HOW TO BUILD TRANSIT ORIENTED CITIES

EXPLORING POSSIBILITIES

South African CitiesNetwork

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ACKNOWLEDGEMENTS

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LIST OF ACRONYMS

BEPP	Built Environment Performance Plan
BRT	Bus Rapid Transit
CBT	Campaign for Better Transport
CPRT	Current Public Transport Record
CSIR	Council for Scientific and Industrial Research
DfT	Department for Transport (UK)
DoT	Department of Transport
DPME	Department of Performance Monitoring and Evaluation
DPW	Department of Public Works
DRT	Demand Responsive Transport
ETA	eThekwini Transport Authority
GMS	Growth Management Strategy
GPRS	General Packet Radio Service
GPS	Global Positioning System
ICDG	Integrated City Development Grant
ICT	Information and Communication Technology
IDP	Integrated Development Plan
IPTN	Integrated Public Transport Network
IRTN	Integrated Rapid Transport Network
LAA	Land Availability Agreement
MBT	Minibus Taxi
MIG	Municipal Infrastructure Grant
MTRC	Metro Transit Rail Corporation
NDG	Neighbourhood Development Grant
NFC	Near Field Communication
NLTA	National Land Transportation Act
NLTTA	National Land Transport Transition Act
NMT	Non-Motorised Transport
NPC	National Planning Commission
NTLA	National Land Transport Act (2009)
PRASA	Passenger Rail Agency of South Africa
PRE	Provincial Regulatory Entity
PTA	Peninsula Taxi Association
PTIG	Public Transport Infrastructure Grant
PTISG	Public Transport Infrastructure and Systems Grant
PTNOG	Public Transport Network Operations Grant
PTNOS	Public Transport Network Operating Subsidy
PTOG	Public Transport Operations Grant
PTOS	Public Transport Operating Subsidy
RTMC	Road Traffic Management Corporation
SACN	South African Cities Network
SATS	South African Transport Services
SDF	Spatial Development Framework
SPLUMA	Spatial Planning and Land Use Management Act
StatsSA	Statistics South Africa
TOD	Transit-Oriented Development
UK	United Kingdom
USDG	Urban Settlement Development Grant
WHO	World Health Organization

AUTHOR PROFILES

Fatima Beg is an Urban Governance Advisor at the Gesellschaft für Internationale Zusammenarbeit (GIZ). She studied economics at the University of Hamburg and political economy of development at the School of Oriental and African Studies (SOAS) in London. For six years, she worked on transport budgets and financing policy at National Treasury, an experience that provided her with an in-depth understanding of the sector and subsidy system. With public transport being an urban development focus, she continues to work on the issue and is excited by the possible public transport future of South African cities.

Geoffrey Bickford is a researcher at the South African Cities Network, managing the public transport portfolio. Having previously worked as a transport planner for a global built environment consulting firm, he has a particularly strong appreciation of transport challenges facing urban areas. He has a BSc Honours in Urban and Regional Planning and is currently working towards a Master of Philosophy in Transport Studies. He is particularly interested in the relationship between land-use patterns and transport systems.

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a project manager at the Auditor-General. She has a keen interest in understanding the workings of intergovernmental fiscal systems.

Rehana Moosajee is an independent consultant and international speaker who focuses on helping organisations and individuals to get results beyond expectation by adding heart to everything they do. Between 2006 and 2011, she was the Mayoral Committee Member for Transport in the City of Johannesburg and was reappointed to the portfolio after the 2011 local government elections until her resignation in February 2013. During her tenure, Rehana and her team established the Transport Department as a stand-alone department, and were responsible for transport during the Confederations Cup 2009, FIFA World Cup 2010 and the African Cup of Nations 2012. The team delivered Africa's first full bus rapid transit system (Rea Vaya) in under three years. She remains passionate about people-centred, participatory and holistic approaches to development.

David Schmidt is a Director of Strategies for Change, an independent consultancy specialising in leadership, innovation and strategy. He has been a prominent figure in developing regional and city strategies in South Africa and in facilitating multi-stakeholder collaboration. He has worked with the taxi industry for the past three years, supporting them in their negotiations with the City of Cape Town about the introduction of the MyCiti BRT project. He has degrees in public management, economics and law.

PREFACE

Developing integrated public transport networks is complicated the world over but, in South Africa, is further complicated by the challenge of addressing a spatial legacy that has contributed to a fragmented and sprawling urban landscape. While the enormity of the problem has been acknowledged, this challenge also presents a major opportunity to envision, invest in and create the South African city of the future.

The 2010 FIFA World Cup provided the perfect impetus for introducing a range of transport options, such as the bus rapid transit systems (Rea Vaya in Johannesburg, A Re Yeng in Tshwane and MyCiti in Cape Town) and the Gautrain. The introduction of these world-class transport modes suggests that South Africa, in particular the major metros, possesses the vision and capacity for implementing complex institutional transport arrangements. However, these developments are just the first step towards the building of an integrated transport system, as envisaged by the White Paper of 1996, the Public Transport Strategy of 2007, and the 2009 National Land and Transport Act (NLTA).

The NLTA recognises that metro municipalities are well located and have the ability to develop the necessary capacity for creating integrated public transport networks. The massive investments that follow (and are planned for the future) acknowledge the potential of public transport to transform the spatial, economic, financial and environmental inefficiencies in urban areas.

Creating public transport-oriented lifestyles, which allow for better connectivity, social engagement and improved efficiency, is seen as key for our future urban vision. But how can this be achieved? What are the steps and incentives for building cities that have an efficient and effective integrated public transport network? Specific questions that need to be asked are:

- How do we promote public transport as aspirational and a viable alternative to private transport use?
- What are the planning tools and incentives for improved land use, human settlements and transport integration?
- What institutional arrangements would facilitate this integration?
- What funding mechanisms exist to drive innovation and integration in the built environment?
- Do we understand the needs (current and future) of public transport users and how do we engage them more centrally in the planning and implementation process?
- What are the opportunities for using renewable energy sources and technological advances to improve the public transport experience?

This timely publication begins to unpack these critical questions. Public transport will play an essential role in addressing the spatial and socioeconomic inheritance in South Africa. It will also help define the city of the future. But we have to get this right, as the investment we make now will determine our built environment legacy. There are many lessons to be learnt from all over the world, from the continent, and right here in South Africa. While not aiming to be an exhaustive account, this book begins to reflect on these lessons and opportunities for cities in their pursuit of efficient and integrated public transport that improves mobility, inclusivity and access.

Sithole Mbanga, South African Cities Network CEO

OUR CITIES ARE ALIVE

May 2030

Welcome to a special edition of *Urban Mobility* that showcases the City Alive complex, winner of the international Design for Life award for best new mixed use and income development in 2030.

City Alive wins the international Design for Life award

What impressed the judges the most was the way in which 'diverse housing options were skilfully and creatively integrated with retail, commercial, educational and recreational facilities, to produce liveable, accessible and inclusive spaces for all who live, work and play in the city'. They also praised the fact that the development contains both low-income housing and traditional middle-class apartments, which are 'indistinguishable from each other'.

City Alive is the latest in a series of developments that have propelled South Africa to the forefront of urban integrated public transport and development. It is just one more example of how partnerships between the private sector, national government and cities have transformed (and are transforming) South Africa's cities. Underpinning these developments is the South African Public Transport Model, which is fast becoming the standard for affordable and functional urban transport systems throughout the developing world. The model marries the cost effectiveness and flexibility of the community transport sector with high quality rapid bus and rail networks along strategic corridors and major truck roads.

Urban Mobility decided to go and find out what makes the City Alive development distinct and to hear the views of those who live, work and play in this part of the city.

Demand for City Alive-type developments is growing

Our first stop is with Mr Zulu, the founder and CEO of Transit World Developers, the company behind the City Alive complex. He has used public transport all his life and is jubilant that occupation is at 95% across the development, just one day after the official launch. 'The response has been outstanding,' he says, 'but I am not surprised by the demand for our transit-rich properties. We are going to see more and more people moving to transit-oriented developments because of astronomically high petrol prices coupled with dramatically improved public transport services.'

More and more people use public transport

The improved public transport network means that more and more people are choosing not to own and drive private vehicles – the Central Square intermodal station just next to City Alive sees over one million passengers pass through its doors daily. We spoke to resident Jacques Venter, who says he doesn't own a car anymore, 'I no longer feel I have to have one and I hated paying so much for parking. It's easier to take public transport and, if public transport won't get me there I know I have my bicycle'. Mr Venter is not alone in appreciating his bicycle. Mayor Thando Molefe caused a small stir on his first day in office, refusing the traditionally allocated parking bay, and opting instead for a mayoral bike rack. (As a result, his staff jokingly presented him with a 'bicycle chain of office'.)

Even the mayor is on his bike

We caught up with the mayor at the opening of the revamped minibus rank, part of the Central Square station. 'Cycling is a way for me to connect with the citizens and really get to grips with what is going on in the physical urban spaces. Keeping fit and healthy is an added benefit. It also helps that public transport allows me to take my bicycle where ever I go', he said. Accompanying the mayor was the head of the City Transport Authority, Letishia Moodley, who explained that the city receives a portion of the rental income from the City Alive development, under a structured agreement for value capture. The money is ring fenced and

URBAN MOBILITY
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May 2030

used to cover the operating shortfall of the public transport network. What this does is create a 'reinforcing cycle of growth, as the City is able to spend surplus revenues on improving the public transport experience'.

CityGo card simplifies public transport

Also at the opening was the national Minister of Housing, Letimile Hlongwane, who was proudly showing off her CityGo card, which she describes as her 'new car key'. 'If I don't have it with me, I feel stuck!' she exclaimed. CityGo cards, which exist under different names across all cities in South Africa, provide access to minibus taxis, buses, trains and bike-share bicycles. 'Even better,' she explained, 'as fares are integrated across all modes of transport, I can choose which fare package suits me best – this card has revolutionised my life.'

Technology has revolutionised the minibus taxi industry

Even more revolutionary is what's happened in the minibus taxi industry, with the introduction of new technology that has transformed the lives of minibus taxi passengers and drivers and operators. Passengers and operators benefit, which sets up a virtuous cycle: more passengers, more operator profitability, more investment in newer, more fuel efficient and bigger vehicles, leading to improved service and growing passenger numbers. This improvement has encouraged transport authorities to embrace the minibus taxi industry as partners, hence the revamped transport exchange.

We asked Sam Mofokeng, who operates 16 taxis, about how things have changed. 'Our on-board wifi and television screens mean that our passengers have access to information and entertainment,' enthuses Mr Mofokeng, 'while the on-board cameras and vehicle tracking systems have improved safety by 150%'. A recently launched app allows operators to run their fleet more efficiently: bookings along the route can be combined, and so minibus taxis can collect a full load of passengers from their homes or workplaces, or from stops on the street. 'My taxis are now fully loaded and, even better, my drivers are more careful on the road because I receive an immediate alert if any passenger gives the driver a bad rating,' says Mr Mofokeng, who is planning to add a further 10 taxis to his fleet this year.

Businesses stay open late

Upon leaving the minibus rank, we are struck by how vibrant and busy the streets are, in an area which was considered too dangerous to walk about in, especially at night. The transport service has extended its hours, and so businesses are now able to operate later in the evenings, as patrons and staff are assured a safe trip home until all hours. We stop to chat to a street trader, Ellen Benefeld, who has just completed her rental agreement with the city for an apartment in the development. Smiling, she says, 'It has all come together for me, I live just here (pointing to her apartment which can be seen from her stall), so my transport is free, my kids' school is nearby, business is good and I'm looking to grow.'

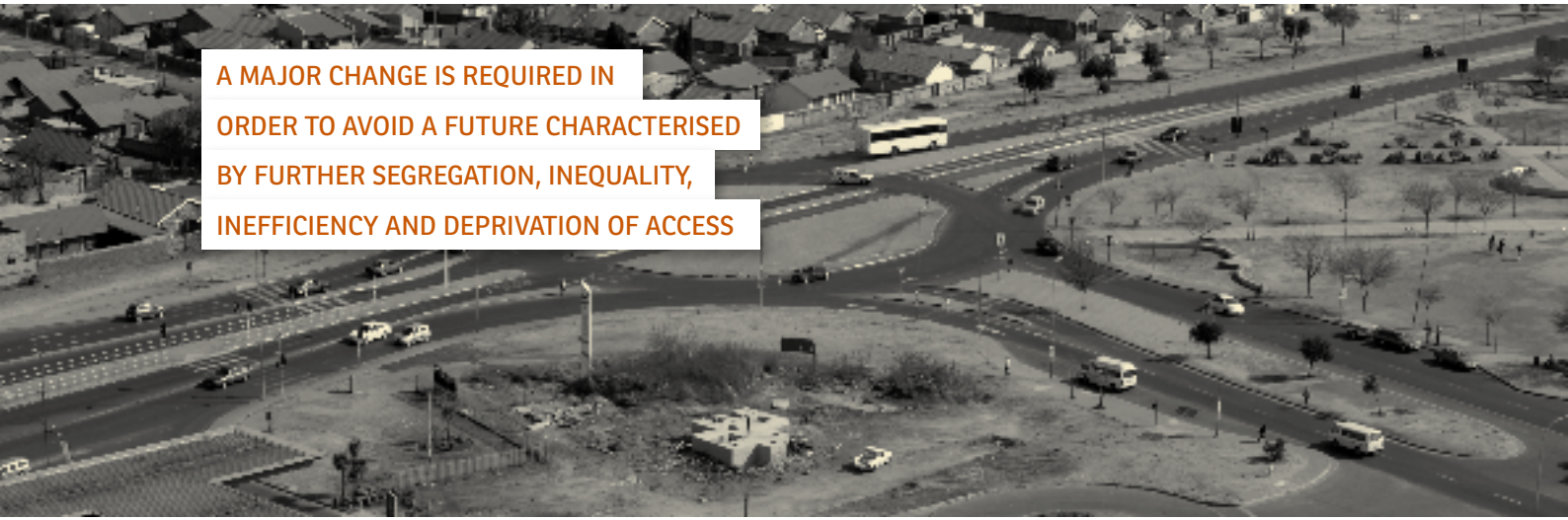
Everyone wins

With so much hype surrounding City Alive's award, you could be forgiven for thinking it was just a publicity show. Instead, we found that everyone benefits from the development and that South African cities are justifiably leading the world in integrated urban development. We applaud the leadership, vision, determination to collaborate, the commitment to innovation and the boldness to implement, even when early efforts seemed to yield limited results.

INTRODUCTION

Geoffrey Bickford

INTRODUCTION



A MAJOR CHANGE IS REQUIRED IN ORDER TO AVOID A FUTURE CHARACTERISED BY FURTHER SEGREGATION, INEQUALITY, INEFFICIENCY AND DEPRIVATION OF ACCESS

> A great deal of progress has been made since 1994, but South Africa is far from achieving the Reconstruction and Development Programme (RDP) goals of 'breaking down apartheid geography through land reform, more compact cities, decent public transport and the development of industries and services that use local resources and/or meet local needs'. Despite reforms to the planning system, colonial and apartheid legacies still structure space across different scales.' (NPC, 2011: 260)

South African cities are in a challenging position, as they have shifted towards a more sustainable transport landscape, but the general structure of the built environment remains largely unaltered. And, while a shift has occurred within transport thinking in the country, largely galvanised by the hosting of the FIFA World Cup, much remains to be done. There is a growing awareness that, despite the understanding that transport and land use are mutually dependent (Bertolini, 2012), transport investment alone will not automatically generate spatial restructuring. A host of factors enable and facilitate the growth of transit-oriented cities – investment in improved public transport is but one, albeit critical, ingredient in the transformation agenda.

