Sustainable Parking Management

Annex A of the Handbook 'Navigating Transport NAMAs'

TRANSfer Project – Towards climate-friendly transport technologies and measures

The concept

Readily available and free-of-charge parking supply increases vehicle ownership and use. The availability of parking spaces at a destination influences people's choice of modes. In particular free-of-charge or very cheap parking spaces are attracting factors for car use. In this way, extensive parking supply contributes to urban sprawl, which in turn fosters automobile dependency. Furthermore, parking contributes to fragmented settlement structures. Large car parks create barriers for pedestrians and cyclists and are often prone to night time security problems. Moreover, parking increases the extent of paved areas inhibiting the drain of rainwater and contributing to the urban heat island effect (Banfield, 1997; Litman, 2011b).

Elements of sustainable parking management:

- Management of parking supply
- City-wide parking charges

For more details on the elements' characteristics see Box 1.

Table 1: GHG mitigation matrix of sustainable parking management

	Avoid	Shift	Improve
Direct effects		☑ Make car owners use alternative modes ☑ Disincentive for car ownership	
Indirect effects	☑ Can increase the density of the city structure	☑ More space for cycling and walking infrastructure	
Rebound effect	☒ Can lead to increased traffic due to parking space search ('*cruising for parking*')		
Complementary measures *(to achieve full mitigation potential)*	☑ Land use policies that prevent car dependent urban sprawl (see Factsheet '*Dense and Transit-oriented Urban Development*') ☑ Parking	☑ All 'pull' measures that offer an alternative to the private car (*e.g.* walking and cycling infrastructure (see Factsheet '*High Quality Walking Infrastructure*'), 'Public Transport First' strategies (see Factsheet "'*Public Transport First' Strategy*")) ☑ Additional 'push' measures (*e.g.* road toll (see Factsheet '*Economic and Regulatory Instruments for Road Traffic*'), fuel pricing (see Factsheet '*Sustainable Fuel Pricing*'))	

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Box 1: Possible elements of sustainable parking management

Management of parking supply

Extensive parking supply can be managed by limiting the maximum amount of parking capacity allowed at particular sites or within a particular area. A parking cap is useful particularly in growing commercial centres. Site-specific parking maximums can be included in building-authority approvals. For instance, parking spaces per office or housing unit can by limited to a specific number. For example, in 1982, the city of New York limited the number of allowable parking spaces to one space per 4 000 square feet (≈370 m²) of commercial floor area. For residential developments, parking maximums of 0.2 to 0.35 parking spaces per unit were introduced (Weinberger *et al.,* 2010).

On-street parking needs to be limited as well, since these parking spaces are installed often at the expense of other road infrastructure such as cycling and walking infrastructure.

Search traffic can be reduced by real time parking information and guidance. Available parking could be displayed in parking signs. The internet and smartphones can further help to find a parking lot quickly.

How it works and intended effects:

- Limits the availability of parking spaces so that supply is slightly under the demand;
  - ➔ Reduction of car use;
  - ➔ More trips are shifted to public transport or non-motorised modes;
  - ➔ Potential reduction in car ownership in the long term.
- Less road space is allocated to on-street parking;
  - ➔ Conditions for walking and cycling are improved.

To be considered for implementation:

- A parking study or audit could be conducted to develop a suitable strategy for parking supply.
- Can be implemented at low costs.
- Can require more staff in the enforcing body, but generates revenues.
- Parking maximums in building permissions take several years to become effective.
- Requires cooperation with companies, shops or public institutions, which often provide free parking on their grounds.

Responsible actor: Local land use planning departments, local transport planning departments (on-street parking)

City-wide parking charges

Parking pricing forces motorists to pay for the use of parking facilities. Parking charges increase the cost of vehicle use and thus set an incentive to shift modes, especially when suitable alternative modes are cheaper (*e.g.* the price of a return ticket for public transport is lower than parking charges). As Litman (2011a) points out, vehicle owners tend to react very sensitively to parking charges. Parking fees have a greater effect on vehicle trips than other pricing schemes such as higher vehicle taxes. This is because they have to be paid for each trip. However, parking charges require strong enforcement to be effective. Parking pricing, which reflects the costs of parking spaces, typically reduces vehicle trips by 10 to 30 % compared to free of charge parking (Litman 2011c).

In order to reduce traffic disturbance by parked cars, parking charges should be higher for on-street parking than for off-street parking (Rye, 2010).

Moreover, parking charges can be integrated in city-wide transport payment schemes; *e.g.* in Hong Kong, parking fees can only be paid by the Octopus Card, the main payment method for public transport.

How it works and intended effects:

- Increases direct costs per vehicle trip;
  - ➔ Make people to package trips and thus reduce the vehicle kilometre travelled;
  - ➔ Induces a mode shift and the formation of carpools;
  - ➔ Generates additional revenues to cross-subsidise more environmentally-friendly modes.
- Time-based parking pricing reduces parking duration and increases the turnover rate per parking space;
  - ➔ Less parking spaces required;
  - ➔ Less commuting by car.

To be considered for implementation:

- Parking charges may require a legislative framework.
- Possibly an extension of the enforcement staff is required.
- Requires investments in ticket stations and guidance systems and their maintenance.
- The expenses can be covered by revenues from parking pricing.

