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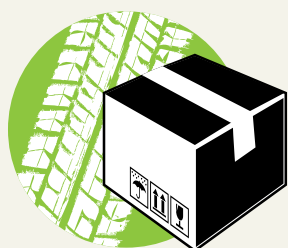
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Low-Carbon Frameworks: Transport



**Planning for sustainable  
urban freight movement**

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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 brief was produced under the auspices of the global WWF One Planet City Challenge, which recognises the efforts of cities and towns to provide sustainable housing, transportation and energy for their residents, and take ambitious and innovative climate actions.

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# INTRODUCTION

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Most goods used in cities originate elsewhere, and their delivery to cities is referred to as the ‘last mile’ in the supply chain.

It is this ‘last mile’ that impacts on the experience of other road users, businesses, and residents – and that is increasingly perceived as competing with passenger or private transport for road space, and reducing urban quality.

Urban logistics are extraordinarily complex and diverse, as cities are served by hundreds of different supply chains (Behrends, 2016). The freight industry not only delivers the produce, commodities and other goods necessary to sustain the urban economy but also generates significant direct and indirect employment. ‘Goods movement is absolutely critical to people’s lives and must be addressed as a key component of the liveability and efficiency of our cities today’ (VREF, 2016).

Yet the actual contribution of urban freight to congestion, road degradation and air quality has largely been overlooked in sub-Saharan African cities (Pirie, 2013; SSATP, 2015) and, until relatively recently, globally too (VREF, 2016). Most published research and evaluations of freight interventions are from Asian cities or from European cities with fewer than two million people (Behrends, 2016; GIZ, 2013). Freight planning in Africa, on the other hand, tends to be on a regional corridor and national scale rather than an urban one (Pirie, 2013).

This brief broadly notes the key challenges facing urban freight movement and, within the constraints of the literature and studies available, presents four successful interventions in developing world cities: a city-level freight management strategy; a shift from road to rail for waste transport; the use of bicycles for inner-city cargo; and night deliveries in a mega-city. Finally, the document presents a typology of measures to reduce the environmental and social impact of urban freight movement.

## **The socio-economic and environmental impact of urban freight movement**

The movement of urban freight has significant economic, environmental and social impacts. Economic impacts include infrastructure damage, road congestion, inefficient traffic movement and the potential to waste resources such as fuel and time when freight is inefficiently managed (Blanco, 2014).

Environmental impacts include those related to air pollution, global warming and the increased use of fossil fuels. Trucks generally have significant environmental impacts in the form of greenhouse gas (GHG) emissions: CO<sub>2</sub>, nitrogen oxide (NO<sub>x</sub>) and fine particulate matter (PM<sub>10</sub>, PM<sub>2.5</sub>, PM<sub>1</sub>), and noise pollution. Social impacts include an increased number of road traffic crashes and slower emergency response rates, noise and public health concerns (Civitas, 2015; TCT, 2016).



ELSABE GELDERBLOM

A parcel-delivery service competes for kerb-side space with the MyCiTi bus in Cape Town, South Africa.

The urban freight link is the most polluting in the entire supply chain. Final products are delivered in low volumes and at high frequencies in congested traffic conditions. This generates a high number of trips at low volumes with high pollution and low fuel efficiency (Gota, 2015).

In European cities, urban freight traffic accounts for about 10–15% of kilometres travelled and emits approximately 6% of all transport-related GHG emissions. It accounts for between 2 and 5% of the total workforce employed in urban areas, and it is estimated that between 3 and 5% of urban land is reserved for logistics activities (Civitas, 2015).

**>30**  
**DELIVERIES PER WEEK**  
**ARE NOT UNCOMMON**  
**FOR A 20–30 m<sup>2</sup> SHOP**

### How improved urban freight transport could reduce GHG emissions

- Reducing the number of kilometres driven and time spent in traffic will reduce fuel demand for delivery vehicles. This will have a positive impact on local air quality and will also reduce the GHG emissions associated with transport. Every thousand kilometres less in distance travelled by a three-tonne delivery truck reduces GHG emissions by about 265 kg CO<sub>2</sub>e.
- Calculating the ‘emissions benefit’ of driving off-peak to avoid traffic stop-starts is difficult as it varies widely between vehicles, driving conditions and driver behaviour. One international study suggested a potential reduction in emissions from delivery trucks of around 12% when driving off-peak versus peak periods. An idling truck can use up to 2 litres of fuel per hour, giving rise to 5.2 kg CO<sub>2</sub>e per hour.
- Bicycle deliveries are clearly emissions free, while rail transport requires around 5 to 10% of the fuel equivalent compared to road transport.