The urban future looks problematic, if cities continue to do business as usual, i.e. delivering transport interventions in isolation from other built environment solutions. A major change is required in order to avoid a future characterised by further segregation, inequality, inefficiency and deprivation of access. Enabling and incentivising all stakeholders to plan and implement in

a more integrated, sustainable and equitable manner will provide the impetus to drive change. Such a shift in thinking – promoting innovative context-specific solutions and championing an alternate growth trajectory for South African cities – will place urban South Africa at the forefront of sustainable, inclusive and productive development within the global arena. Yet the enormity of the task cannot be underestimated. Transformation is a multi-dimensional concept, 'a fluid, open-ended, multi-levelled process and is perhaps most effectively captured by the notion of "tension-ridden planning-in-motion"' (Williams, 2000: 171). The transformative path is thus one that requires contention, re-imagination and exploration. If driven by iterative processes of learning and implementing that break away from business-as-usual approaches, transformed outcomes are undoubtedly achievable.

The purpose of this series of papers is to delve into how to transform the built environment in the current South African urban context. This publication is not meant to provide a comprehensive outlook, act as a manual or framework, or even advocate for change (there is already widespread support that change is needed). Rather it explores what could occur within some of the areas that are pertinent to the transformation of public transport in South African cities. The introductory chapter reflects on the current state of public transport in South African cities within the broader context of transforming the built environment. After providing a brief pre-1994 historic contextualisation, the post-1994 transport interventions and outcomes are explained, followed by an exploration of the transformation role of cities. The chapter culminates in a discussion on the role of transport in restructuring the built environment and the meaning of spatial transformation for South African cities: how to define spatial transformation, whose business is it and what are the necessary conditions for achieving transformed urban spaces.

THE SOUTH AFRICAN LAND USE-TRANSPORT RELATIONSHIP

The history of the land use-transport relationship is relatively unique in South African cities. Before the advent of the car era, the growth of South African cities was strongly related to public transport, which historically has always been delivered by a range of stakeholders. After the Second World War, the rapid increase in car ownership and use dramatically altered the spatial landscape of cities throughout the world, and South African cities were no exception. With an unprecedented level of investment in road networks catering for private vehicle-based movement, the more peripheral urban areas became accessible, prompting rapid sprawl across cities. At the same time, the introduction of apartheid spatial planning enforced the deeply discriminating and compartmentalising of settlements. Although racial discrimination had been a long-standing feature of public transport services in South Africa, the forcible removal of many black people to the urban periphery exacerbated the outward expansion of urban areas.

The majority of black people living in cities were structurally dependant on public transport to access the city (which they had to do in order to earn an income). Public transport thus facilitated the controlled movement of black labour in and out of South African cities on a daily basis. However, with the prioritisation of private vehicle

infrastructure, public transport investment declined, resulting in deteriorating public transport service quality. The consequences of poor public transport services were increasingly felt by peripheral black communities, as the majority of white urban residents were able to afford private vehicles.

The situation of black communities was made worse by the settlement patterns of peripheral black townships, which were not transit-oriented and instead resembled a perverse suburban style, largely consisting of a single house per stand. The result was that transit-dependent communities were forced to live in vehicle-oriented settlements. As these relatively low density peripheral areas grew, public transport became increasingly less feasible and less accessible. This poor land use-transport relationship paved the way for the rapid growth of the minibus taxi, as a flexible alternative that provided a public transport service in a car-oriented environment.

Despite the arrival of democracy in South Africa in 1994 and a good understanding of these problematic land use-transport relationships (as discussed in the next section), the status quo has remained stubbornly in place. The delivery of subsidised RDP housing[1] has largely taken place on the periphery, exacerbating the mismatched land use-transport relationships in poorer urban areas. Continued under-investment in public transport has reinforced the dominance of private vehicles across South African cities, and private property investors have responded by developing vehicle-oriented developments.

Essentially, the land use-transport relationship present in South African cities has become one that is oriented towards the private vehicle, even in transit-dependent communities. Awareness is growing about the many socioeconomic, environmental and spatial issues caused by private vehicles in cities across the globe (Cervero, 2001; Newman and Kenworthy, 1996; Vasconcellos, 2003). However, even with the noticeable increase in investment in public transport, the challenge will be to overcome the predominance of vehicle-oriented city growth.

THE POST-1994 AGENDA

The newly elected democratic government understood that part of the inherited urban challenge was the poor integration of land use and transport, and the dominance of private vehicle infrastructure. It recognised that most people were captive users of very poor quality public transport services, yet investments catered for the minority of private vehicle users. Since 1994, a clear policy shift towards prioritising public transport has occurred (Wilkinson, 2006). The emphasis has also been on strengthening the integration of land use and public transport; this thinking comes through clearly in the White Paper on National Public Transport (1996), which states that 'transport can also play a leadership role, for example in acting as a catalyst for development or in correcting spatial distortions'. This notion, that transport can drive spatial restructuring, underpins South African urban policy and strategy. The White Paper also highlighted the awareness of the inherited consequences of ill-aligned public transport and urban development:

1. RDP housing refers to housing units built under the Reconstruction and Development Programme (RDP), the socioeconomic policy framework implemented by the post-1994 democratic government.

> Land use and transport development are not integrated owing to a fragmentation of responsibilities for the administration, planning and regulation of the various aspects of land use, infrastructure, operations and regulations. This fragmentation and the legacy of apartheid policies has led to low density development, spatially dislocated settlements and urban sprawl, resulting in inordinately long commuting distances and times, low occupancy levels, high transport costs and low cost recovery. The current housing approach which supports single units on single plots will not achieve the densities required, and conflicts between housing and transport policies need to be resolved.

In accordance with this understanding, 'spatial restructuring' means that densification would be required to combat the public transport–land use divide, through prioritising denser, infill, mixed land-use developments along public transport corridors. The White Paper's spatial strategic objectives for passenger transport included:

- To encourage more efficient urban land use structures, correcting spatial imbalances and reducing travel distances and times for commuting to a limit of about 40 km or one hour in each direction.
- To promote the use of public transport over private car travel, with the goal of achieving a ratio of 80:20 between public transport and private car usage.

The message was clear: public transport service levels were poor and needed to be addressed from a customer perspective. The constants of transport policy in post-apartheid South Africa have been the lack of integration of public transport and land use, resulting in highly inefficient and unequal spatial landscapes, and the need to prioritise denser mixed-use developments along public transport corridors. The devolution of transport responsibilities, especially in the metropolitan areas, was seen as critical to achieving improved outcomes.

TRANSIT DEPENDENT COMMUNITIES WERE FORCED TO LIVE IN VEHICLE ORIENTED SETTLEMENTS

EFFORTS TO DELIVER ON THE VISION: THE INCREASING RESPONSIBILITY OF CITIES

The policy shift was clear after 1994, but the outcomes at local government level have been less clear. In South Africa's transition to more integrated and sustainable cities, local governments are seen as essential to the new growth agenda and, in particular, to improved and integrated public transport services. However, local government structures are in their infancy, existing in their current form for just over a decade, and despite some promising progress, much work remains to be done.

The National Development Plan (NDP) lays out a 20-year development outlook and attempts to shift the growth trajectory, to arrive at a South Africa in 2040 that is more inclusive, productive, sustainable and liveable (NPC, 2011). City growth and development will play a pivotal role in galvanising a new growth path. Therefore, the core of the plan for urban areas is addressing the

ever-growing spatial inefficiencies and inequalities that persist across all South African cities. The growing socio-spatial divide is resulting in severe resource inefficiencies and entrenching high levels of socioeconomic inequality within the DNA of South African society.

Acknowledging the important role of cities in achieving the NDP vision, an Integrated Urban Development Framework (IUDF) is currently being drafted to provide a more coherent direction for coordinating interventions at the city level. The IUDF is a framework that 'builds on and seeks to take forward the work of the National Planning Commission by developing a strategy to operationalise more integrative urban management' (DCoG, 2013: 8). It strengthens the prominent role envisioned for cities in transforming South African urban spatial patterns. Transport is acknowledged as a major contributor to shaping future urban growth, (NPC, 2011: 266):

> Transportation networks are critical to the spatial transformation of urban areas. There has been progress in some cities in delivering new public transport infrastructure, but the major shift from supporting private cars to incentivising public transport is yet to happen, and insufficient attention has been given to integrating modes of transport and coordination across municipalities.

This emphasis, on cities as the drivers of transformation, has been in place since 1996, and so it is worthwhile to look at the progress made by cities over the past two decades.

Devolution

The devolution of the transport function to the lowest appropriate level of government has long been seen as essential in improving transport services. The underpinning principle is that a single entity can more effectively plan and manage a transport network than having multiple stakeholders delivering different modes and services in a single area. The National Land Transport Transition Act (NLTTA) No. 22 of 2000 made provision for the formation of Municipal Transport Authorities, but did not provide directives on devolving the contracting and regulatory services from provincial government or the rail services from national government. Thus, even where municipal transport authorities were developed, they were largely ineffective (Cameron, 2005). The National Land Transport Act (NLTA) No. 5 of 2009 commits to the devolution agenda and provides direction on devolving road-based contracting and regulating functions from the provincial level, but does not provide clear directives on rail (Schmidt and McKenzie, 2012). So, although the NLTA supports devolution, many questions remain.

Devolving the transport function to local government level, especially in the larger metropolitan areas, remains important, but some resistance and uncertainty remains around devolving bus operating contracts (including minibus operating licences) from the provincial sphere and rail planning and operations from the national sphere. This has thus inherently limited the ability of cities to have a widespread influence over public transport in their respective jurisdictions. However, some metropolitan local governments are beginning to act in accordance with the NLTA and to take on more transport functions and responsibilities. In the short term, the most likely transport function to

be devolved from provinces seems to be bus contracts and minibus taxi operating licences. This will test local government capacity and systems.

Devolution also creates an opportunity for cities to drive transformation in the built environment. If city governments prepare adequately, by developing innovative and integrated systems, the status quo can be challenged, especially since the human settlements function is concurrently being devolved. However, the risk is that systems operating under a silo-based system are simply passed on to a different sphere with little to no change in outcomes. Moving away from this institutional 'lock-in' will require exploration, innovation and bold attempts to implement alternative solutions. The exploratory studies presented in this book will prove invaluable to developing thinking around how metropolitan local government can more effectively drive public transport-led built environment transformation.

Integrated rapid public transport networks

Given that the fragmentation of service provision across public transport networks in South Africa is a major challenge to mobility and accessibility, the integration of various modes and services has been a prominent objective of public transport transformation. However, multimodal integration has proved to be challenging.

The 2010 FIFA World Cup provided the impetus for public transport improvements. The Public Transport Strategy and accompanying action plan produced in 2007 paved the way for the development of integrated rapid public transport networks (IRPTN) (Schmidt and McKenzie, 2012). The intention was to create rapid transit corridors, consisting of a mixture of rail and bus, to serve as the public transport backbone. Local governments were to be the drivers of IRPTN development, and the Public Transport Infrastructure and Systems Grant (PTISG) was established for developing bus rapid transit (BRT) services that would complement rail, which already existed in certain areas.

An important component of the strategy was the development of infrastructure for non-motorised transport (NMT) feeder services and the densification along corridors. The PTISG included finance for developing NMT infrastructure, but how densification might occur is unclear. Although the grant has resulted in BRT systems in certain municipal areas, the BRT systems do not appear to have been catalysts for multimodal integration or spatial restructuring. Nevertheless, the BRT investments have provided an opportunity for cities to become more prominent role-players in the provision of public transport. The challenge ahead will be to ensure integration between various modes and to strengthen the alignment with urban growth.

Planning emphasis on corridor development

Since 1994 corridor development has become synonymous with spatial planning. In line with the White Paper, densification and mixed land use along transport corridors have been promoted in the majority of spatial development frameworks (SDFs), which are the spatial component of cities' integrated development plans (IDPs), the leading planning tools for municipalities. More recently, metropolitan municipalities have promoted transit-oriented development (TOD) as a way to achieve spatial restructuring. TOD is an internationally popular

term used to describe dense, mixed land use, pedestrian and cyclist priority precincts that are inextricably linked to public transport systems.

TOD thinking seems to be growing in importance across some of South Africa's largest metropolitan municipalities. However, to date, despite planning intentions, transit-oriented corridor development is limited. Although public transport-based access and mobility has improved over the past five years, private vehicle-based access still seems to be driving development processes and decision making, often working in direct contradiction to planning intent. This publication is an attempt to grapple with how cities can begin to build transit-oriented cities that capitalise on the access and mobility benefits provided by improved public transport systems. Building dense liveable communities around public transport infrastructure enables greater portions of the population to access transport services and also makes public transport more financially sustainable.

THE ROLE OF TRANSPORT IN SPATIAL TRANSFORMATION

The IUDF Discussion Document highlights the enormity of the spatial challenge facing South African cities, stating that 'it is harder in 2013 to reverse apartheid geographies than it was in 1994' (DCoG, 2013: 16). The infrastructure and service levels required for such disparate spatial layouts of cities are enormous and, in a resource-constrained environment, place huge pressure on state systems. City systems are particularly affected, as local government is largely responsible for the delivery of services. This pressure is arguably going to increase with the devolution of the human settlements and transport functions to local level.

The highly dispersed, mono-functional land use layouts of cities adversely affect not only government systems but also residents. People have to travel long distances to and from places of work, which translates into higher travel costs and less time and money to spend on other social or recreational aspects that result in more fulfilled lifestyles. The reality in South Africa is that many of the poorest people in urban areas live in the most peripheral locations of cities and are most disadvantaged by the long travelling distances (Behrens and Wilkinson, 2003).

Spatial transformation is at the core of addressing the issues faced in South African society. While the tendency has been to suggest that transport can lead to spatial restructuring, as presented in the White Paper, the reality is more complex. Transport and land use are mutually dependant (Bertolini, 2009; Newman and Kenworthy, 1996), and public transport can serve as a catalyst to land intensification but will not automatically achieve spatial restructuring or transformation.

Spatial transformation in a South African context

The transformation required in South Africa is not merely spatial and physical, but also socioeconomic and environmental. Within the spatial context of South Africa cities, important considerations are the particular location and network distribution of public transport improvements and affordability levels, which are crucial for a more equitable distribution of improved access to opportunities in cities. Transport has a fundamental

role to play in reducing the large and growing levels of inequality that exist in society. Public transport can also bring environmental sustainability benefits. Globally and in South Africa, transport is the second largest contributor to greenhouse gas emissions, and so moving people and goods in a way that places less pressure on natural resources and systems is of paramount importance. A key aspect is how transformation can create a prosperous and healthy future for urban residents. Sustainability is therefore a constant thread that implicitly weaves throughout the narrative of this publication. Building more inclusive and sustainable urban spaces is central to achieving effective transformation.

