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Low-Carbon Frameworks: Transport

Parking

Reflections for growing and developing cities

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WWF South Africa's Policy and Futures Unit undertakes enquiry into the possibility of a new economy that advances a sustainable future. The unit convenes, investigates, demonstrates and articulates for policymakers, industry and other players the importance of lateral and long-term systemic thinking. The work of the unit is oriented towards solutions for the future of food, water, power and transport, against the backdrop of climate change, urbanisation and regional dynamics. The overarching aim is to promote and support a managed transition to a resilient future for South Africa's people and environment. The organisation also focuses on natural resources in the areas of marine, freshwater, land, species and agriculture.

This is one in a series of publications produced by WWF South Africa's Transport Low-Carbon Frameworks programme, which is a dimension of a broader mission around economic transitions towards economically, socially and environmentally sustainable futures. The transport project aims to provide a platform, expertise and perspectives to support labour, business and government in engaging with the challenges implicit in the shift to a low-carbon economy. We seek solutions that will lower greenhouse gas emissions and enable a flourishing South Africa, to deliver developmental outcomes and social equity in the context of South Africa's economic geography. Consideration is given to the three tiers of interventions that will be required to effect the transition of this sector, being to **reduce** movement of goods and people, **shift** to low-carbon modes of transport, from private to public and from road to rail, and **improve** mobility services, and energy and fuel efficiency.

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INTRODUCTION

The last few decades have seen rapid rates of urbanisation. By 2050, 66% of the world's population will be living in cities (UN, 2014).

The sprawling and dispersed manner in which urbanisation takes place in cities in developing countries leads to an increased dependence on automobiles to get around and an accompanying increased rate of car ownership (Kenworthy & Laube, 1999; Rye, 2010). Currently there are over a billion private cars in the world and it is projected that by 2040, this number will reach 2 billion (Sperling & Gordon, 2016). More private cars on the road means increased traffic and congestion, as well as rising greenhouse gas (GHG) emissions.

2 BILLION

By 2040, the world will have 2 billion cars on the road

Cities can be categorised as either transit- or vehicle-orientated cities, based on factors such as the quality of their public transport system and their spatial layout. The way parking is provided and managed also plays a role (Kenworthy & Laube, 1999). These factors affect the mobility of urban residents and the accessibility of opportunities or destinations (Rode et al, 2014). While parking generates considerable revenue for local city councils, it also takes up valuable urban space and attracts and incentivises the use of private cars, which in turn leads to an increase in urban transport emissions (Bickford & Khoza, 2016; Rye, 2010). Ideally, cities should provide transport infrastructure and services to encourage their inhabitants to move away from private car use to public transport and non-motorised transport (NMT), thus encouraging the use of more sustainable transport (UN, 2016).

This brief focuses on the urban and environmental impacts of parking. It includes the best-practice case studies of Pasadena and Portland (USA), and London (UK). The case studies are useful to urban and transport planners in developing countries, such as South Africa, with their sprawling and car-dependent cities.

IMPACTS OF PARKING

Eating up space

Parking in cities assumes various forms and includes public on-street parking, public off-street parking, private off-street parking and private residential parking (Rye, 2010). On-street parking is most typically publicly owned and is either free or charged at a particular rate. Public off-street parking can be either publicly or privately owned, but may be used by any member of the public, usually subject to a set of regulations such as time limitations or a parking charge (Rye, 2010).

Ever since the increase of the private car in the 1950s, the urban landscape has developed into an unfriendly one that is far less attractive for low-carbon modes of travel: it consists of infrastructure that accommodates and prioritises cars, brought about by the oversupply of parking (Manville & Shoup, 2005; Mumby, 2009). On-street parking, for example, obstructs non-motorised and more sustainable forms of transport such as walking and cycling.