## Freight-related challenges facing cities – and challenges facing urban freight

Local and national governments, together with residents and road users in sub-Saharan African countries, are grappling with the challenges that rapid urbanisation and resource constraints have brought to passenger transport provision and performance (see WWF case study: Approaches to incorporating paratransit in scheduled public transport<sup>1</sup>). At the same time, urbanisation has increased the demand for urban freight. These factors compound the constraints on an urban system already characterised by congestion and constrained land and road space (Pirie, 2013; Behrends, 2016; VREF, 2016; Blanco, 2014).

For example, trucks need to access kerbs or loading zones to unload goods (rather than double-parking) (VREF, 2016) and in some cities, informal trading, parking facilities, bicycle lanes and bus stops hinder the movement of freight. Buildings need to be configured to handle freight, with sufficiently sized loading docks, freight lifts, secure after-hours holding areas and on-site storage (each of which can impact on the number of trips, trip timing and the impact of deliveries). The shifting of warehousing and distribution activity to the periphery of cities has meant that truck trips and travel distances have increased (VREF, 2016). The increasing demand for online shopping and home deliveries is also stretching freight operations, which have become characterised by ‘high delivery failures, empty trip rates and a lack of critical mass in areas with limited demand’. This results in high distribution costs and emissions (Behrends, 2016).

Furthermore, urban freight movements are even more complex in developing cities because of the large share of small, owner-operated retail stores. Because these are small, with limited product assortment and shelf space, they require frequent deliveries. It is not uncommon, according to Blanco (2014) for a store of 20–30 m<sup>2</sup> to receive over 30 deliveries a week.

1 Available online at [wwf.org.za/report/incorporating\\_paratransit\\_scheduled\\_public\\_transport](http://wwf.org.za/report/incorporating_paratransit_scheduled_public_transport)



ELSA BEEGELDERBLOM

Effective route planning and local knowledge can reduce freight-kilometres travelled.



ELSABE GELDERBLUM

Inadequate loading areas result in freight activities blocking two of the three traffic lanes in Adderley Street in Cape Town's central business district.

## The need for focused local freight plans

Although freight and logistics have ramifications for the social and economic viability of cities, few freight studies, strategies or policies in sub-Saharan Africa are at city scale. Instead, the focus has been on freight movement at national or regional scale (Pirie, 2013; SSATP, 2015) with specific reference to large-scale trade, ports and transport corridors (AfDB, 2014).

In sub-Saharan Africa, much of the demand for freight to and from cities is accommodated by road transport, largely because of relatively low investment in freight rail networks and infrastructure, and limited connectivity between cities and towns. High-level policy focus in Africa remains centred on heavy infrastructure investment – improved and upgraded trunk routes, new rural roads, improved logistics from ports to inland markets, and infrastructure investments in and around cities (Odero, 2015; AfDB, 2014).