TOD THINKING SEEMS TO BE GROWING IN IMPORTANCE ACROSS SOME OF SOUTH AFRICA'S LARGEST METROPOLITAN MUNICIPALITIES

Improved public transport is but one component of transformation

Many commentators (from the planning, economics and property development fields) have argued that investing in high-quality, fixed-line transport is a catalyst for development intensification. Simply put, the fixed line transport infrastructure offers a platform for densification, through increased capacity to support high-density developments, mobility and accessibility benefits, and by providing long-term confidence to private investors. However, transport investment alone will not automatically generate spatial restructuring, as explained by Belzer and Autler (2002: 27) reflecting on the TOD experiences in America:

> Even with transit, however, any given site must still compete with every other site in the region for development. Since transit is only one of many factors driving development, many other sites may prove more attractive to developers. To be sure, the public sector – most notably local government – can elevate market demand at a site by working to create more of the necessary conditions for development. But without strong existing demand or coordinated policies to help create it, transit alone will not drive appropriate development even if it leads to increases in land costs.
>
> This can make transit-oriented development a particular challenge in low-income areas, where the real estate market is usually weak. Real or perceived problems such as crime, social problems, and deteriorated physical conditions deter investment. Either investment will simply not occur or the quality of the development will be compromised. As a result, new development in transit-rich low-income neighborhoods is very difficult to achieve and often lacks the full set of features, such as appropriate site design and pedestrian connectivity that would maximize location efficiency. Under these conditions well-planned transit investments can constitute a key piece of an economic development or revitalization package, but a host of supporting policies, incentives, and investments are also necessary.

In South Africa, transport investments will be required in lower-income areas in order to drive more equitable land use-transport arrangements, highlighting the need to think about conditions necessary for TOD-type

development. Building or upgrading public transport systems has 'the potential to 'restructure' cities through providing the capacity needed to support high intensity growth and development', but land-use intensification does not automatically follow. In other words, public transport investments do not always lead to faster development but 'can have a positive impact on land values and commercial rents'. As an example, the MyCiti (BRT) investment in Cape Town is unlikely to lead to development in the short-medium term without supporting development strategies, policies, tools and mechanisms (Behrens and Grey, 2013: 38).

Spatial transformation has been at the core of post-apartheid urban policy (Wilkinson, 2006) and its aim is relatively clear: a concerted effort to restructure the built environment around the principle of inclusivity is needed to address the socio-spatial inequalities inherited from apartheid planning. However, the socio-political spatial challenges can make decisions difficult. Spatial inefficiencies have been exacerbated by the decisions to locate low-cost housing on the periphery of cities, where land is more affordable. Yet these decisions cannot be assessed in isolation of the land dynamics at play in South Africa through the land legal system, land-use planning frameworks and the principles underpinning land-market functionality. A particular political system, institutional arrangements and various funding mechanisms underpin these elements and also contribute to spatial outcomes.

Therefore, to galvanise a shift in built environment outcomes, energy must be directed at each of the facets which play a fundamental role in driving spatial transformation (Dittmar and Ohland, 2004). By acknowledging that a host of factors and stakeholders are involved, a solid foundation can be created to ensure that energy is directed at each of the various areas and that there is synergy between the various factors. Coordination and integration are terms that resound through post-apartheid policy and strategy documents, but achieving these concepts in practice has proved difficult (DCoG, 2013).

Necessary conditions of transformation

Strengthened integration of transport and land use is essential to the transformation of cities. TOD is an important tool for achieving this integration, and experiences elsewhere illustrate the value of having certain supportive factors in place. These range from facilitating and enabling factors (e.g. political and institutional architecture, funding mechanisms, land use and planning tools) to operational elements (e.g integrated ticketing and technological enhanced services). All these factors contribute to improving the quality of public transport services, which in turn increases confidence in public transport as an attractive and viable transport option, which is essential to driving developer interest. This publication examines some of these supportive factors.

Politics and institutions

Examples of effective land use and public transport integration from around the world share common elements of strong leadership and highly coordinated institutional arrangements involving a variety of stakeholder groups. Importantly, 'siloed' approaches to city building will not result in urban growth structured around and oriented towards public transport. **Rehana Moosajee** looks at what

is meant by sustainable urban mobility and what is required to achieve stronger institutional coordination, especially in light of the devolution of the transport function to certain municipalities. She examines the type of leadership required, and how transport-related functions can be integrated both horizontally and vertically.

Public transport finance and investment

To date, the PTISG has been the main source of public transport spending within South African cities. However, funding for transport projects is being placed under scrutiny, as large operation subsidies are required to run services, in part because of spatial inefficiencies. An important starting point for the broader funding discussion would be to unpack how cities have invested in public transport and what the outcomes have been. In her chapter about public transport financing, **Amanda Jitsing** explores a number of key themes and insights that will help national, provincial and local government to improve the design and application of funding mechanisms.

Technologies and operations

Today information technology is a fundamental aspect of urban lifestyles. Increasingly, public transport users are seeking service information that is communicated simply and accurately via ICT platforms, and public transport operators are drawing on technology to improve services. There are many ways in which technology can be used to improve existing transport services. **David Schmidt** looks at technological solutions in the minibus taxi industry, using the experience of a pilot project in Cape Town, while **Jesse Harber** examines the role of integrated ticketing and fares.

Land management systems: planning tools and incentives

TOD development tends to focus on the proximity to transit and density, and neglect the other principles that are central to improving land use and transport integration. Indeed, the way in which TOD has been interpreted in South Africa has diluted the strength of the concept quite substantially. A package of complimentary tools and incentives is widely regarded as the most effective manner in which to shape and direct growth through TOD. While recognising that land management alone cannot transform the built environment, the chapter by **Stuart Paul Denoon-Stevens** provides a starting point. It looks at possible tools and incentives that can realise the principles of TOD and how they can be packaged to improve co-ordination between land use, property development and public transport in South African cities.

The understanding that transport outcomes are dependent on many cross-cutting issues raises many strategic questions about which issues are most pertinent to the transformation of the built environment. This series of exploratory studies, while not exhaustive, will provide insight into a range of issues that affect transport outcomes, including political and institutional arrangements, financial and funding mechanisms, land management planning and implementing tools, and technology and innovation. These issues are by no means isolated from one another and are indeed interdependent. The hope is that this series of papers will provide thought-provoking insights into the real challenges and exciting possibilities that exist in attempting to confront the car-oriented development tendencies and to begin building transit-oriented cities.

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CREATING TRANSIT-ORIENTED CITIES THROUGH BOLD LEADERSHIP[1]

Rehana Moosajee

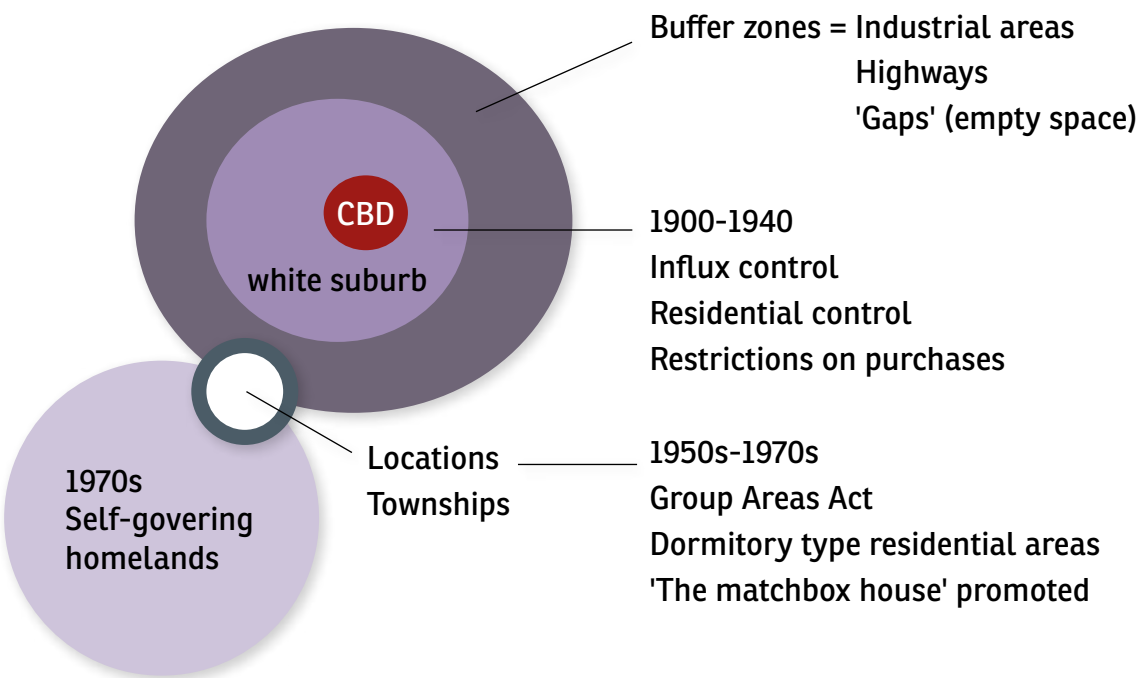
INTRODUCTION

Unless mobility habits change, '[t]raffic congestion will bring cities worldwide to a standstill' by 2025 (Arthur D. Little and UITP, 2014: 4). The use of private vehicles continues to rise, with '6.2 billion private motorized trips every day in cities of the world' (ibid); public transport offers a way to help cities to improve urban mobility, which is the number one priority for cities wanting to attract investors (Arthur D. Little and UITP, 2014: 6).

Urban mobility is recognised as a formidable challenge facing cities across the globe, but in South Africa the situation is exacerbated by the country's history. The shape and form of South African cities in 2014 have been determined by apartheid ideology, which sought to separate people of different 'race groups'. All economic centres were associated with 'white' settlements, but the segregated groups had to be sufficiently close to provide a labour pool, i.e. within commuting distance and returning to dormitory townships to sleep. Transit infrastructure was designed to bisect 'group areas', to provide further barriers to any interaction among residents of different races.

1. The paper draws primarily on the practical experience of the author in leading and championing Transport Transformation in the City of Johannesburg Metropolitan Municipality and the learning derived in the period 2006–2013, as well as desktop research resources (Arthur D. Little and UITP, 2014; DoT, 2012; Frank et al. [n.d]; Litman, 2012, 2014; Price, 2001.

Figure 1: Apartheid legacy: spatial engineering through policy



Source: Tsela Tshweu Design Team [n.d.]

The absurdity of apartheid spatial planning flies in the face of sound city development policies and international best practice on transport planning and land use. Yet, over the past 20 years of democracy, the practice of locating the poor on the periphery of economic opportunity has largely continued and has worsened the burden of transport costs on poor households. The emergence of decentralised economic hubs close to affluent suburbs has added to the problem by effectively increasing travelling distances, times and costs for the marginalised poor. Today, the apartheid city form is a stark reality that must be confronted, dealt with and transformed. Public transport has the potential to be a key lever in the transformation of the built environment in South African cities.

However, spatial transformation of democratic spaces is not only about overcoming the spatial legacy of apartheid but also about a radical departure from car-centric principles and policies. It is about fundamentally changing the way in which residents interact with each other, the shared spaces and urban fabric. In other words, transit-oriented development (TOD). The TOD Standard outlines the following eight criteria for urban development (National Treasury, 2013):

1. Develop neighborhoods that promote walking [WALK]
2. Prioritize non-motorized transport networks [CYCLE]
3. Create dense networks of streets and paths [CONNECT]
4. Locate development near high-quality public transport [TRANSIT]
5. Plan for mixed use [PLAN]
6. Match density and transit capacity [DENSIFY]
7. Create compact regions with short commutes [COMPACT]
8. Increase mobility by regulating parking and road use [SHIFT]

The dream urban mobility system

A near-perfect mobility system does not yet exist in the world today [...] A hypothetical best-in-class urban mobility system would:

- ✓ Be as affordable as Hong Kong, with a similar modal split and level of smart-card acceptance. It would also have as few vehicles as Hong Kong.
- ✓ Ensure air is pure as Stockholm's
- ✓ Promote cycling like Amsterdam
- ✓ Be as safe as Copenhagen
- ✓ Have best-in-class bike sharing as demonstrated in Brussels and Paris
- ✓ Have a public transport service as frequent as the London Tube
- ✓ Have best-in-class car sharing as demonstrated in Stuttgart
- ✓ Have as minor an impact on climate as in Wuhan
- ✓ Ensure travel times as short as they are in Nantes.

Source: Arthur D. Little and UITP, (2014: 21)

A NEAR-PERFECT MOBILITY SYSTEM DOES NOT YET EXIST IN THE WORLD TODAY ...

Clearly no city in the world (or South Africa) has the perfect mobility system as described, but South African cities can start moving in the right direction. Cities need to set immediate priorities and medium to longer term objectives because continuing on the current private car-dependent trajectory is not an option.

This chapter aims to encourage city leaders, decision makers in other spheres of government and all stakeholders in the mobility value chain to:

- recognise that cities are key players and at the forefront of transforming urban mobility, space-making and quality of life of residents,
- acknowledge that urban mobility is operating in a fragmented environment and that institutional reform is important,
- foster better linkages between a variety of urban strategies and financing mechanisms,
- accept that innovative mobility solutions require integration rather than improvements in single transport modes,
- invest in the creation of the requisite skills for the transformation of transport and the built environment,
- encourage innovation and holistic approaches to space-making and mobility solutions.

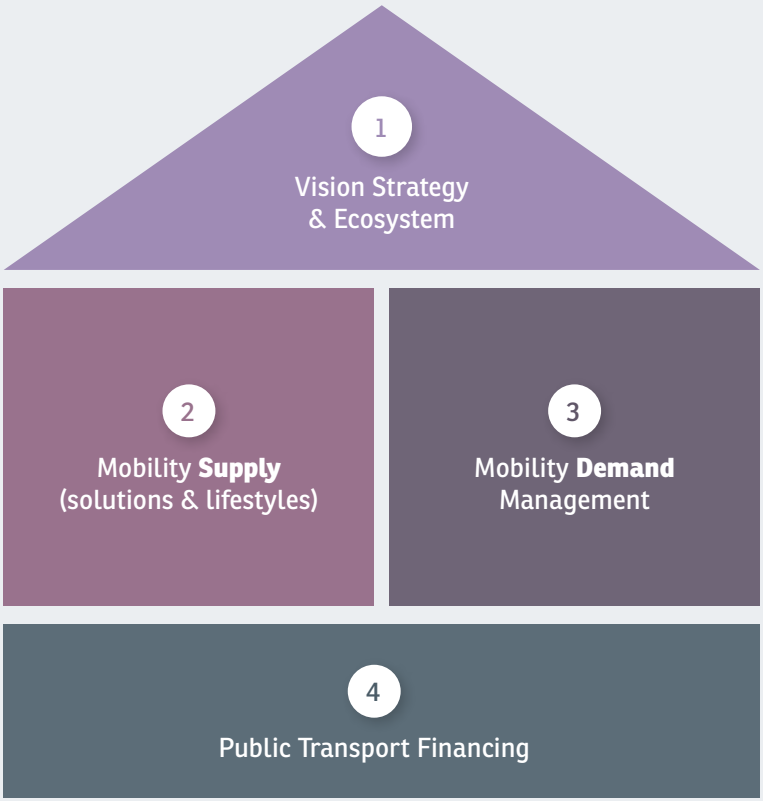
This chapter starts by looking at what is meant by sustainable urban mobility and then explores the elements necessary to transform public transport and the built environment within South African cities,

in light of the devolution of the transport function to certain municipalities. The most important element is to have visionary pro-public transport leadership and to integrate transport-related functions both horizontally and vertically. Horizontal integration will entail breaking the silo mentality, creating a culture of learning and collaboration and developing the administrative capacity necessary to manage complex transport projects. Vertical integration means having sound intergovernmental relations and getting buy-in from civil society and interest groups, thereby embracing an active citizenry.

