce carbon emissions and contribute to core sustainable land use practices at the same time. What is more it is in reality "low hanging fruit" that can be addressed by planners relatively easily and have a significant impact over time.

How do you make this change?

Litman (2006) provides a comprehensive set of principles that should be applied to reform car parking management.

1. **Consumer choice:** Consumers are allowed to choose between travel options in an economically neutral environment, which directly rewards those who choose to travel by less resource-intensive transport modes.
2. **Pricing:** As much as possible, users should pay directly for the costs of providing parking facilities, particularly the opportunity costs associated with land it occupies. This principle supports consumer choice, by rewarding efforts to reduce demand for parking.
3. **Prioritisation:** The most desirable spaces should be managed to favour higher-priority uses, such as commercial vehicles and the mobility impaired. This principle effectively seeks to establish a hierarchy of parking users.
4. **Sharing:** Parking facilities should serve multiple users and destinations. This allows for parking resources to accommodate variations in peak demand profiles associated with different land uses.
5. **Efficient utilisation:** Parking facilities should be sized and managed so spaces are frequently occupied. Policies should facilitate the redevelopment and/or conversion of inefficiently used parking facilities.
6. **User information:** Users are well informed of the location, availability, prices, regulations, and penalties associated with the use of parking facilities.
7. **Flexibility:** Parking management practices flexibly accommodate uncertainty and change.
8. **Peak demand management:** Special efforts should be made to deal with major peaks in demand. This acknowledges the negative side effects of excess demand for parking, such as driver frustration, illegal parking, and increased traffic congestion.
9. **Emphasis on quality:** The quality of parking facilities is considered as important as quantity. This principle aims for parking facilities to provide acceptable levels of security, accessibility, and user information.
10. **Comprehensive analysis:** All significant costs and benefits should be considered in the planning and provision of parking resources, including the capital opportunity cost of land used for parking. This principle allows the identification of the most cost-effective strategy for managing parking resources.

These principles need to underlie the development of successful strategies. Whilst a package of policies, also focussed on economic reform will likely be most effective, this paper focuses on those changes that planners can make to their municipality planning documents and how they assess development proposals.

1. Remove Minimum Parking Requirements

Removing minimum parking requirements from municipality planning documents is a critical first stage. Instead it is suggested that that the private sector will be able to determine the quantum of car parks to be made available as part of their developments in a more efficient and responsive manner. The private sector is likely to be more responsive than municipalities in this respect, particularly when there are clear economic benefits for developers in minimising wasted land and therefore maximising profit. Further, because most urban centres have an over supply of car parking spaces anyway, the removal of car parking minimums from municipalities plans will take time to have an effect.

2. Prohibit Surface Parking

By removing car parking minimums, the choice of how much parking to provide will lay with the developer. However the form and location of this parking should be controlled by municipality planning documents. Requiring that all surface parking in central urban areas be prohibited and instead be provided by structured car parking will result in more efficient land use patterns.

3. Utilise Parking Management Plans

Planners can also utilise overflow and spill-over parking plans that manage the effects of excessive parking demands that may arise during special events and the peak retail season, such as Christmas and Easter, or as a result of changes in parking management in adjacent areas. These plans can help mitigate the potential negative effects associated with excessive parking demand, such as increased vehicle congestion; unsafe and/or illegal parking on streets, footpaths, and grass verges; and driver frustration (Donovan and Genter 2008).

4. Workplace Travel Plans

The requirement for Workplace Travel Plans can be written into municipality planning documents. Travel plans are a management tool designed to assist organisations and businesses reduce inefficient travel demands associated with both home-to-work and work-based travel. Travel plans help to address organisational issues affecting how people choose to travel, such as company cars and free parking. In many instances changes in company policy have been shown to catalyse large reductions in employee vehicle use (Litman, 2006).

Guidelines on the reductions in parking supply

Planners may require guidance on advising developers about the appropriate amount of parking to supply, particularly after minimum requirements have been removed. Donovan and Genter (2008) compiled the following table to guide the decision making process;

Table 1 - Parking provision adjustment factors

Factor	Typical adjustment	References
Pricing	Reduce parking supply 10-30% where parking is priced	Kuzmyak, 2003; Litman, 2006; Booze Allen Hamilton, 2006.
Shared parking	Reduce parking supply where shared parking is available	ITE, 1995; ITE, 1999; Stein Engineering, 1997; Kuzmyak, 2003.
Unbundled parking	Reduce parking supply 10-30% where parking is unbundled	Shoup, 2005.
Car-sharing	Reduce residential and commercial parking supply by 5-10% if a car-sharing service is located within 750m	Carplus, 2003.
Workplace travel plan	Reduce commercial parking supply by 10-20% where workplace travel plans are implemented	Carplus, 2003.
PT accessibility	Reduce parking supply 10% for housing and employment located within 750m of frequent bus service, and 20% for housing and employment located within 750m of rail transit station	Litman, 2007.
Active mode accessibility	Reduce parking supply 5-10% in walkable communities, with additional reductions if walking improvements allow more shared and off-site parking Reduce commercial parking supply by 5% where end of trip facilities are available, such as showers and lockers are available	Cervero and Radisich, 1995; Litman, 2006.
Availability of nearby parking	Reduce parking supply depending on the surplus of parking available in surrounding area. The magnitude of effect of this strategy is highly site specific.	N/A
Travel patterns	Adjust parking supply to reflect variations in vehicle ownership and trip rates in area	Litman, 2006.
Residential density	Reduce parking supply by 2.2% for each resident per hectare	Litman, 2006.
Employment density	Reduce parking supply 10-15% in areas with 120 or more employees per gross hectare	Litman, 2006.
Land-use mix	Reduce parking supply 5-10% in mixed use developments, with additional reductions if parking resources are shared	Litman, 2006.

Factor	Typical adjustment	References
Type of land-use	Reduce parking supply in response to the type of land use and demographic profile of the target market	Litman, 2006.
Mobility	Reduce parking supply by 20-40% for housing or developments designed to serve young, elderly, or disabled users	Litman, 2006.
Income	Reduce parking supply 10-20% for the lowest 20% income households and 20-30% for the lowest 10% income households	Litman, 2006.

Conclusion

Well intentioned but poorly founded planning provisions and market distortions can have a significant adverse impact on urban form and transport efficiencies, and are therefore a significant and inadvertent contributor to carbon emissions.

Car parking minimums within the plans utilised by municipalities are a prime example of this, and the role of car parking in shaping urban form and therefore private motor vehicle use should not be underestimated.

The removal of car parking minimums, controls on the form and location of parking, promotion of shared car parking, increasing efficiency of existing facilities, and workplace travel plans are relatively simple matters that can be addressed by planners as part of changes to municipality plans.

These car parking management strategies can be described as a form of “low hanging fruit” available to planners to manage as a part of an overall sustainable strategy to reduce carbon emissions.

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