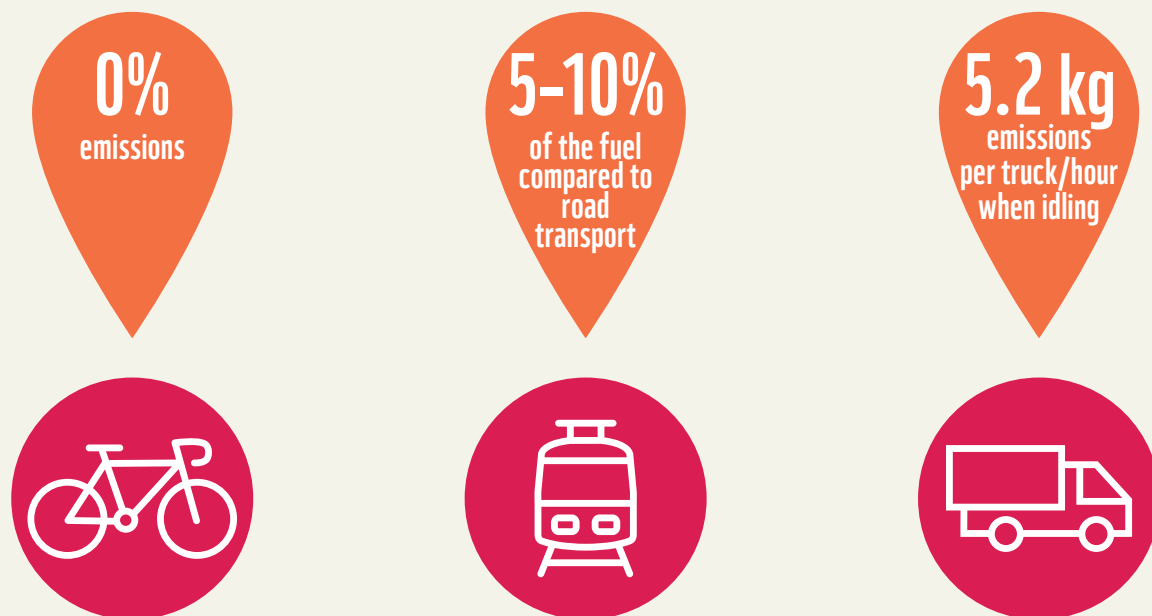
Namibia, for example, has developed a master plan for the development of an international logistics hub for SADC countries (JICA, 2015). This is a plan at regional scale and although it does consider 'sustainability', this is largely in a financial rather than an environmental context.



Nevertheless, the plan recognises the impact of a logistics hub on the environment and society (higher risks of traffic accidents, noise, impeding movement of wild animals, and the increased spread of communicable disease due to long-distance movement) but notes that this can be managed through mitigation actions.

Tanzania's master plan for Comprehensive Transport and Trade System Development complements its Ports Master Plan (2008–2028) (AfDB, 2014) and includes a chapter on freight transport development, with the vision to lead the growth of east African countries and support the growth of neighbouring countries as a regional hub. Historically, long-distance, international transport lines were developed to haul extracted or harvested resources straight from the production areas to the ports for export, and areas in between were neglected (JICA, undated). Although one of the five key strategies in the plan is the alleviation of bottlenecks in Dar es Salaam itself,<sup>2</sup> the plan is chiefly a national and a regional one.

However, according Blanco (2014), all large-scale successful solutions have started with strong local urban freight plans. In South Africa, the national Department of Transport, through the National Land Transport Act (2009), the National Freight Logistics Strategy (2005) and the Road Freight Strategy (2011), indicated the need for local and regional freight strategies in addition to national plans.



<sup>2</sup> The Tanzania Ports Authority planned to improve the performance of Dar es Salaam and increase annual cargo trade by 30% from 13.5 million tonnes in 2013 to 18 million tonnes by 2015 (AfDB, 2014).

The 'last mile' in the supply chain impacts on the experience of other road users, businesses and residents. It is increasingly perceived as competing with passenger or private transport for road space, and reducing urban quality.





# URBAN FREIGHT MANAGEMENT OPPORTUNITIES

Successful interventions to improve the movement of urban freight in developing world cities such as Cape Town and São Paulo include strategic planning and the use of rail, bicycles and night deliveries.

## Cape Town's freight management strategy

Freight moves into and out of Cape Town through what is known as the 'functional region' – through multiple local authorities and along the three major national corridors, the N1, N2 and N7. The Port of Cape Town, the major generator of freight in the city, has plans to roughly treble its current container-handling services in the next 20 years. About 95% of the freight arriving at the Port is road-based (TCT, 2016).

The City's Comprehensive Integrated Transport Plans (CITPs) have since 2006 noted that the freight transport system should become safer and more efficient. This resulted in a Freight Management Strategy, prepared for Cape Town's Transport and Urban Development Authority (TDA), being approved in 2016 (TCT, 2016).

The strategy focuses on urban freight and divides challenges into 11 focus areas – outlining principles and actions for dangerous goods, abnormal loads, overloading, road congestion, freight demand, road safety, incident management, freight emissions and air quality, rail freight, technology and innovation, and advocacy and inter-governmental structures.