SUSTAINABLE URBAN MOBILITY

As South African cities work on transforming their mobility systems and spatial form, global experience provides four pillars that could lay a solid foundation for a sustainable urban mobility system .

Figure 2: System-level framework for sustainable mobility



1

Develop a political vision and urban mobility objectives that are supported by all key public and private stakeholders; establish a transparent, viable and stable regulatory framework with clear allocation of roles and responsibilities; and ensure transport planning is coordinated with other city policies.

2

Invest in a sustainable mobility offering, rather than replicate the mistakes of developed cities.

3

Make businesses and individuals aware of the sustainable travel and location choices; introduce and enforce parking policy (to steer mobility choices); define appropriate land-use policies to influence long-term mobility patterns and encourage TOD.

4

Maximise fare revenue by driving demand for public transport through increasing the quality of the services offered; prioritise public funding for capital investment into projects that demonstrate policy benefits and long-term viability; leverage private funding and innovation where possible

Source: Arthur D. Little and UITP (2014: 21)

For South African cities, a useful place to start the journey (of transforming the built environment by leveraging transit development) would be to consider the following:

1. Commit to breaking the cycle of car dependency and building cities with a new transit hierarchy and a vision of what that end-state would look like.
2. Invest in building political champions who understand the need for change and have sufficient confidence to provide bold and visionary leadership.
3. Understand the skills required to drive large-scale transformation and invest in leaders across disciplines to create the requisite capacity at city administration level.
4. Create an active culture of community-centred approaches to planning and delivery, which breaks internal silos and is steeped in a desire for ongoing learning and development.
5. Implement plans with the necessary budgets for creating efficient and effective urban centres that balance new capital projects with improvements to existing modes.
6. Create institutional form and organograms, and monitoring and evaluation mechanisms at city level that focus on smart growth and citizen-centred development.

A vital element in the transformation of public transport and the built environment is leadership.

COMMIT TO BREAKING THE CYCLE OF CAR DEPENDENCY AND BUILDING CITIES WITH A NEW TRANSIT HIERARCHY

PRO-PUBLIC TRANSPORT LEADERSHIP

Transport in South Africa is a reflection of power relations in society. The public discourse about transport mirrors a disproportionate emphasis on the issues of private vehicle users, to the exclusion of the vast majority of the population who use public transport, walk or cycle. What is needed is visionary pro-public transport leadership.

The current reality is that political and technical decision-makers are often indifferent to public and non-motorised transport because of their attachment to (and the convenience of) their cars. In South Africa, the overwhelming majority of policymakers and implementers are car captive. The car has become an aspirational status symbol, viewed by many as the key to the ultimate freedom in mobility – with no restrictions of waiting times, scheduled stops and limited hours of operation. Furthermore, for a long time public transport has been considered the means of mobility for the poor, while transit nodes in cities are often seen as areas of crime and grime, and pockets of decay.

Decision-makers tend to view city-making through the lens of car ownership and easy access to a private vehicle and yet, in most South African cities, less than a third of households own a car. In other words, the majority of citizens use public transport. It is incumbent upon those who are shaping city planning and policy to experience the reality that citizens face on a daily basis. This cannot be achieved by having the occasional, highly staged experience during transport month, when an Executive Mayor, MEC, Minister or City Manager takes public transport. Decision-makers should heed the advice of

Jane Jacobs who said 50 years ago, 'go out there and see what works and what doesn't work and learn from reality. [...] spend time in the streets and squares and see how people actually use spaces, learn from that and use it' (Anderson-Oliver, 2013). Only when they are steeped in the lived experience of commuters will political and administrative leaders understand the daily frustration faced by commuters, which has in the past exploded into violent outbursts, with users venting their anger by destroying infrastructure. While using public transport on a daily basis may not be practically possible, leaders in government (particularly in the transport sector) should experience the system first hand as often as they can.

Furthermore, to arrive at a vision of people-oriented rather than car-oriented cities, the shortcomings of the current system need to be understood, alongside an image of the alternative system that supports walking, cycling, public transport, mobility and access. This represents a radical shift from the current car-based approaches to planning and space-making. However, continuing on the current trajectory of car-based planning is unsustainable from an environmental, quality of life and effective city perspective. City governments of today owe it to the generations of tomorrow not to make the city-development mistakes of the past.

CAR OWNERSHIP IN MOST SA CITIES

is RESTRICTED to

1/3

or less of households in that city

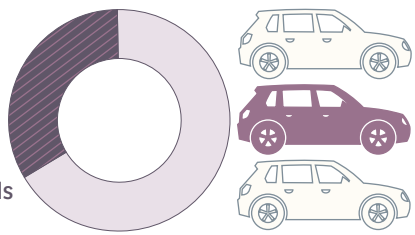
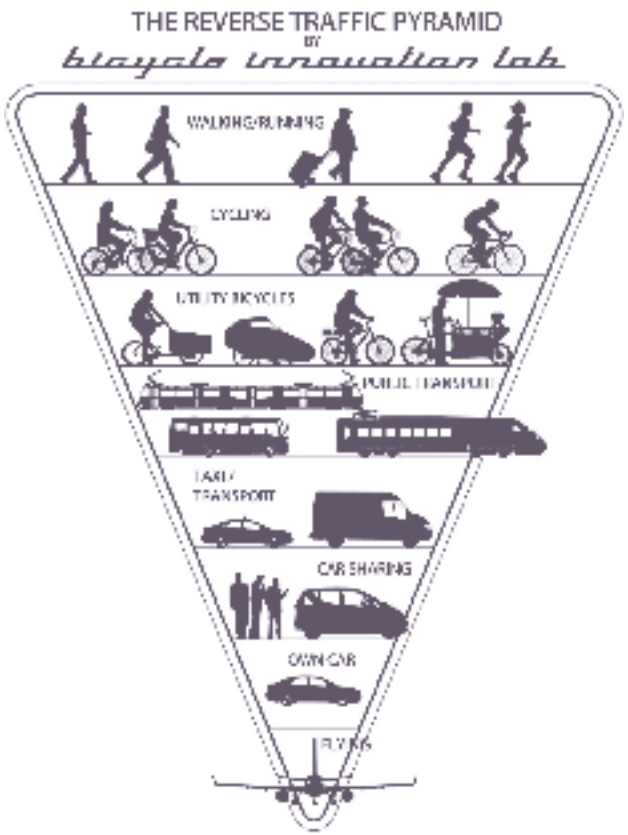


Figure 3: The reverse traffic pyramid



Source: The Bicycle Innovation Lab (http://www.bicycleinnovationlab.dk/?show=jpn)

Cities need urgently to move away from one-person-one-car to more equitable modes of transport, especially given the rapid rate of urbanisation and the costs to the economy and society of traffic congestion and road fatalities. The hosting of the FIFA World Cup 2010 enabled some South African cities to begin this journey, but greater urgency is required.

The International Association of Public Transport (UITP) encourages cities to double the market share of public transport by 2025 (Arthur B. Little and UITP, 2014). To achieve this, South African cities need to benchmark the current modal split, set targets with stakeholders and introduce a variety of mechanisms (both 'carrot' and 'stick') to encourage car users to walk, cycle and use public transport. However, recent developments, such as the Gautrain, Rea Vaya and MyCiti, will not be enough on their own. Other changes are needed, for instance, suitable pedestrian access at destinations on the Gautrain bus or Rea Vaya routes (e.g. at the Design Quarter, Nicolway Shopping Centre or Campus Square). Many developments continue to plan for private-car access only and often make pedestrian access extremely inconvenient. In some cases, office parks insist that those entering on foot leave their identity documents at security checkpoints!

Simultaneously, the problems of the current public transport system need to be acknowledged and understood, i.e. the system is fragmented, has limited hours of operation and vastly different standards. What is required is improved integration, common standards, affordability and effective information dissemination that leverages technological advancements.

Cities also need to confront the myth about the lack of well-located land for residential, employment creation and food security purposes. For instance, the amount of well-located land currently being used to 'house' cars in multi-storey parking lots is land that, if used differently, could radically transform space, use and quality of life.

South African cities need to encourage car users to walk, cycle and use public transport. However, recent developments, such as the Gautrain, Rea Vaya and MyCiti, will not be enough on their own.

However, such action would require a degree of boldness and the ability to navigate some deep vested interests. South African cities need to make policy decisions that unashamedly favour public transport, cycling and walking and to provide leadership that gets everyone behind the vision and implementation of a fundamentally different way of moving, living and being.

BREAKING THE SILO MENTALITY

The responsibility for the planning, provision and regulation of public transport in South Africa is widely dispersed between the three spheres of government, a range of parastatals and private operators. As the Constitution and other legislation make different spheres of government responsible for different aspects of the transit system, the approach tends to be 'we are all responsible so someone else will catalyse transport improvements'.

The importance attached to matters of transport, more specifically public transport, differs vastly from city to city. Transport is a stand-alone department in some cities but, in other cities, is strongly linked to the roads function or resides with engineering services and the bulk infrastructure provision. When cities equate transport with a road-building function, in all likelihood the planning will be restricted to the mobility requirements of private car users and the responsibility seen too narrowly as about moving vehicles, not people. What cities need to have is a transport department that favours public transport and receives the necessary resources and emphasis in the overall city vision, plans and budgets.

Cities cannot afford to have a transport organisation that is divorced from other city-related activities and planning. Cities have sufficient authority through the National Land Transport Act to become the champions of transforming mobility and simultaneously spatial planning, land use and the quality of built environment. It will require the establishment of a single organisation at city-level that is responsible for all land transport functions (road and rail) in a city or province: policy and planning, infrastructure development, compilation of standards for operators, licencing and regulation, communication and promotion, and disbursement of subsidies based on monitoring and evaluation.

At the same time, it is imperative that the country moves away from a one-size-fits-all approach to transport in cities. In conjunction with neighbouring cities and provincial authorities, each city needs to grapple with who takes responsibility for what. It is also not useful for cities to simply replicate what other South African cities are doing without testing solutions against their broader development objectives and specific local conditions.

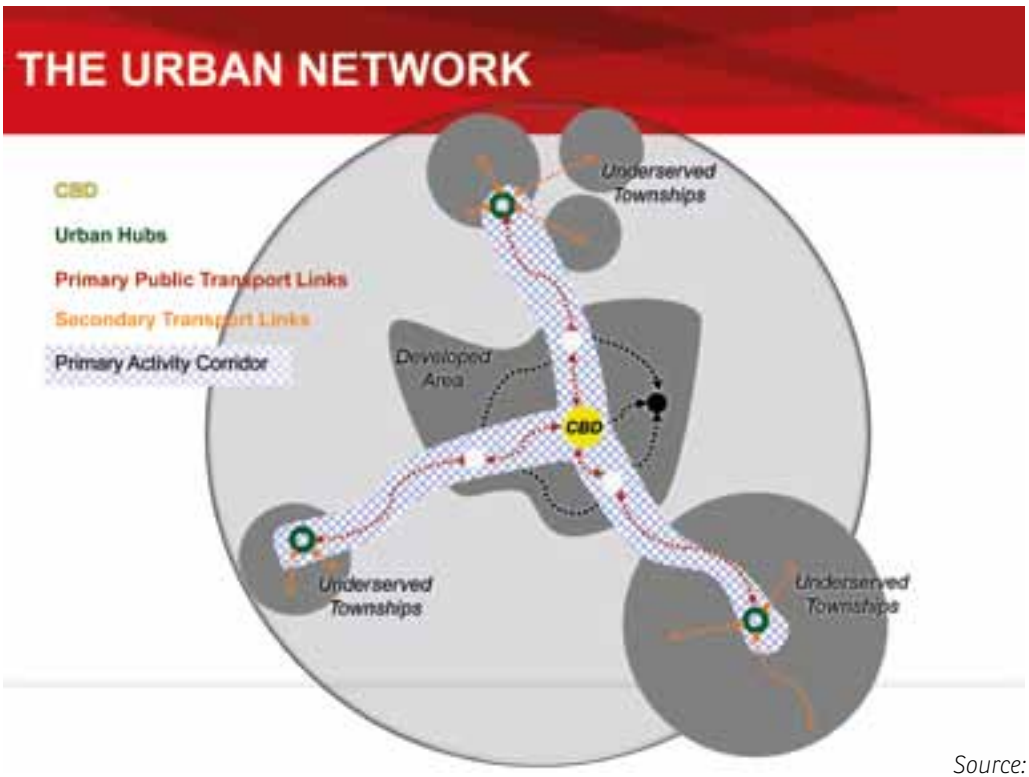
Cities are required by law to have an integrated approach to planning and development for both long-and short-term planning. Yet, although all cities produce integrated development plans and citywide growth and development strategies, in most cities the reality is that the integration of these plans is often an after-thought. The integration is an attempt to use common language and diction with very little effective coordinated planning in the day-to-day activities.

In general, cities divide the mandate of governing and providing city services into line departments and functions. Although practical, this mechanism often leads to fragmentation, gaps in city-wide planning and coordination and even territorial contestation. Too often one department is oblivious to the impact of its projects and plans on other city departments. The lives of citizens are not compartmentalised, and thus much higher levels of inter-departmental planning and coordination are required.

The solution to overcoming this fragmented approach is to create customer-centric scorecards for city departments and senior managers. These scorecards would advocate for active citizenry and consider city delivery from the perspective of a citizen who has to interact with different departments in a city. Cities need to understand how their stakeholders experience their service offerings and create both vertical and horizontal integration to close gaps.

In acknowledgment of the strategic role of urban centres in transforming inefficient and unsustainable cities, National Treasury developed an Urban Networks Strategy (UNS). The UNS represents a shift away from the Neighbourhood Development Grant and works in partnership with other grants, such as the Public Transport Infrastructure and Systems Grant and the Urban Settlement Development Grant. The UNS is 'a pro-poor/pro-growth investment approach' that aims to 'shift infrastructure investments towards the creation of efficient and effective urban centres that will increase economic growth, create employment and increase access to urban amenities, especially for the poor located in marginalised settlement areas, such as townships'[2].