'Of all the automobile infrastructure in an urban region, parking is the most dynamically supplied'
(Manville & Shoup, 2005: 244)

95%

On average, cars are parked and stationary for up to 95% of the day

Parking consumes a lot of physical space in cities, which are essentially dedicated to vehicles that are stationary for up to 95% of the day, instead of alternative social or economic activity such as spaces where people live, work and socialise (Bickford & Khoza, 2016; Vanderbilt, 2015). Companies, for example, allocate as much, if not more, space and money to parking as they do to actual office space (The Economist, 2017).

On the positive side, parking plays an important fiscal role since parking fees and fines provide a substantial revenue base for local municipalities. Revenue that is generated in this manner can be reinvested directly into cities and used for urban upgrades and improvements (Rye, 2010; Litman, 2016; Kolozsvari & Shoup, 2003). It is therefore important that cities extract the most benefit from one of its most abundant features through effective parking management (Rye, 2010). This refers to the set of policies, strategies and programmes that increases the efficiency of the use and supply of parking resources, thus '[improving] the transport, environmental and economic situation in a city for most travelers' (Litman, 2016; Rye, 2010: 14).

$4–$20 BILLION

The estimated cost of emissions from parking infrastructure in the USA

Environmental considerations

A significant but less-researched issue related to parking is the direct link between parking infrastructure, parking policy and GHG emissions (Gantelet & Begon, 2008). This gap in the literature can be attributed to a fixation with travelling patterns and travel modes rather than the starting and end points of vehicle trips (Manville & Shoup, 2005). It is estimated that the annual cost of emissions from parking infrastructure in the USA alone is between $4 and $20 billion as it contributes to energy use, environmental degradation and the emission of pollutants such as sulphur dioxide (SO_2) (Chester et al, 2011).

In addition, parking encourages, and essentially subsidises, private car use (Bickford & Khoza, 2016). When the urban environment becomes less vehicle-oriented and more accessible to all modes of public transport, shared transport, cycling and walking, the need for private cars will ultimately be reduced and GHG emissions will decline (Mumby, 2009).

'Parking requirements subsidize cars, increase traffic congestion and carbon emissions, pollute the air and water, encourage sprawl, raise housing costs, degrade urban design, reduce walkability, damage the economy, and exclude poor people … we are poisoning our cities with too much parking.'

(Shoup, 2016: 26)

Example of how reduced parking availability can save GHG emissions in South Africa

The South African case study (see text box on next page) highlights that a 5 000 m^2 shopping centre would have a minimum of 350 parking bays. Assume that 70% of these bays are each filled four times a day by dual-occupancy vehicles, seven days a week, by shoppers who drive an average return trip of 15 km. The total emissions associated with travel to the shopping centre would be to the order of 785 tonnes of CO_2 per year. If those people rather travelled by public transport because there were fewer parking spaces available, the emissions associated with transporting the same number of shoppers to the centre in a bus rapid transit (BRT) bus with 28 passengers would be around 115 tonnes of CO_2 per year. In a taxi with 14 passengers, it would be around 145 tonnes per year. The potential savings per shopping centre could thus be between 640 and 670 tonnes of CO_2 per year. When considering the number of shopping centres across the country, the impact could be significant.

Minimum vs maximum parking requirements

A central issue in the parking discourse has been the rethinking of parking requirements, in particular the re-evaluation of parking minimums. This provides an important opportunity for improved parking management and policy. Minimum parking requirements were first imposed in Columbus, Ohio, USA in the 1950s and have since been 'ingrained in planning practice' across the world (Shoup, 1999: 560).

‘Minimum parking requirements’ refer to the minimum number of fixed parking spaces required by a particular land use. Urban planners are tasked with setting such parking requirements, outlined in zoning ordinances, for the vast variety of urban land uses that exists in cities (Shoup, 2016).

640–670 TONNES OF CO_2

The potential savings in emissions, per shopping centre per year, if South Africans travelled by bus or minibus taxi instead of by private car

However, parking minimums require no upper limit on how many parking spaces to provide (Shoup, 1999). This often results in an oversupply and under-pricing of parking (Shoup, 2016; Guo & Ren, 2013). In addition, parking minimums are often modelled taking only peak times and peak demand into account, which means that for much of the week, month or year, parking spaces are vacant or have a low occupancy (Summers, 2012). Parking is also often provided by developers conventionally, even if it is not required (Shoup, 2016).