Revealing the significant impact of freight on safety, cost and congestion within urban areas, a Transport Development Index (TDI), developed by Transport for Cape Town (now the TDA) in 2015, describes the concerns and problems of four groups of freight users: local deliveries, medium freight, heavy freight and long-distance freight. The TDI established that:

- the direct transport cost (fuel, salaries, maintenance and repairs, toll fees, etc.) for the freight user group is R1.755 billion annually
- the cost of congestion for the freight user group is R121 million annually
- the cost of safety is R19 million annually
- the cost of crime is R15 million annually
- the impact of freight transporters on Cape Town's residents in terms of crashes is R930 million annually
- the impact of freight transporters on the city's road network (capital expenditure and maintenance) is R713 million annually.

## Enablers and implementation

To prepare a local freight management strategy, the then Transport for Cape Town conducted a series of local data collection exercises to prepare the evidence base for decision making. For example, the City commissioned a Status Quo Assessment: Freight (2015), which drew on earlier important studies such as an Investigative

**R1.755 bn**  
The direct transport cost  
per year for the freight  
user group in Cape Town

Report on the Management of Strategic Routes and Abnormal Load Transportation (2003); a Transportation of Dangerous Goods (DGs): Status Quo assessment (2014); a Freight Demand Model (2014); an Abnormal Load Route Study (2014); a study regarding Weigh-in-Motion Technology for Load Assessment/Control (2015); and a Heavy Vehicle Accident Study (2015).

## Challenges

Cape Town's mandate is limited to the planning, implementation, coordination and efficient functioning of road-based freight in and through the city and its functional region. The City has limited jurisdiction regarding matters such as provincial and national freight routes, rail freight, port operations, air cargo, the development of freight regulations, law enforcement and the extent and imposition of penalties (TCT, 2016).

Nevertheless, the TDA has undertaken extensive liaison with the national rail network, Transnet Freight Rail, to optimise the use of rail for freight, and the Airports Company of South Africa (ACSA) in relation to air freight. In addition, the TDA is liaising with the Port of Cape Town to review its development plans to ensure that it reduces the generation of road-based freight (TCT, 2016).

## From truck to bicycle – small inner-city deliveries

Non-motorised modes of inner-city delivery, such as delivery bicycles, pose less of a risk for pedestrians and cyclists than do large trucks and delivery vehicles. In addition, they offer opportunities for micro-entrepreneurship, produce fewer emissions, generate less noise, and promote a more liveable environment (VREF, 2016).

In European cities such as London, Berlin and Paris, ordinary bicycles as well as sophisticated cargo cycles – two- or three-wheeled electric-assist cycles – are used in a number of sectors, such as mail, courier, parcel and home deliveries. In Gothenburg, Sweden, an organisation called the City Delivery (Stadsleveransen) consolidates deliveries for 500 shops and businesses at an urban consolidation centre located near the CBD and then uses cargo cycles to distribute the goods to shops within the centre. Stadsleveransen has successfully reduced the number of deliveries per receiver by 14% on average. As a result, the delivery trips of transport companies are up to 10% shorter and 5% faster in the CBD (VREF, 2016).

In African cities, non-motorised modes of delivery are plentiful, yet they operate in dangerous environments without infrastructure and with little evidence of formal recognition or active encouragement and support (Pirie, 2013). Three-wheel rickshaws (such as Dar es Salaam's *gudrum matatu*), handcarts and 'trolley-pushers' are important means of goods and waste (recycling) transport, but are often situated near central markets and transport hubs where they come into conflict with officials more concerned with maintaining motorised traffic flow (Pirie, 2013). In smaller South African cities and informal areas, traditional delivery bicycles play an important role: in Rustenburg, North West province, for example, bicycles are used to deliver small parts for the motor trade, bread, sandwiches and water within the CBD.

## From road to rail

### Waste by the tonne

Urban commercial and household waste disposal by road transport is already a significant freight sector on its own – and is set to expand. Five years ago, 35% of solid waste in Addis Ababa (Ethiopia) was not collected, while in Lusaka (Zambia) only 15% of solid waste was collected (Pirie, 2013). As African countries urbanise, their larger urban populations generate more dry waste, which needs to be collected, consolidated and transported to landfill, recycling or burning.