Figure 4: The Urban Network



Source: http://ndp.treasury.gov.za

2. http://ndp.treasury.gov.za/default.aspx

This evolution in thinking at national level is useful, but the approach must be one of collaboration, discussion and guidance. These interventions will not be sustainable in the long-term if cities perceive them as one sphere of government attempting to direct urban development, with no appreciation of the capacity and ability available at municipal level. Cities must grapple with overcoming the apartheid spatial form and, in so doing, build capacity and institutional knowledge. The developing and developed world offer exciting examples of cities thinking more creatively about how to harness the changing circumstances of the urban poor and to plan in collaboration with communities, so that households have sufficient flexibility to shape their own spaces as their social and material circumstances change.

Figure 5: An example of integration across departments

Integration and collaboration is also important at city level, especially building understanding of integrated outcomes across departments, as described below.

Transport and Planning:

The requirement for a coordinated and structured working together of the planning and transport departments cannot be over-emphasised. The experience of the Singapore Land Transport Authority offers some useful lessons, in particular how functional coordination was realised between the Singapore Land Transport Authority and the land development authority (the Urban Redevelopment Authority), based on a common and fully integrated five-year master plan. Other lessons include the release of state land for private development and sale on 99-year leases, the state's ability to control development rights, and linking transport project implementation to land release (DoT, 2012).

In the South African context, zoning, incentives, densification, planning of social and community amenities should all be interrogated through a public transport lens. Planning should encourage as many activities as possible on or in close proximity to the transit system. Good connectivity and public transport should mean that educational and social amenities are easily accessible to communities – if facilities are built at inaccessible locations, they will be under-utilised. Private developers should be given specific codes for new buildings and developments, and understand the city's expectations regarding the provision of cycling lanes, pedestrian-friendly infrastructure and public transport. Another way of promoting non-motorised and public transport is through parking ratios and limiting the available parking spaces.

Transport and Environment:

The modal shift, from one-person-one-car culture to that of sharing resources, walking, cycling and using mass transit, is as important for the planet as for urban mobility. Therefore, the environmental department must share in the plans of the transport department and play an important advisory and monitoring role (in respect of air pollution, traffic noise exposure and the overall preservation of a high quality habitat). The environmental department should be active in shaping city decisions regarding fuel types, job creation, and applying for carbon credits for green projects. Transit hubs should be designed with green principles, such as rainwater harvesting, solar power and maximum use of natural light, and encouraged recycling, in view of the quantities of waste generated by commuters.

Transport and Health

Significant health benefits can result from people using public transport instead of private cars: commuters are more active, less likely to suffer from respiratory ailments (because of the reduced air pollution) and less at risk of car-related accidents. Indeed, research has found that 'over the long term, land use and transport policies can provide significant health benefits' (Frank et al., [n.d.]).

Transport and Economic Development

A city's economy is profoundly affected by congestion, productivity, energy costs, access to education and employment, efficient prioritisation of facilities and the movement of freight. Collaboration between economic development and transport in understanding freight and logistics movements and providing the requisite infrastructure for freight movement is important.

SIGNIFICANT HEALTH BENEFITS CAN RESULT FROM PEOPLE USING PUBLIC TRANSPORT INSTEAD OF PRIVATE CARS

The economic development department must understand the potential of the transport sector to create direct and indirect jobs and can assist with transformation; for instance, working with the minibus taxi sector, so that they can become operators in mainstream transport opportunities. The economic development department can also share with other stakeholders the impact of road safety and congestion on costs, productivity and, ultimately, the economy.

Transport and Human Settlements

Historically the price and availability of land have dictated housing developments in cities, particularly for lower income groups. In the quest to provide shelter to the large number of households living in informal structures, the emphasis has been on building the structure rather than the location and integrated planning. Too often large new settlements are built far from affordable and accessible transport systems, without paying sufficient attention to the mobility needs of residents. Transport is often an after-thought, and so these developments do not include dignified waiting spaces for commuters or have clarity on (and access to) the main modes available to the community.

The essential pedestrian infrastructure, cycling lanes, public transport infrastructure and operations should all be considered at the planning phase of human settlements. The lack of consultation and planning for

mobility at the inception of projects leads to unplanned and uncoordinated human settlement developments, resulting often in turf wars among informal transport operators. Transport planning should to be more actively involved in the potential new settlements being planned by the human settlements department, to ensure that the municipality acquires land on transport nodes and corridors so that better-located settlement opportunities are available.

Transport and Community Development

The community development department can include transport subsidies to commuters in its poverty alleviation projects. The department needs to deepen the understanding of those in the transport department about the particular needs of children, people with disabilities and the aged. Joint promotion of social amenities, such as theatres, libraries, community centres, sporting facilities and museums etc., that are on transit routes will increase uptake of services offered.

Transport and Information Communication Technologies (ICTs)

The rollout of ICTs (e.g. fibre optic, wireless and broadband connectivity) at transit hubs could, in the short term, give widespread access to communities without having to make the infrastructure immediately available at individual household level. Functional multi-purpose nodes at transit interchanges and on trains and buses that include Wi-Fi, internet access and cell-phone charging stations could all help in bridging the digital divide. Variable working hours, telecommuting and more effective use of technology would not only have an impact on mobility but also reduce the operational costs for departments. For instance, instead of spending time and resources commuting to and from meetings, the municipality could introduce online meetings and other innovative governance approaches.

Transport and Corporate Services

A municipality, particularly in larger cities, is an important employer and so must understand the transport habits of its own employees and advocate for a greater use of public transport, walking and cycling among its own work-force. The practice of travel allowances and subsidised parking spaces, which encourages car use, has to be reversed. The municipality should rather be using its remuneration structure to incentivise car-sharing, walking, cycling and the use of public transport.

Transport planning should to be more actively involved in the potential new settlements being planned by the human settlements department

Transport and Safety

The internationally accepted way of enhancing safety is to have 'more eyes and more activity on the street'. Having safe walking routes to schools in local communities could re-create a culture of children walking to school and satisfy parents and community members that enough thought has been given to safety of children. A city culture must be fostered of streets as shared spaces with the rights of pedestrians, cyclists and public transport users rights being seen as important. For instance, cars should not be parked on sidewalks and in bicycle and public transport dedicated lanes. An important first step is to build a citywide culture of transit nodes that are high-quality environments rather than areas of crime, grime and degeneration. The visibility of safety personnel in public transit spaces is also vital. To realise a shift from private to public transport will require safe walking, cycling and public transit environments.

Safe walking routes to schools in local communities could re-create a culture of children walking to school.

Ultimately, the silo approach to city planning and service provision must be replaced with a collaborative approach, which considers the needs of citizens, families and communities in a holistic and integrated manner.

CREATING A CULTURE OF COMMUNICATION, LEARNING AND COLLABORATION

South African cities are not alone in their attempt to transform the culture and to undo policy and planning decisions that have led to diminished quality of life, poor use of space and overall inefficient cities. Across the globe, cities are grappling with similar issues.[3]

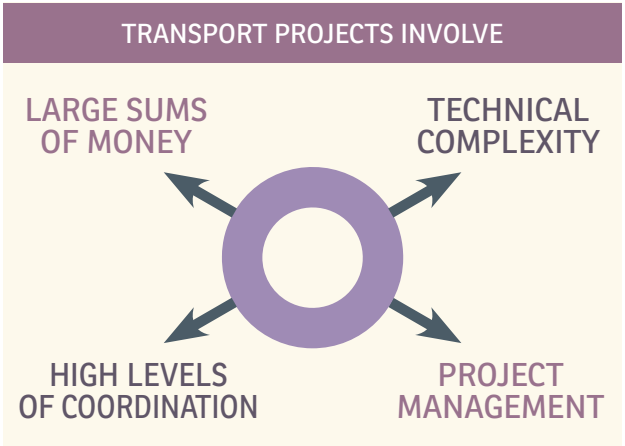
In the daily pressures and grind of running a city, policymakers and implementers need to actively set aside time to share information about best practices and ideas (and how to adapt them to the local reality), and to reflect on innovative problem-solving approaches. Suitable physical spaces, scheduled time and exciting ways of learning and sharing must be built into the institution. And, expensive study tours are not necessary – shared learning can take the form of portals, online learning forums, chill rooms and creative spaces where a culture of excitement, fun and daring is fostered. Cities should create a love for learning among employees at all levels and foster a culture of aligning personal goals to professional development, so that life-long learning, growth and development become part of city culture. Rather than be fearful of making mistakes, city departments should be encouraged to be innovative, bold and daring (but not reckless). In this way, apartheid spatially planned cities can be transformed into new

3. Many of these issues were raised at the 'Spatial Transformation of Cities: Johannesburg as laboratory' held in Johannesburg, 4–6 March 2014 http://www.sacities.net/joburg_spatial_transformation/.

dynamic and integrated cities that foster inclusivity, liveability and a sense of ownership among those who live in the neighbourhood and the city.

Departments and projects should be encouraged to share knowledge and best practices with each other and with external stakeholders, in order to ramp up, scale, replicate and transfer skills through action-based learning. Cities that collaborate with external stakeholders from the perspective of a learning organisation are likely to gain the respect of partners. This approach must include a willingness to listen to and learn from the variety of stakeholders a municipality interfaces with. Fostering a culture of collective problem-solving with partners and stakeholders regarding the many spatial and mobility challenges that cities face creates ownership of the challenge beyond the municipal department. Stakeholders with varied interests are actively engaged in owning the problem and in assisting the city to create solutions that have maximum buy-in. This is not to underestimate the competing (and often contradictory) interests of different stakeholders, but the city can be the facilitator of authentic conversation and provide the platform to work together through complex issues in order to achieve the broader vision of a transformed city.

When the centrality of communication must be understood spatially transforming cities and their mobility systems. Ongoing communication within the city, between the city and other spheres of government, and between the city and its various stakeholders should be adequately budgeted for, appropriately staffed and seen as part of the critical mission of the department.



DEVELOPING ADMINISTRATIVE CAPACITY

Transport projects generally involve large sums of money, technical complexity and require high levels of coordination and project management. When cities are also leveraging transport as a catalyst for built environment transformation, additional complexities and competing needs of stakeholders arise. Before embarking on these projects, cities need to understand their in-house capacity and skills, including engineering, technical and project management capacity, as well as community engagement, economics, financial, legal and communication skills. Coaching, mentoring and appropriate career pathing should be in place to attract and retain the requisite skills. The municipal team must be sufficiently skilled to be able to manage and question recommendations from consultants and other professional experts whose services may be procured for the duration of the project.

The teams tasked with driving transport and city transformation will ideally be drawn from a variety of departments and disciplines and have a whole-systems approach to driving transformation. Transformation of transport and built environment is not restricted to changing the mode of transport used. It must also give active expression to commuter dignity and a customer-centred approach in service provision, without being at the expense of working conditions for public transport workers. Not all stakeholders will welcome transport transformation, and so city teams have to understand why (and which) stakeholders may resist change. They need to be sensitive to the needs of different groups, listen to concerns and objections with a view to finding solutions, while staying firmly focused on the outcomes of a transformed transport system and built environment. No single stakeholder grouping should be allowed to hold city development to ransom and, while every effort should be made to be inclusive, build consensus and find win-win solutions, the teams should be prepared for the eventuality of legal challenges and highly public contestation of transformative efforts. Therefore, the project planning should include support to team members to help them to stay centred and focused during challenging periods. If the cities do not have the required skills, an active plan needs to be in place to create and develop as much in-house capacity as possible – continuing to rely on private-sector expertise is unsustainable. Different cities in South Africa can also compare, share and draw on each other's experiences, not in a spirit of 'one-upmanship' but rather of mutual respect and desire for continuous improvement.

TRANSFORMATION OF TRANSPORT AND BUILT ENVIRONMENT IS NOT RESTRICTED TO CHANGING THE MODE OF TRANSPORT USED

Creating an integrated, affordable, accessible, reliable and efficient transport system across modes is not a short-term assignment. It requires the stamina and commitment to continuously engage and drive the vision forward. Communities and neighbourhoods that receive or benefit from transport projects are not homogenous and contain complex dynamics. Therefore, city implementation teams will have to be skilled in navigating community dynamics and building maximum consensus.

Then, once the projects arrive at the operational phase, the required skills and standard operating procedures and manuals must be in place. These skills need to be developed during project implementation. Bringing academia, transport experts, transport operators, property developers, and representatives from labour, business, ratepayers' and civic organisations, and commuters on board in transport and city transformation will create an environment that needs to be sensitively managed. It calls for courageous leadership from city policy-makers and implementation teams.

ENCOURAGING SOUND INTERGOVERNMENTAL RELATIONS

By virtue of transport responsibilities traversing the three spheres of government, the respective roles and

functions must be clear. Although the Constitution speaks of the independence and inter-dependence among the three spheres, the daily reality is that local government is often treated as a tier of government and experiences 'big brother' approaches from other spheres. Yet transport provides a useful springboard to give expression to the spirit of intergovernmental relations as envisaged in the Constitution and legislation.

The political and administrative leadership at the three spheres need to share a common vision of an integrated, affordable, accessible and efficient transport system that is multi-modal but planned and operated with the end user in mind. Public investment in transit corridors and nodes should be used for land value capture[4] and broader socioeconomic and political objectives, e.g. using transit to foster social cohesion, access to amenity and economic transformation.

Not all cities are ready for the devolution of powers and functions related to public transport. However, as the City of Cape Town is a front runner in this regard, important learnings will emerge that can gradually be shared with other cities. In the interim, active intergovernmental cooperation and collaboration is key. Better synergies between funding cycles, more discretion to municipalities in how to use grant funding and less onerous reporting requirements will all go a long way in making transport investments that help to change the built environment.

Cities also need to begin to play a more active role in agreeing service-level standards with parastatals, such as PRASA/Metrorail who have embarked on fleet and systems refurbishment. For these investments to serve goals beyond mobility, active collaboration and joint planning between the city and parastatals responsible for airports, rail and ports will be required. The envisaged planning authorities should actively promote spatial transformation, urban regeneration and practical solutions for the needs of both the formal and informal sectors that are involved in transit spaces.

The regulatory and licencing function, currently vested in the provincial departments, must be dealt with to ensure stability and competition for routes rather than on routes. All spheres of government need to work with the minibus taxi sector, in order to improve and transform existing service-level offerings, showcasing new technologies and ways of organising that could enhance the industry's profitability and bring it into the subsidised regime. Simultaneously, cities must have a greater voice in relation to the provincial bus subsidies, a function that should eventually devolve to municipalities.

There is no one-size-fits-all solution for intergovernmental coordination. In the instance of Gauteng province, which has three contiguous metropolitan municipalities, the need for cross-city collaboration and integration with provincial plans is important. Each city should seek the most appropriate and practical solutions rather than adhere to a prescriptive regime that does not take into account the city's capacity, developmental stage and future growth prospects.

4. This is a public financing technique that 'captures' a part or all of the increases in private land values resulting from public investment. The additional revenue can be used to finance infrastructure for economic growth and urban development, or for poverty alleviation. The infrastructure financed in turn leverages private investment in the area as it improves. http://www.urbanlandmark.org.za/research/x58.php.