According to Shoup (1999), while minimum parking requirements may increase the supply and lower the price of parking for the end user, they create various external costs, such as high construction costs, maintenance and the environmental costs associated with road traffic such as congestion and air pollution. Many cities across the world also replicate parking requirements without a nuanced appreciation of the local context. However, it is important that these requirements be tailored to the unique conditions of a specific area (Rye, 2010).

The South African case study

Most noticeably, in suburban residential areas, the consequence of minimum parking standards has been an increase in the number and size of shopping centres in South Africa (Hitge & Roodt, 2006). Currently there are more than 1 600 shopping centres in the country, accompanied by a greater public demand for parking and convenience (Prinsloo et al, 2014). As indicated in Table 1, a neighbourhood shopping centre with an area of less than 5 000 m^2, for example, is required to have seven parking bays per 100 m^2 (Mackey et al, 1985). However, the nature of the urban landscape has changed dramatically in the past 30 years and will continue to change in future, requiring revision that takes current and future urban form into account (Hitge & Roodt, 2006).

Table 1: Extract of South African minimum parking requirements for off-street parking

Land use	Type	Standard
Residential	Hotel and motel	1 space per room + 10 spaces per 100 m^2 area accessible to public
Office	General office	2 spaces per 100 m^2
	Bank, building society and other public office	4 spaces per 100 m^2
Business	Neighbourhood shopping centre (<5 000 m^2)	7 spaces per 100 m^2
	Hypermarket	7 spaces per 100 m^2
Educational	Primary school	1 space per classroom or office

SOURCE: MACKEY ET AL (1985)

A recent practice, noticeable in cities across the world such as London, Amsterdam, Sydney and Paris, has been the restriction or removal of minimum parking requirements, and replacing these with maximum parking requirements (Guo & Ren, 2013). Maximum parking requirements impose upper limits to the provisioning of parking and therefore prevent an oversupply and under-pricing of parking (Shoup, 2016; Guo & Ren, 2013). Early in 2017, Buffalo City (USA) became the very first to incorporate parking maximums for all areas across the city (Hess, 2017).

CASE STUDIES

The following case studies, focusing on three cities (in the USA and UK) illustrate interventions and successes in parking management and policy. The case studies illustrate the role of effective parking management and policy to drive a sustainable urban trajectory.

Pasadena (USA) – Parking revenue as driver of urban upliftment

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Over 1 200 parking meters have been installed in five areas of Pasadena with different rates, time limits and hours of operation.

Pasadena, California, is a good example of effective parking management and the successful regeneration of a run-down urban environment through priced parking initiatives.[1]

During the mid-20th century, Pasadena became a run-down city. Its downtown area, named 'Old Pasadena', had no parking meters and enforced two-hour parking limits, which created a parking problem for employees and customers of local businesses. The downtown area, which was characterised by its poor condition and poor parking, attracted very little business and few customers (Litman, 2016).

In responding to the problems of Old Pasadena, a Parking Meter Zone, otherwise known as a 'parking benefit district' was introduced in 1993 (Kolozsvari & Shoup, 2003; Oregon Transportation and Growth Management Program, n.d.). Within this 'zone' or 'district' that incorporated priced parking, revenues from parking meters and fines were directly reinvested into local upgrades (Litman, 2016).

This intervention has since continued in Pasadena. Today, the city regards parking as a 'key element' of its transportation programme. It addresses its parking issues by coordination among various stakeholders, including residents, businesses and institutions and also recognises the spatial and environmental problems associated with too much parking and the need to reduce the amount of land consumed by parking (Banerjee & Associates, 2003). Pasadena now uses a preferential parking permit system for a particular cohort of streets, consisting of residential, visitor,

1 Weinberger et al, 2010

daily and temporary permits (City of Pasadena, n.d.). The city restricts on-street overnight parking, for example, between 02:00 and 06:00 in an 'overnight parking policy' (Abendschein, 2009).