Responsible actor: Local transport planning departments (in close cooperation with local financial departments)

GHG mitigation effect and co-benefits

Parking pricing and management usually lead to a shift towards public transport and non-motorised modes. Furthermore, commuters often form carpools so the occupancy rate of cars is increased and the number of cars is reduced. It is estimated that parking pricing at worksites can lead to a 0.5 to 4 % reduction in vehicle kilometres travelled and non-work parking pricing can achieve even higher reductions of between 3.1 to 4.3 % (IEA, 2005). The International Energy Agency (2001) estimated that parking-related measures could lead to a 4 to 10 % reduction in CO_2 emissions from transport compared to business as usual. If combined with complementary measures such as improvements in transit systems and promotion of alternative modes, the reduction potential is estimated to be in a range of 4 to 21 %. Dierkes *et al.,* (2005) assume that a municipal parking programme including limiting parking supply and increasing parking charges can lead to a 19 % reduction in vehicle kilometres travelled.

In 1993, the city of Vienna implemented district wide short-term parking areas and parking pricing to reduce commuter traffic. A before-and-after analysis carried out in 1998 showed that, in some districts, the number of kilometres travelled by car was reduced substantially, so that CO_2 reductions of up to 20 % were achieved. It is estimated that an expansion of the parking scheme to the whole city could lead to CO_2 reductions of traffic emissions of up to 4 % (Klementschitz and Stark, 2009).

Besides the reduction of GHG emissions and atmospheric pollutants, several positive effects are associated with parking restrictions and pricing:

- Less land is consumed and paved[1];
- Fewer expenses for parking facilities[2];
- More street capacity for low-carbon modes;
- More efficient and dense land-use and increased walkability;
- Reduced building development costs, since building owners are not required to construct a large amount of parking spaces per housing unit or commercial space (Litman, 2011b);
- Less safety and congestion problems caused by on-street parking (Rye, 2010).

Towards implementation

The measure addresses everyday travel behaviour of motorists. It targets commuting to work as well as shopping, errands and leisure trips.

Key stakeholders

- Local land use planning departments:
  Responsible for the allocation of parking spaces; implements regulations for parking grounds associated with new buildings (minimum/maximum parking requirements). They are also responsible for the authorisation of underground carparks and large office buildings and malls with huge car parks at the outskirts of the city.
- Local transport planning departments:
  Responsible for management and pricing of on-street parking.
- Local financial departments:
  Can play a key role in the introduction of area-wide parking pricing and administer the revenues generated by parking pricing.

[1] A typical parking space covers an area of 13 to 19 m^2 (Litman, 2011b).

[2] A parking space in the US annually costs between USD 250 and USD 2 250 depending on expenses for land, construction and operational costs (*e.g.* attendants) (Litman, 2011b).

Table 2: Potential barriers to implementation and countermeasures

Barriers	Options to overcome
Public and political backlash	■ Inform the community about the advantages of parking supply restrictions (Banfield, 1997). ■ Show alternatives to car use, such as park and ride (P+R) or public transport (Rye, 2010). ■ Start participation and moderation processes. ■ Quickly use the reallocated road space to increase the liveability of streets.
Commercial interests	■ Improve the access of public transport and non-motorised modes to local shops and businesses (Banfield, 1997). ■ Convince the owners that even more customers access the commercial area if the access by alternative modes is improved (Banfield, 1997).
Fragmentation of responsibilities	■ Launch parking management round tables that unite the different municipal departments as well as private owners of large car parks.

Success factors

- It is important for a city to find the right balance between too much and too less parking as well as too low and too high prices. A parking study, analysing the supply and demand is therefore a key tool for cities to move forward;
- Revision of obsolete parking planning practices that imply that parking should be abundant and free (Litman, 2011b);
- Strict enforcement of existing parking regulations, *i.e.* end illegal parking;
- Improve management and information about existing parking spaces and availability[3];
- Implement parking pricing and restriction area-wide to avoid spillover effects;
- Set parking prices in accordance to public transport fares[4];
- Provide sufficient alternatives to the private car (public transport, infrastructure for non-motorised modes).

Practice example: Parking management in Portland

In the US, the city of Portland, Oregon, successfully implemented parking supply management. In 1975, a parking cap was introduced, which limited the non-residential parking spaces in the central business district (CBD) to 40 000. The limit was based on tight regulations for parking spaces per area (0.7 parking spaces per ≈100 m^2 for sites in proximity to public transport and 1.0 elsewhere in the CBD). In the CBD, the public transport share of commuter trips rose from 20 to 25 % in the early 1970s to 30 to 35 % in the 1980s and 1990s (Kuzmyak *et al.,* 2003).

In 1995, the parking management scheme was adapted to new conditions. The city experienced a growth in population and jobs in the CBD grew from 70 000 to more than 90 000. The parking ratios were extended to peripheral areas, where the parking spaces were limited to 2.0 per ≈100 m^2. Additionally, a variety of measures were implemented to encourage a mode shift and to reduce transport demand (*e.g.* improved walking and cycling conditions, carpooling, development of housing near jobs and transit). Overall, the city of Portland achieved a public transport share of 43 % during peak commuting times, with 17 % of the commuters using carpooling (Kuzmyak *et al.,* 2003).

Durban, South Africa – Photo by Jonathan Gómez, 2011

[3] Inform travellers about parking availability and prices to avoid search traffic. For instance, changeable message signs can provide real-time information about free parking spaces.

[4] Sakamoto and Belka (2010) suggest that parking fees per hour should be higher than a single bus fare in order to encourage the use of public transport.

Further reading

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