OBTAINING BUY-IN FROM CIVIL SOCIETY AND INTEREST GROUPS

Many civil society groupings have both direct and indirect interests in public transport and the built environment. They range from commuter representative groups to organisations for people with disabilities, ratepayers' and residents' associations, schools, business, organised labour, faith-based organisations, women's groupings, safety-related structures, youth formations and public transport operators across modes. Naturally, these various groupings have inherent tensions on a range of matters.

For a city to drive a transport and built environment transformation agenda, political representatives and the administration must create opportunities for interfacing with sectors and between sectors. A wide range of stakeholders must be included at the strategy and policy formulation phases and, as far as is practicable, the views and inputs of stakeholders should shape the city's policy and vision. Thus it is important to create a formal structure where stakeholder organisations can interface with the city, raise concerns, get updates and explanations, and interact with each other.

Particular groups will be vehemently opposed to a pro-public transport agenda, and ongoing engagement will be needed in order to build the collective understanding of the benefits in terms of quality of life of citizens, economic growth, sustainable environmental practice and overall city functionality. The city should use a variety of methods to build the requisite understanding and broad consensus among the diverse groupings. An open-door approach (together with a joint problem-solving and solution-seeking response) builds an understanding among civil society leaders on the complexity of transport and city transformation. More effort, time, budget and skills need to be devoted to marketing and communication, from the start of the project to the start of operations. The Rustenburg IRPTN provides a benchmark for two-way communication, while the Singapore Land Transport Authority's website contains some simple and effective methods to keep the public informed about new initiatives and ongoing improvements to the transport system, its interface with land use and getting communities involved.

CONCLUSION

Throughout the world, cities are facing the challenge of urban mobility. For South African cities, the situation is made worse by the country's history, as apartheid ideology determined the urban shape and form. It is not sustainable to continue along the same path of car-based planning. Cities need to start moving in the right direction, by committing to break the cycle of car dependency and to build cities that are people-oriented rather than car-oriented.

To achieve this will require visionary pro-public transport leadership, which means that policymakers and implementers use public transport as often as possible and make policy decisions that are unashamedly in favour of public transport, cycling and walking. All three government spheres need to support the same shared vision of integrated, affordable, accessible and efficient transport system that is multi-modal but planned and operated with the end user in mind. Cities also must adopt an integrated approach in reality (not just on

paper). This means breaking the silo mentality and encouraging a collaborative approach, which considers the needs of citizens, families and communities in a holistic and integrated manner.

Cities also need to encourage collaboration, learning and communication, and to build the necessary skills for driving large, complex projects. These skills must include communication and community engagement skills, as the city needs to involve stakeholders and interest/civil society groups in the process of developing an integrated public transport system.

Clearly the 'how' of making public transport everybody's business and transforming the built environment is a complex task. It requires a focus on infrastructure and people, on technical knowledge and soft skills, on accepting the past and driving a vision of a transport system and city that is radically different to the one that was born on 27 April 1994. No doubt the task is daunting. Yet city leaders have no choice but to take a fragmented and ageing transport system designed to divide and use it to transform cities into spaces for all – where city dwellers in all their diversity can come together and share transit-spaces and a built environment. In so doing, the cities we hand to our children will be more humane than the ones we inherited.

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USING PUBLIC TRANSPORT FUNDING TO CREATE INCLUSIVE CITIES

Amanda Jitsing

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INTRODUCTION

DESPITE DEMOCRACY, ... DECADES OF UNDER-INVESTMENT IN PUBLIC TRANSPORT MEAN THAT SOUTH AFRICANS STILL FACE ENORMOUS CHALLENGES IN MOVING FROM ONE PLACE TO ANOTHER

Every day, millions of South Africans use inaccessible, unsafe and unreliable public transport that was designed to reinforce racial segregation, with the singular purpose of moving workers in and out of cities and towns. For black South Africans, public transport routes were meant to discourage intra-urban mobility and keep workers out of white suburbs and areas. In contrast, the apartheid state supplied cheap transport services to the 'white' suburbs with relatively low densities. The ramifications of this system of segregation persist today. Despite democracy bringing the freedom to travel and work anywhere, decades of under-investment in public transport mean that South Africans still face enormous challenges in moving from one place to another.

Two decades since the end of apartheid, some progress has been made in relation to public transport. A shift in policy landscape is evident. Policymakers acknowledge that public transport should be integrated into the built environment in order to develop inclusive and compact cities. Most importantly, local government is best placed to plan and deliver public transport services. This is because public transport networks will invariably affect the urban form of cities and towns over the long term. Without better integration between land-use patterns, human settlements development and public transport, cities run the risk of creating a fragmented urban form or, at worst, entrenching apartheid spatial patterns. The economic costs of either of these scenarios are enormous to both the country and, ultimately, to the citizens.

Reforming public transport in South Africa is about providing the majority of citizens with a safe, reliable and affordable way of commuting, but these reforms will take different forms depending on the commuters targeted. Large-scale investment in transport infrastructure is necessary to bring public transport services to historically disadvantaged communities but, at the same time, will invariably make public transport unaffordable for these commuters. Therefore, some form of subsidisation will be needed.

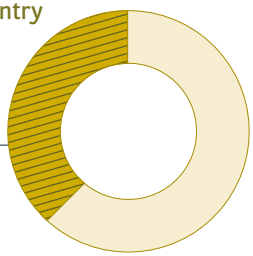
Although providing public transport services to the majority of South Africans remains the main objective of the country's policy framework, it is not the only one. Public transport must also offer convenient and reliable commuting in order to lure car owners away from private transport. For instance, in the City of Johannesburg (the economic hub of the country, where about 42% of commuters travel to work in a private car), public transport policy and plans should be designed to break the cycle between rising incomes and private travel (City of Johannesburg, 2013: 17)[1]. Ultimately, the overarching goal is that public transport should become the mode of choice for all citizens, overcoming barriers of class and income and helping to build integrated, connected and inclusive cities.

IN THE CITY OF JOHANNESBURG

the economic hub of the country

42%

of commuters travel to work in a private car



This chapter focuses on the role of public transport funding in achieving this overarching goal. Realising this vision is not an easy feat for a public transport sector, which was fashioned by decades of apartheid and left to its own devices until as recently as 2007, when the public transport strategy was published. Four critical questions emerged from a review of the evolution and the current landscape of public transport policy and funding mechanisms in South Africa.

1. Can funding mechanisms be used to encourage modal integration within cities?
2. Can public transport funding mechanisms be designed to enhance integration within the built environment to create inclusive and integrated cities?
3. Is there scope for leveraging private sector funding for public transport?
4. How can funding mechanisms be used to create low carbon public transport networks in cities?

This chapter aims to contribute to this debate about the future of public transport funding. Its aim is not to give definitive answers but rather to explore a number of key themes and insights, which will help national, provincial and local government improve the design and application of funding mechanisms.

BACKGROUND

Historical perspective

The apartheid regime designed public transport networks to perpetuate racial segregation. The Bantu Transportation Act (No. 53 of 1957) governed the delivery of public transport. Under this legislation, employers

1. This information is from the Gauteng Quality of Life Survey conducted in 2011. With the completion of the Gautrain, this figure may be noticeably lower.

were obliged to contribute towards subsidising the costs of transporting workers to and from their places of work (Buthelezi, 2014). These subsidies allowed bus operators to transport thousands of commuters from Bantustan towns to metropolitan cities on a daily basis (Smith, 1992).

As subsidies were allocated on a per passenger basis, bus operators were inclined to overload buses and skimp on maintenance to make higher profits. The bus operators were largely unregulated and were not held accountable for the quality, reliability or safety of bus services provided to historically disadvantaged communities. Most of the buses operators were also given perpetuity contracts, which entrenched their monopoly over routes and guaranteed their revenue flows.

This system of bus subsidisation introduced under apartheid continues to influence bus services. Routes are over-serviced and carrying capacity is underutilised at certain times of the day. Bus services remain unintegrated with other modes of transport. Even worse, because bus subsidies offer an affordable way for commuters to live further afield and work in the city, they encourage urban sprawl.

In addition to bus services, the apartheid government built passenger rail infrastructure to transport workers from the furthest outlying towns and rural areas into urban nodes. Moreover, passenger rail enabled apartheid planners to maintain a large buffer zone between cities townships and rural areas. The South African Railways and Harbours, which was established in 1961, built and operated much of the passenger rail infrastructure and services. In 1981, the company was restructured into the South African Transport Services (SATS), to reflect the multimodal nature of the company, and was allowed to operate on commercial principles (Transnet, 2011).

This decision has undoubtedly had a long-term impact on the passenger rail industry, which is still evident today. In pursuing commercial sustainability, SATS attempted to stem the financial impact of its loss-making commuter rail by minimising the cost of operating and maintaining stations. Over time, this led to a decline in the quality and reliability of rail services. It also delayed investments in railway infrastructure and rolling stock (Teljeur, 2006), which meant that by the turn of the new millennium, ageing and inadequate rolling stock made commuter rail an unreliable form of transport for its 2.2 million daily passengers (DPME, 2014).

The manner in which passenger rail infrastructure and bus routes were designed made travel for purposes other than work extremely difficult for black South Africans. As townships grew, the minibus taxi emerged to provide feeder services to the long range bus and train services. Minibus taxis also offered quick access to economic nodes where businesses was located for township residents. When it was eventually deregulated in 1987, the minibus taxi became an integral part of the public transport system, offering commuters quicker journeys into cities and intra-urban feeder services (Edwards, 2007). Unlike other modes of transport, the minibus taxi industry does not receive a subsidy and has remained financially viable by setting fares on a profit basis.

Furthermore, during the 1970s and 1980s car ownership grew, as income among the white population increased. To cater for car users, municipalities built new roads and spent

Today, South Africa has a good municipal road network, which requires significant resources for maintenance.

large amounts on upgrading and maintaining existing roads. Today, South Africa has a good municipal road network, which requires significant resources for maintenance.

Policy and legislative reforms

The White Paper on the National Transport Policy recognised that some form of subsidisation of public transport was needed for poor and marginalised communities and distinguished between 'commercially viable passenger transport' and 'infrastructure for social access'. It argued that commercially viable public transport should not be subsidised and espoused the principle of cost recovery where the user bears the full cost of using the service (RSA, 1996). However, it also made the case for reforming the way public transport was subsidised.

The National Land Transport Transition Act (NLTTA) No. 22 of 2000 was introduced to give effect to the principles set out in the White Paper and, in particular, to address the subsidy system. In line with Section 25 of the Act, municipalities were required to establish transport authorities that would:

- rationalise the subsidised services within and between nodes;
- determine the extent of subsidisation;
- rationalise services across borders to improve interprovincial transport;
- minimise competition between subsidised bus services;
- structure subsidised concessions to attract competitive bidding;
- ensure that routes and route networks are used optimally; and
- facilitate the development of a future integrated transport system.

These reforms proved difficult to bring about because of the perpetuity bus contracts, which encouraged inefficient operations and route choices. The NLTTA sought to change the system, from awarding bus contracts on a per-passenger basis to introducing competitive contracts, awarded on the basis of per kilometre travelled. This reform has two advantages. First, it removes the incentive for operators to inflate their passenger figures and overcrowd buses. Second, it allows government to reimburse operators on a 'cost-plus' basis – that is their direct operating costs plus any acceptable margin – making expenditure more predictable for government. The idea was to encourage bus operators to control and monitor their operational expenditure by seeking out efficiencies.

Unfortunately, a number of problems beset the reform of the bus subsidisation. Bus operators responded to the competitive tender system by cutting operating costs. Cost-cutting exercises are not in principle a bad thing, if they improve efficiencies, but in this case they led to substantial job losses, which were highly unpopular. Bus operators reduced the number of employees, lowered wages and benefits, and outsourced a large part of their services to individual bus owners. Yet even with these cost-cutting measures, the cost per kilometre of tendered contracts was significantly higher than expected because the size and capacity of vehicle fleets were not geared towards an efficient bus service, while routes were not optimised to use the full carrying capacity of these fleets. Ageing bus fleets meant that their operating and maintenance costs were high and, under the per-kilometre subsidy system, bus operators had little incentive to upgrade and renew their fleet.

OVER THE NEXT 20 YEARS

approximately
R257-billion
of investment will be needed to improve road-based public transport systems

& an estimated **R90-billion**
investment will be needed to address Metrorail's operational infrastructure backlogs

The shift from perpetuity to tendered contracts led to the loss of approximately 40% of jobs in the bus sector. In the end, in 2000, government put the tendered contract system on hold, following the large public outcry and vehement opposition by labour unions (DoT, 2013a). Since then, bus operating contracts have been renewed on a monthly basis. In March 2013, the DoT estimated that two-thirds of funding for bus subsidies was spent on interim contracts (DoT, 2013a).

This situation creates uncertainty and makes any long-term capital investment risky for bus operators, while government is unable to use its contracting powers to promote modal integration. Worryingly, as long as this uncertainty exists, it is nearly impossible to optimise or introduce new routes to either promote densification or meet the demands of commuters. Unless this situation is resolved soon, the result will be an ageing and unreliable bus fleet that remains isolated and unintegrated with other forms of public transport.

Cities are facing overwhelming demands to maintain existing infrastructure while developing new transport networks to meet the needs of a rapidly urbanising population. Back in 1996, the White Paper recognised that decades of under-investment in public transport infrastructure had created severe backlogs. More recently, a study commissioned by the DoT estimates that approximately R257-billion of investment will be needed over the next 20 years to improve road-based public transport systems in South Africa (DoT, 2012). Equally worrying is the estimated R90-billion investment needed to address Metrorail's operational infrastructure backlogs. A large proportion of this investment programme will be spent in metropolitan municipalities. The question is how this considerable investment will be funded.

Investment in public transport infrastructure is closely linked to the affordability of the transport service for users and taxpayers alike. The White Paper argues for the principle of 'user-pays', but this principle is likely to cause further inequities when a large proportion of public transport users are from poor households. It also proposes reducing the levels of subsidisation and promoting competition among bus operators (RSA, 1996) However, the White Paper did not set a clear direction for the funding of public transport, resulting in a policy vacuum that endured until the release of the Public Transport Strategy in 2007.

The Public Transport Strategy was crafted to accelerate improvements in public transport by establishing Integrated Public Transport Networks (IPTNs) over a 13-year period. These networks are designed to introduce a variety of modalities – including priority rail corridors and bus rapid transit (BRT) systems – into cities, to provide passengers with quick and reliable public transport services.

The strategy contains a number of targets, with the most noteworthy one being the expansion of the BRT system to 12 cities by 2014/15. The strategy describes the infrastructure funding arrangements as relying solely on funding from the fiscus but gives little indication of who bears the cost and responsibility of maintaining and operating public transport networks (DoT, 2007). Despite these omissions, the strategy gained further credibility when the National Treasury tied the Public Transport Infrastructure and Systems Grant (PTISG) to the targets set out in the plan. The need to develop public transport networks was made even more urgent by the country's commitment to FIFA ahead of the 2010 World Cup.

INVESTMENT IN PUBLIC TRANSPORT INFRASTRUCTURE IS CLOSELY LINKED TO THE AFFORDABILITY OF THE TRANSPORT SERVICE FOR USERS AND TAXPAYERS ALIKE.