The revenue initially generated from the priced parking of the Parking Meter Zone was fed directly into inner-city improvements such as street cleaning and pedestrian facilities. An advisory board was established to manage parking policies and revenue (Litman, 2016). These and other parking interventions have since facilitated an incredible regeneration of the area, has sparked business growth and increased sales tax revenue, and also enhanced a pedestrian culture (Kolozsvari & Shoup, 2003).

Portland (USA) – 'Model' for best-practice parking management

Portland, Oregon, is a model for successful parking management owing to the city's varied, innovative and comprehensive parking policies that include bicycle parking, priced and timed parking, as well as parking differentiations and districts.[2]

In the early 1970s, the need for Portland's parking policies was created by the state of its air quality and the specifications of the Clean Air Act, with which it struggled to comply. In order to comply, the city's initial goal was to reduce parking per capita by 10% in 20 years. This was initiated by freezing the use of 45 000 parking spaces in 1972 (Weinberger et al, 2010; Rye, 2010). An efficient network of public transport and non-motorised transport was simultaneously prioritised, and the city encouraged urban residents to move away from the use of private cars (Weinberger et al, 2010; Rye, 2010).

Later, in 1997, the city incorporated more flexible parking requirements which, rather than preventing parking construction, was specifically aimed at managing parking based on parking demand research and policy impact scenarios (Rye, 2010). Downtown Portland was divided into 13 parking management zones, each based on occupancy and demand variations and governed by a different policy (Oregon Transportation and Growth Management Program, n.d.).

Parking minimums, for example, do not apply to the city's densest commercial and residential districts, or to any new developments that are within 500 feet of a form of public transit that offers a peak-hour service of, at least, 20-minute intervals. Parking maximums vary according to parking districts, while closer distances to public transit points mean fewer parking spaces that are permitted. In addition, car parking spaces are substituted by bicycle parking spaces, with every five bicycle spaces replacing one permitted car parking space (Rye, 2010). The city also uses a system of parking transfers in an attempt to maintain control over parking spaces: developers building below the maximum requirement are allowed to transfer parking development rights to other developments (Rye, 2010).

As a result of the initial interventions and parking restrictions by Portland in the early 1970s, public transit use had increased from 20–25% to 48% by the mid-1990s (Rye, 2010). More recently, in the Lloyd district of Portland, for example, on-

2 Rye, 2010; Wilson, 2015; Weinberger et al, 2010; Oregon Transportation and Growth Management Program, n.d.

street parking management in the form of two-hourly parking meters for 'primary customer locations', and five-hourly meters for locations with lower customer occupancies have encouraged an increase of 46% in public transit use (Oregon Transportation and Growth Management Program, n.d.).

London (UK) – The success of parking maximums

London provides a good example of a city that has undergone significant parking policy reform, as it replaced its minimum parking requirements with maximum parking requirements.[3]

London's parking policy reform was initiated by the Department for Communities and Local Government's 'Planning Policy Guidance (PPG 13): Transport' document in 2001. The document prioritised the development of parking policies that encourage sustainable transport and a reduction in the dependence on private cars. It specifically prevents minimum parking requirements, excluding disabled and handicapped parking, and stipulates the purpose of maximum parking requirements in promoting sustainable transport and reducing traffic and congestion, as well as the use of private cars (Al-Fouzan, 2012; Shoup, 2016).

Following the issuing of the PPG 13 guideline, the Greater London Authority set requirements for all 33 boroughs to implement a maximum parking requirement for off-street parking, with no minimum requirement for all developments. The city had previously introduced parking maximums during the 1970s, but these were limited to private and non-residential parking only and later weakened (Guo & Ren, 2004). The new requirements of the London Plan, in 2004, included a maximum requirement of one parking space per dwelling unit that is within a 10-minute walk of a town centre or that has good access to a point of public transit, while a 1,5 to 2 parking space maximum is enforced for residential units with four or more bedrooms (Shoup, 2016; Guo & Ren, 2013).