Like with most cities, solid waste in Cape Town is collected by road vehicles and disposed of at various landfill sites via a waste transfer facility in Athlone (ARTS). Every day approximately 1 000 tonnes of general waste are collected door to door from households across Cape Town and deposited at ARTS where the waste is transferred into containers for landfill. In 2012 the local authority signed an agreement with Transnet Freight Rail to transport waste to the Vissershok landfill site by intra-urban rail rather than by road. An estimated 222 000 tonnes of waste was handled in this way in 2013. In 2016 the freight-rail agreement was extended until 2023 (CCT, 2016).

In terms of its new Freight Management Strategy (see above), Cape Town will, wherever possible, facilitate an increase in rail's modal share of freight and maximise the use of rail for the disposal of solid waste.

*The Johannesburg Declaration on Ecomobility in Cities (October 2015) includes three action items for cities and low-carbon and green urban freight:*

- Develop local green freight policies, instruments and infrastructure, and link these with national transport and trade policies.
- Develop urban freight offices as local change agents and dry ports as freight consolidation centres.
- Manage freight delivery vehicles and delivery times, and reorganise 'last mile' deliveries towards more sustainable solutions.

### Improving inland ports

In Ekurhuleni, Gauteng province, South Africa, Transnet Freight Rail is proceeding with an initiative known as the Tambo Springs inland port.<sup>3</sup> This facility includes a significantly improved intermodal capability (road, rail and sea) for the movement of freight to and from Gauteng, extending to the port cities of Durban and Port Elizabeth.

The Tambo Springs terminal will be linked to the Durban container terminal by traditional rail link and will be designed to significantly increase the rail capacity for container freight to and from Gauteng. In addition to an improved direct rail link with Durban, the initial phase of Tambo Springs links the Coega Industrial Development Zone (IDZ) and its adjoining deepwater Port of Ngqura in the Eastern Cape with Durban in KwaZulu-Natal via a sprinter freight rail link.

### Night or after-hour deliveries

After-hour delivery programmes are a relatively common intervention in cities in Europe and the USA. Diverting truck trips to overnight hours, however, requires receivers to change behaviour and, in some cases, reconfigure their buildings to accept deliveries without staff (VREF, 2016).

3 [www.tambosprings.co.za](http://www.tambosprings.co.za)



Every day approximately 1 000 tonnes of general waste are collected door to door from households across Cape Town, South Africa.

These programmes can be voluntary or required by urban authorities. In Addis Ababa<sup>4</sup> (Ethiopia), urban freight is not permitted in the city during peak hours, and deliveries are to be provided outside of daytime opening hours. However, these regulations are seldom enforced (SSATP, 2015).

During the 2014 FIFA World Cup in Brazil, a pilot project set up by a logistics company in São Paulo shifted delivery times to what they describe as off-hour deliveries (22:00 to 06:00) rather than the usual pre-10:00 delivery time. Under normal circumstances in the city, restrictions affecting cargo delivery activities already limit circulation and the loading and unloading of goods in certain regions, and at certain times a truck ban is in place (Bertazzo et al, 2016). A Maximum Vehicle Restriction Zone (ZMRC, Zona de Máxima Restrição de Circulação) comprises approximately 100 km<sup>2</sup> – smaller trucks may operate inside the ZMRC during daytime. Shopping malls may only receive goods from large delivery vehicles at night.

The logistics company implementing the pilot noted that, despite concerns about nuisance at night, less noise was in fact generated, as vehicles did not have to manoeuvre within parking lots. The company was able to make a clear business case for night delivery with increased productivity in deliveries owing to reduced travel and unloading times.

To help Guangzhou (China) improve its air quality before the 2010 Asian Games, the World Bank and Clean Air Asia implemented a pilot project aimed at improving fuel economy and reducing emissions and air pollution from waste trucks in the city.