Since then, substantial amounts of funding have been spent on establishing BRT systems in Johannesburg, Cape Town and Nelson Mandela Bay. The rapid investment has re-invigorated the sector and is slowly changing perceptions around public transport. That said, the investment has been less successful in promoting modal integration as part of building IPTNs. Therefore, the next section looks at the role of funding mechanisms in promoting modal integration.

FUNDING AS AN ENABLER OF MODAL INTEGRATION

Governance and funding arrangements for public transport in South Africa are innately complex because public transport is a concurrent function that transcends national, provincial and local government. In addition, various public entities play a part in delivering public transport. For instance, the Passenger Rail Agency of South Africa (PRASA) provides passenger rail services across the country delivering commuters to stations in cities.

Table 1 summarises the governance and funding roles of each sphere of government in relation to the different modes of public transport.

Table 1: Governance and funding responsibilities for public transport

Service	National DoT	Provincial DoT	Metropolitan municipality
Bus services (BRT and metro and interprovincial bus services)	▪ Sets public transport policy framework ▪ Provides guidance on contracting bus services ▪ Disburses the Public Transport Infrastructure Systems Grant (PTISG), the Public Transport Network Operations Grant (PTNOG) and the Public Transport Operations Grant (PTOG)	▪ Contracts bus operators and disburses subsidies (PTOG) ▪ Oversees and monitors performance of bus operators ▪ Gauteng: coordinates across metros ▪ Some provinces contribute financially to the services they contract	▪ Plans public transport systems and land use ▪ Builds, maintains and operates bus stops and other related public transport infrastructure ▪ Contracts bus operators and disburses subsidies (PTNOG) ▪ Funds metro bus services ▪ Contributes financially to IPTN operations
Road network	▪ Sets policy framework ▪ Promotes information sharing and benchmarking ▪ Disburses conditional grants and earmarks funding for road maintenance ▪ Funds South African National Roads Agency Limited (SANRAL)	▪ Maintains provincial road maintained ▪ Funds provincial road maintenance from their equitable shares and conditional grant	▪ Maintains municipal road network ▪ Funds maintenance through a combination of own revenue or conditional grants. e.g. Urban Settlement Development Grant (USDG) and the Municipal Infrastructure Grant (MIG)
Non-motorised transport (NMT)	▪ Sets NMT policy ▪ Provides special allocations towards NMT	▪ Customises NMT policy and includes in Integrated Public Transport Policy ▪ Develops funding models for NMT	▪ Customises NMT policy and includes in Integrated Public Transport Policy ▪ Develops funding models for NMT
Minibus taxis	▪ Sets policy on the recapitalisation of taxis ▪ Disburses funds towards taxi recapitalisation	▪ Regulates public transport operations (taxi associations and operators)	▪ Integrates taxi services into integrated transport plan
Rail	▪ Sets out rail policy ▪ Regulates rail services, prices and services ▪ Disburses capital funding for expansion and renewal of rail infrastructure and PRASA's fleet as well as operational subsidy	▪ Integrates rail services in integrated transport plan ▪ Oversees Gautrain management agency and funds operational shortfall according to ridership guarantee	▪ Integrates rail services into integrated transport plan ▪ Involved in specifying service level standards within jurisdiction

Source: Miscellaneous policy and legislative framework

In general, public transport draws on a variety of funding sources, often used in conjunction with one another (National Audit Office, 2012). Public transport infrastructure and operations are funded from the fiscus, private sector and user charges. The source of funding depends on policy aims, the historical context, the service that is funded and the risk-sharing arrangements.

Conditional grants

Throughout the world, national governments are increasingly using conditional grants to direct funding towards specific priorities. The conditions attached to these grants are stringent and regulate how and when public funds are spent. For national government, conditional grants are powerful instruments that minimise the risk of non-performance by tying funding to strict conditions. For cities, however, conditional grants can be inflexible sources of funding, that can restrict their ability to plan and implement integrated transport networks.

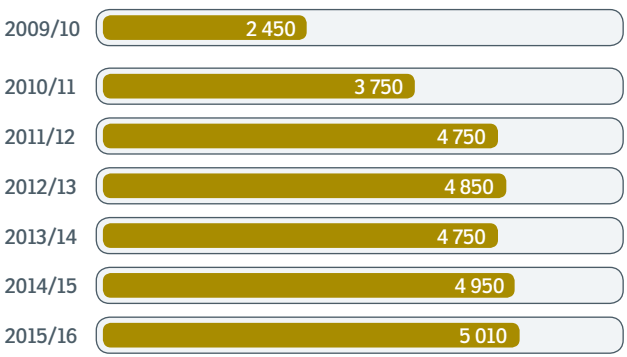
In general, conditional grants can be allocated for building capital infrastructure or, alternatively, for subsidising the cost of operations. Investment in public transport infrastructure (whether BRT systems, roads or rail) has largely been driven by conditional grants in South Africa. The Public Transport Infrastructure Grant (PTIG) has mostly funded the IPTNs, but other cross cutting grants, such as the Urban Settlement Development Grant (USDG) and the Municipal Infrastructure Grant (MIG), also contribute to the financing of road-based public transport infrastructure.

Infrastructure grant

First mooted in the 2005/06 budget, the PTIG's predecessor – the Public Transport Infrastructure Systems Grants (PTISG) – was used to fund some of the more pressing public transport infrastructure projects for host cities ahead of the 2010 FIFA World Cup (National Treasury, 2006: 800).

In its latest iteration, the PTIG is allocated to municipalities for the development of IPTNs (National Treasury, 2014). As Figure 7 shows, its growth has been rapid, totalling about R20.2-billion in expenditure on public transport infrastructure between 2009/10 and 2013/14. Understandably, some of this expenditure was driven by the need for a functional public transport system in host cities ahead of the 2010 FIFA World Cup. Following the surge in expenditure by the early adopters of the BRT, growth in expenditure is expected to moderate, as existing projects near completion and several cities complete their IPTN plans (National Treasury, 2014). Yet funding the expansion of existing BRT networks and the rollout of new IPTNs will place large demands on the national fiscus.

Figure 6: PTIG growth between 2009/10 and 2015/16



Source: National Treasury database

Note: In 2012/13, the PTISG was spilt into the PTIG and PTNOG. Therefore, figures after 2012/13, reflect the PTIG only

The PTIG promotes government's devolution agenda by allocating funding directly from the national fiscus to municipalities. In its current form, the PTIG funds three types of expenditure:

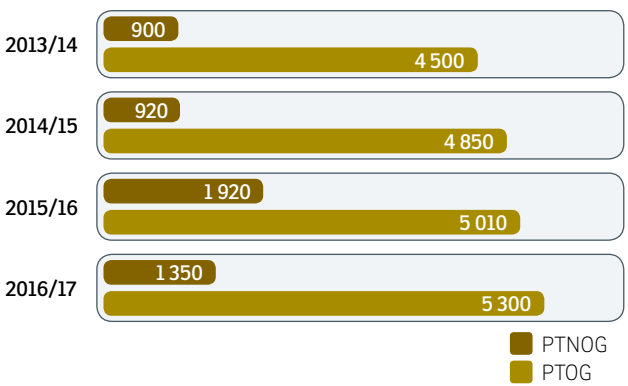
1. The development of comprehensive IPTN plans, which must demonstrate integration with other modalities and create transit systems that are passenger centric, accessible and affordable.
2. The construction of fixed infrastructure as part of the IPTN, including the immovable infrastructure such as bus stations, depots, boarding bridges, 'kassel' kerbs[2] and lane enforcement enhancements. In the start-up phase of the IPTN, the PTIG can be used to procure vehicles that will be used by contractors, with the grant funding streams being used as collateral to finance the purchase of vehicles.[3] In addition, the funding can be used to build NMT infrastructure, such as pedestrian precincts and cycling lanes to complement other modes of transport.
3. The setup costs of operational and business systems (e.g. ticketing system, financial and information technical systems) necessary for the functioning of the service.

Operating grants

Capital outlays for establishing IPTNs are sizeable. For the private sector, funding large capital investments (e.g. the purchase of buses) only becomes viable if the return on investment is attractive or guaranteed. Therefore, to entice private operators, governments subsidise public transport, so that the private operators can earn an acceptable return on their investment, but transport services remain affordable to users. However, subsidies are difficult instruments to get right and, when designed poorly, can create inefficient public transport systems. Thus the level, structure and quantum of the subsidy become critical when setting up IPTNs.

In its broadest terms, the Public Transport Operations Grant (PTOG) and Public Transport Network Operations Grant (PTNOG) are two subsidy instruments used to fund the operational costs of public transport operators. The PTOG is allocated to provinces, and a large of part of the grant is used to fund private bus operators in metropolitan municipalities. As Figure 2 shows, the allocation to the PTOG is substantial: on average R4.6-billion over the medium term, with 20% of all PTOG funding earmarked for cities by 2016/17. The problem with this arrangement is that, until recently, cities had little influence over bus operators that serviced their jurisdiction because the operational subsidies were paid by province.

Figure 7: Growth in operating grants to municipalities and provinces



Source: National Treasury database

2. These are concave-section kerbs for bus stops served by low-floor buses, first introduced in the German city of Kassel. They allow the buses to dock as close as possible to the kerb without damaging the tyres.
3. While this may be appropriate during the establishment of the IPTN, international experience suggests that in the long run, cities should adopt an owner-operator model, where the costs and risks associated with purchasing and maintaining vehicles shift to the public transport operator (World Bank, 2011).

The devolution of PTOG to the City of Cape Town (when it finally happens) will be a landmark change in the delivery of public transport. If the function is devolved to other metropolitan municipalities, all cities will be able to rationalise their routes, add new routes to the bus system and optimise the use of buses during peak and off-peak hours.

In a similar way, the devolution of operational rail subsidies from PRASA to metropolitan municipalities will help foster greater integration between rail and road-based public transport. For cities, being able to influence the scheduling, operating times and service standards in rail will allow them to integrate rail services with road-based public transport.

Administering a subsidy system is a new and foreign terrain for cities, and so, in devolving the function, national government must ensure that cities have the necessary capacity to manage and monitor these new functions. The capacity is not only about administering the financial aspects of the subsidy, but also about improving the contracting and monitoring of public transport services. Building contracting and monitoring capabilities will allow cities to leverage the subsidies to improve modal integration and passenger experiences. Therefore, national government should fund part of the costs of establishing the capability to administer subsidies in cities, which is likely to be well-spent money.

54 159
taxis were scrapped by the industry between 2006/07 and 2012/13

But what of the minibus taxis? Given the considerable investment and value of this mode of transport, there are clear arguments for formalising the minibus taxi industry in a city's IPTN. Between 2006/07 and 2012/13, the industry scrapped 54 159 taxis, while government has spent R2.7-billion on its taxi recapitalisation programme that was proposed in 1999 to improve the safety of travel for one of the most popular modes of public transport.[4] Minibus taxis have remained profitable by adopting practices that make them a somewhat unsafe and unreliable form of transport. For instance, overloading is a common practice, as the marginal revenue of each additional passenger adds to the profits of the taxi operator. However, taxis have also developed efficient practices to load passengers and share routes, which reduce operational costs.

Although subsidising a service, which would have otherwise been financially sustainable, is never a good idea, incentives are needed to encourage minibus taxis to participate in the IPTN. One way is to offer a once-off capital grant to allow taxi owners to fit their vehicles with the technology required to participate in the IPTN. This capital grant could also be linked to the taxi recapitalisation programme, so taxi owners who opt into the IPTN receive both the scrapping allowance and the capital grant. Nonetheless, integrating minibus taxis into the IPTN may create additional operational costs for these operators. Therefore, in preparing their IPTNs, cities need to undertake additional research to determine whether minibus taxis will require some form of financial support and how best to introduce this system of subsidisation.

4. MSN News. 2013. 'Taxi recapitalisation efforts will take another nine years: minister', 16 August 2013. Online available at: http://news.howzit.msn.com/taxi-recapitalisation-efforts-will-take-another-nine-years-minister

The grant framework could be used as a lever to improve access and commuter experience. For instance, the design of the PTOG could include an incentive component. This capped incentive would reward those cities that are able to improve (or maintain) commuter satisfaction levels and demonstrate better modal integration. Part of the incentive could be passed on to public transport operators (e.g. buses and minibus taxis), who would in turn be rewarded for efficient and on-time services.

The PTNOG is another operating grant disbursed by the fiscus. This newly established grant came about as a result of the spilt between the infrastructure and operational components covered by the PTISG. Cities can use this grant to fund ancillary and indirect operational costs, such as security services, station management, ticketing services and the control centre operations associated with the IPTN. However, the PTNOG may not be used to defray any direct operating costs (e.g. labour, fuel and vehicle maintenance).

Supplementary grants such as the PTNOG work in interesting ways. They subsidise operational costs while allowing financial risks to be shared between national and local government. Municipalities are required to cover the cost of direct operations and so can reduce their financial obligations if (a) they are able to run their buses in an efficient and cost-effective manner and (b) they manage to transfer some of the financial costs and risks to public operators.

CITIES ARE NO LONGER ABLE TO ACCOMMODATE LOWER-THAN-EXPECTED FARE REVENUE IN THE FIRST YEARS OF THE IPTN OPERATIONS.

Leveraging the grant framework for modal integration

The PTIG and PTNOG work together to fund the infrastructure and part of the operations of the IPTNs. However, like all conditional grants, they are inflexible funding sources subject to strict conditions. This inflexibility is illustrated by comparing the PTIG and its predecessor – the PTISG, which combined funding for capital expenditure on IPTNs and certain types of operating expenditure. With a single grant (the PTISG), cities had some flexibility to shift expenditure between the capital and operational components. This was especially useful in the early years of IPTNs, when cities were uncertain about the levels of ridership and cost of maintenance. Funding could be used to cover certain operational costs and alleviate the financial burden on cities. The PTISG was then spilt into the PTIG and PTNOG, with the intention of providing greater transparency and certainty over operational funding (DoT, 2013b), but as a result cities are no longer able to accommodate lower-than-expected fare revenue in the first years of the IPTN operations.

The trade-off between expenditure control and flexibility becomes an important issue when pursuing modal integration. Modes of transport in South Africa have developed in response to the spatial patterns of cities. Specifically, long-range bus and minibus taxi services will remain a feature of the transport landscape for the foreseeable future. Although proposed BRT systems will capture part of the market share of these two modalities, bus services and minibus taxis can operate as feeder services. Therefore, strong arguments can be made for integrating BRT, bus and minibus taxi infrastructure to create a seamlessness commute.

For cities, this means developing IPTN plans that allow transit between bus stations, minibus taxi ranks and BRT stations. These plans would allow cities to cover additional infrastructure investment associated with modal integration. However, the problem is that cities have been slow to develop their IPTNs, which in many instances focus on BRT systems and give less attention to other modes of transport.