Guo and Ren (2013) undertook research on the impact of this policy change by examining the residential parking supply of over 11 000 residential developments. The research found a 40% reduction in overall parking supply and that the greatest impact had come from the removal of the minimum requirement (Shoup, 2016). The overall measured parking supply formed only 68% of what the maximum requirements provided for, and only 52% of the replaced minimum requirement (Guo & Ren, 2013). Guo & Ren (2013) conclude that strict maximum standards complement street parking regulations and parking taxes, and also form an 'efficient parking market'.

3 Al-Fouzan, 2012

KEY ISSUES AND REFLECTIONS FOR SOUTH AFRICA

Key issues

- Parking has a role in urban space. The supply and cost of parking are factors that contribute to whether people decide to own and drive a car. Parking is the spatial stimulus that attracts cars into urban areas and consumes physical space, but also forms an inherent part of the urban landscape, providing an important fiscal resource that could be used towards city improvements.

- Parking has environmental implications. Responding to parking demand by simply increasing supply and satisfying the interests of new developments will only magnify the problems of growing cities, such as congestion and increased GHG emissions. Parking has a role to play in constraining car use and promoting more sustainable transport, which must be recognised in policy.

- South Africa represents a developing country that could benefit from better parking management and parking policy. Parking has historically been managed in a reactive rather than a proactive way in developing countries (Rye, 2010). South Africa still enforces a minimum parking requirement through the South African Parking Standards of 1985 (Mackey et al, 1985). Literature suggests that this is one of the factors facilitating vehicle use, urban sprawl, a decline in public transport infrastructure and use, and a focus on road infrastructure in the country (Hitge & Roodt, 2006). Hitge and Roodt (2006) indicate that these outdated, yet enforced, standards contradict current land-use and transport policies and legislation, such as the National Land Transport Transition Act 22 of 2000, which aim to promote densification and more sustainable urban environments in South African cities.

Key reflections from international best practice

'It is possible to develop a car parking policy that will manage the negative impacts of urban car use whilst also supporting business and the economy. It is a careful balancing act, which is why it is important to learn from the experience of other places.'
(Rye, 2010: 41)

- **A review of existing parking codes, standards and requirements:** South Africa could benefit from a review of its existing and outdated parking policies based on up-to-date, rigorous research and data, which accommodates the unique needs of each area. These new parking management strategies should also be strictly enforced (see the Portland case study above).

- **Parking maximums**: South Africa currently enforces a minimum parking requirement and could benefit from either reducing the minimum requirements, employing more flexible requirements, or exploring maximum parking requirements that would prevent an oversupply and under-pricing of parking and encourage more sustainable use of transport (see the London case study above).

- **Tighter restrictions on the use of parking spaces:** South Africa could benefit from tighter restrictions on parking spaces, especially on-street parking through stricter time stipulations and enforcing a maximum length of stay. This would make the use of private cars less convenient. Ideally, these restrictions should vary based on the occupancy and demand of the specific area (see all the case studies above).

- **Smart use of parking revenue:** South Africa could also benefit from expanding its paid parking, and making it cheaper for shorter stays and more expensive for longer stays. Furthermore, it could be useful to make on-street parking more expensive than off-street parking. South African cities can use the revenues from paid parking to invest directly back into inner city areas for urban regeneration and upliftment (see Pasadena case study above).

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Parking minimums are often modelled taking only peak times and peak demand into account, which means that for much of the week, month or year, parking spaces are vacant or have a low occupancy.

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95%

On average, cars are parked and stationary for up to 95% of the day

2 BILLION

By 2040, the world will have 2 billion cars on the road

OVERSUPPLY OF PARKING

Accommodates and prioritises cars in cities over other transport modes or land uses

SMART PARKING MANAGEMENT

Can maximise revenues for municipalities from public spaces

Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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