The pilot included the provision of low-rolling resistance tyres and aerodynamic equipment such as a nosecone, cabin fairing and trailer skirts for the trucks. Annual savings were estimated to be 3 557 litres of diesel, 9 tonnes of CO<sub>2</sub>, 33 kg of NO<sub>x</sub>, and 1.5 kg of PM<sub>10</sub>. The equipment had a payback period of 5.1 years (GIZ, 2013).

In sub-Saharan Africa, an opportunity for after-hour efficiencies presents itself in the paratransit sector if minibus taxis were to be given a role in commercial freight transport, for example, delivering out-of-hours to small-scale retailers in informal settlements that are hard to reach, and that can only afford to buy and stock small daily deliveries. Better use could be made of minibus-taxi fleets across the 24-hour day, and the practice could create additional driver jobs (Pirie, 2013).

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<sup>4</sup> In Addis Ababa, Ethiopia, a project has been set up to develop a freight transport hub along the southern corridor aiming to relocate warehousing facilities outside of the city (SSATP, 2015).



# A TYPOLOGY OF URBAN FREIGHT INTERVENTIONS

Regulatory measures	Introduce and enforce vehicle size and weight restrictions, as well as load factor restrictions.
	Enforce emission standards and engine-related restrictions, noise programmes/regulations, low-emissions zones.
	Implement loading and parking restrictions, vehicle parking reservation systems, timeshare of parking spaces, peak-hour clearways (where only taxis and buses may stop at the kerb)
	Enforce time and access restrictions such as daytime delivery restrictions, daytime delivery bans, night-time delivery bans and silent deliveries.
	Prepare freight traffic restrictions such as truck routes, restricted multi-use lanes.
Market-based and behaviour-change measures	Implement and enforce road pricing, congestion charges and parking charges.
	Use incentives or subsidies to encourage the development of sustainable urban distribution.
	Require appointment-based systems for deliveries.
	Consolidate home deliveries by encouraging alternate residential delivery sites.
	Introduce a receiver charge for deliveries.
Land-use planning and infrastructure	Designate parking places and develop loading-zone-related strategies.
	Offer central collection points.
	Develop urban consolidation centres.
	Adapt on-street loading zones.
	Use building-code regulations to develop off-street delivery areas.
Technology	Offer dynamic routing and real-time information.
	Promote alternative fuels or electric vehicles.
	Promote and support aerodynamic vehicles and accessories.
	Lobby truck and delivery vehicle manufacturers to install anti-idling features in vehicles.
Awareness and training	Raise the profile of goods movement by engaging freight partnerships and networks.
	Offer eco-driver training (economical, ecological and safe driving) and other measures.
	Shift modes from road to rail where appropriate and possible.
	Introduce pedestrian- and bicycle-friendly means of delivery, and associated facilities and infrastructure.
	Implement and enforce anti-idling measures.

SOURCES: CIVITAS (2015) AND VREF (2016)

# KEY MESSAGES

- Freight movement must be flexible and respond to changing urban environment.
- Seeking freight solutions involves multiple stakeholders: the government, neighbourhoods and the private sector (logistics, shippers, distribution and warehousing, property owners and commerce).
- No single solution will be able to address and resolve all urban freight challenges, but an appropriate mix of initiatives (see the Typology of urban freight interventions on page 17) – from regulatory to market-based measures, land-use planning, infrastructure, behaviour-change measures and technology – are likely to add up.



Non-motorised modes of peri-urban and inner-city delivery, such as delivery bicycles, pose less of a risk for pedestrians. These modes also produce no emissions, generate less noise, and promote a more liveable environment.

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Worldwide cities are stepping forward to reduce their rapidly increasing carbon emissions from passenger or freight transport. African cities are tackling the provision of accessible and effective transport services in contexts particular to our developing economies and rapid urbanisation patterns. Our cities face issues such as changing lifestyle aspirations, spatial economies with the poor relegated to the peripheries, complementary or clashing interactions between formal and informal transport providers, lack of public investment in transport infrastructure and services, and inherited policies and planning that did not factor in emissions implications.



This is one in a series of publications produced by WWF South Africa's Transport Low-Carbon Frameworks programme under the auspices of WWF's global One Planet Cities Challenge (see [wwf.org.za/what\\_we\\_do/opcc](http://wwf.org.za/what_we_do/opcc)). 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.



**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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