This issue can be dealt with in two possible ways through the grants. First, grant conditions should include a requirement to demonstrate the approach and sequencing of modal integration within the IPTNs. This would allow cities the flexibility to access the PTIG for infrastructure that may be built in later phases but is an important stepping stone for modal integration. National government officials are likely to argue that this will open up the PTIG to all sorts of claims and requests for funding. But, without a grant framework that encourages modal integration across all forms of public transport, the IPTNs risk becoming a BRT-driven system, which may not be appropriate for all cities. A rigid PTIG framework also risks discouraging private operators from participating in the IPTN.

Second, all infrastructure grants that fund road- and rail-based public transport should be linked to a city's IPTN. In practice grants, such as the USDG, MIG and Neighbourhood Development and Partnership Grant (NDPG) should require (as part of their conditions) any planned infrastructure to cater for different modes of public transport and include modal interchanges. Incorporating this type of consistent messaging into the grant framework for road- and rail-based public transport will encourage modal integration.

Fiscal allocation

Passenger rail is funded through an allocation made by national government to PRASA, which in 2014/15 amounted to R11.1-billion for upgrading rail infrastructure and purchasing new rolling stock. PRASA also gets an operational subsidy of R3.9-billion to fund the shortfall between its fare revenues and operational costs.

Under the previous administrative arrangement, when Metrorail fell under Transnet, the operational subsidy was given on a cost-plus basis, where a management fee was added to compensate the rail operator. Although this arrangement has probably continued, international

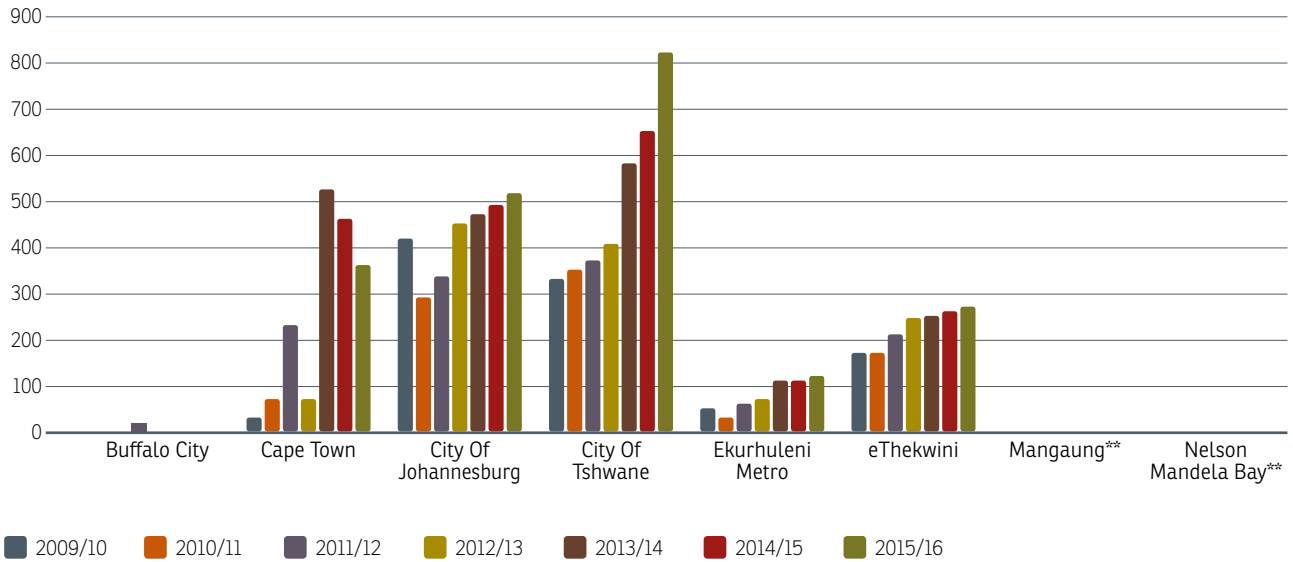
Long-range bus and minibus taxi services will remain a feature of the transport landscape for the foreseeable future.

experience shows that operational subsidies are best allocated on the basis of per passenger kilometre travelled. This approach is useful for many reasons, not least because it enables intermodal comparisons and eliminates the perverse incentives associated with a per-passenger subsidy.

Own revenue

For most cities, operating bus services is a costly exercise. Between 2009/10 and 2013/14, the South African cities spent a combined R6.5-billion on public bus services (see Figure 9 for a breakdown per city).

Figure 8: Operating expenditure on public buses (2009/10-2013/14*)



Source: National Treasury local government database
** Revised estimate of expenditure for the 2013/14 financial year*
***data was not available for Mangaung and Nelson Mandela Bay*

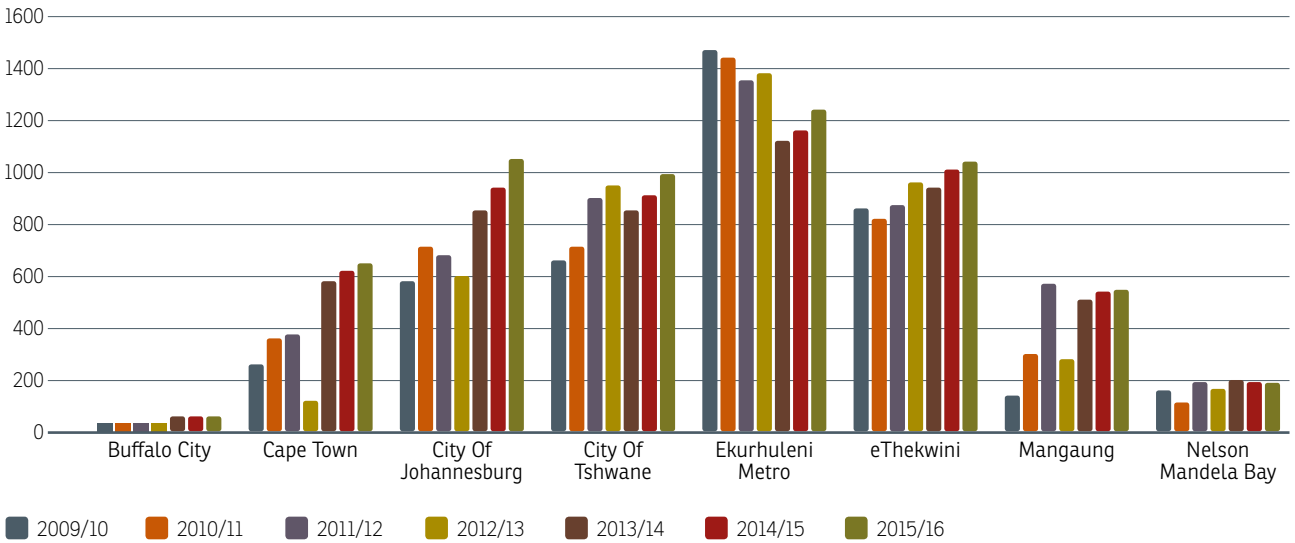
The City of Johannesburg spent on average R431-million per annum to operate their metro bus service and cater for any shortfalls on the Rea Vaya. This expenditure has thus far been funded by their equitable share and local tax revenue. Between 2012/13 and 2013/14 the City of Cape Town's operational expenditure increased rapidly, although the drivers behind this steep rise are unclear.

Similarly, the City of Tshwane's operating expenditure will increase towards the end of 2013/14 financial year as the A Re Yeng BRT is rolled out. No operating expenditure is recorded for Buffalo City and Mangaung, as these municipalities are in the process of developing their IPTN plans, or in Nelson Mandela Bay municipality, where the BRT is no longer operational.

Over the next decade, as the costs of operating bus services increase, cities will have to make provisions to fund the shortfall between operating costs and user charges. These shortfalls will place additional pressure on the already constrained city budgets. However, all hope is not lost: cities have opportunities to extract additional value from their investment in public transport. Possible revenue streams for cities include mechanisms such as business taxes, land value capture, station rents, air rights and advertising, but more research is needed to understand when and how these mechanisms can be used without stifling the economy of cities.[5]

Cities also have to spend money on roads and other traffic-associated measures because cars are the most convenient way to get around the country's sprawling cities. This car-captive market requires smooth roads and a host of traffic-directing and calming measures, all of which come at a cost to cities. Between 2009/10 and 2013/14, South African cities spent approximately R23-billion on maintaining road and instituting traffic measures, or about four times the amount spent on funding bus services (Figure 10). Ekurhuleni spends the most on road maintenance, as a result of the high level of industrialisation in the municipality, which means that scores of heavy vehicles use municipal roads and are responsible for road wear and tear. This volume of vehicle traffic is worrying, not only for Ekurhuleni but for any cities seeking to move to a low-carbon future. It is critical to get citizens out of their cars and onto public transport.

Figure 9: Operational expenditure on roads (2009/10–2013/14*)



Source: National Treasury local government database
** Revised estimate of expenditure for the 2013/14 financial year*

5. Refer chapter 'Using land-use management to create transit-friendly cities'

In general, road maintenance in metropolitan municipalities is funded from the fuel levy, equitable share and/or their own tax revenues. Since 2006/07, the fuel levy is now a direct charge against the national revenue fund and allocated to metropolitan municipalities on the basis of fuel sales in their jurisdiction (National Treasury, 2008). The intent behind the fuel levy is to make sure that road users in cities fund the maintenance of the roads that they use. The fuel levy poses an interesting conundrum for cities because, as the share of private travel declines and public transport rises, their allocation of the fuel levy will eventually decrease. Although this is unlikely to happen over the medium term, it becomes problematic if municipalities rely on the fuel levy to fund other types of expenditure, which appears to be the case. The fuel levy allocation to cities grew from R6.8-billion in 2009/10 to around R9.6-billion in 2013/14. Over the same period, expenditure on road maintenance increased from R4.2 to R4.5-billion. The difference between the fuel levy allocation and expenditure on road maintenance suggests that funds for road maintenance were diverted towards other expenditure. Ideally, the fuel levy allocation should be ring-fenced to fund road maintenance and public transport within cities. This would encourage cities to make available a dedicated stream of own revenue to fund public transport initiatives.

User charges

Historically, user charges were set to recover the operational costs of public transport services. In the case of bus services geared towards low-income communities, fares were used to recover the difference between the cost of public transport and the subsidy.

However, fares are not just about cost recovery. Experiments in behavioural economics reveal that user charges can influence the travel decisions of commuters. For instance, cities such as Chengdu in China offer free public transport to commuters between 5am and 7am to discourage private travel and ease congestion during peak time.[6] An experiment in Singapore found that rewards coupled with lower user charges could be used to spread peaks. The scheme was designed by the University of Stanford to determine the response of commuters to incentives: Singaporeans were rewarded with loyalty prizes for using public transport outside peak time, with ticket holders receiving triple credits if they travelled outside the peak.[7] This incentive scheme was highly successful, as commuters responded by renegotiating their hours of work in order to take advantage of the lower public transport fees.

In general, public transport operators apply some form of fare differentiation based on time of travel. Differentiating by time of travel involves a tricky balance between setting public transport fares low enough to encourage citizens to use it and high enough to discourage peak time use. Fare differentiation is not a new concept in South Africa. Passengers using metro buses, Metrorail and the Gautrain are given the choice of purchasing a daily, weekly or monthly ticket. In this way, passengers benefit from cheaper daily fares when purchasing weekly and monthly tickets, while operators are better able to manage their operations and cash flows when passengers pay in advance. BRT systems tend to differentiate fares according to the time of travel. Strong peak periods draw steeper fares, as capital costs need to be significantly higher to meet the additional demand.

6. China Daily. 2012. 'Free bus rides offered to ease road congestion', 11 October 2012. [Online] Available at: http://usa.chinadaily.com.cn/china/2012-10/11/content_15808457.htm
7. Railway Gazette. 2012. 'Singapore offers loyalty prizes to ensure off-peak metro travel', 1 February 2012. Online available at: http://www.railwaygazette.com/news/urban/single-view/view/singapore-offers-loyalty-prizes-to-encourage-off-peak-metro-travel.html

The nature of public transport means that higher capital investments is needed to accommodate peak periods: more buses, infrastructure and systems are needed to accommodate short peaks in transport demand but are then underutilised in off-peak times.

Table 2 illustrates the fare differentiation by time of travel for the Rea Vaya and MyCiti. The Rea Vaya differentiates between commuters travelling at peak and off-peak times, whereas MyCiti establishes the travel pattern of the commuters by asking them to select between two categories – standard and frequent traveller. Frequent travellers receive additional discounts on fares if they use and load their MyConnect card regularly. By allowing commuters to identify their own travel patterns, the city applies price differentiation to secure a regular ridership for its bus services. In addition to identifying categories of commuters, MyCiti differentiates fares according to the time of travel.

Table 2: Comparison of Rea Vaya and MyCiti Fares

	Fare differentiation	Less than 25 km	Cost per km	More than 25 km	Cost per km
Rea Vaya	Peak	R11.50	R0.46	R12.50	R0.21
	Off peak	R10.35	R0.41	R11.25	R0.19
	Fare differentiation	**20–30 km**	**Cost per km**	**30–60 km**	**Cost per km**
MyCiti	Standard – Peak	R12.70	R0.42	R14.30	R0.24
	Standard – Off peak	R10.50	R0.35	R11.70	R0.20
	Frequent – Peak	R9.80	R0.33	R10.90	R0.18
	Frequent – Off peak	R8.00	R0.27	R9.00	R0.15

Sources: www.reavaya.org.za, www.myciti.org.za and own calculations

The analysis of the cost per kilometre reveals some interesting insights. When comparing standard fares, Rea Vaya is cheaper over longer distances. However, the MyCiti frequent traveller fares outperform the Rea Vaya on all distances in both peak and off-peak times. The cost per kilometre is also much lower over long distances and purposively set to support historically disadvantaged communities who live on the urban edge of cities. However, as with the subsidised bus service, the BRT system is likely over the short and medium term to encourage sprawl and delay much needed urban transformation, unless concerted efforts are made to halt this trend.

MORE BUSES, INFRASTRUCTURE AND SYSTEMS ARE NEEDED TO ACCOMMODATE SHORT PEAKS IN TRANSPORT DEMAND BUT ARE THEN UNDERUTILISED IN OFF-PEAK TIMES

Metrorail differentiates its fare based on the frequency of travel. Commuters can purchase single, return, weekly or monthly tickets. It also offers concessions to scholars and pensioners who pay between 40% and 50% less than a full fare. Metrorail offers three services: Metro, MetroPlus and Express. The MetroPlus service is a premium class travel and offers passengers greater comfort, while Metro is the economy class fare. The fare per kilometre for economy service is significantly lower compared to the BRT: over a 30-kilometre train trip, average fares per kilometre are estimated at 23 cents, or about half the price of a BRT ticket (Metrorail, 2014).

As the fiscal framework changes, cities will invariably be under more pressure to fund operational activities, which may require them to review how user charges (or bus fares) are set. When designed well, user charges are a powerful tool for cities to influence the use of public transport. In designing their fare systems, cities have to balance the competing objectives of cost recovery from the user and the promotion of public transport – which in itself is not an easy feat.

Affordability remains a major concern for the millions of South Africans who use public transport. To maintain affordable public transport services, cities will have to monitor the average commuting cost for the different modes of transport and the price sensitivity of commuters to increases. This will become especially difficult when different modes of transport offer different fares for similar lengths of travel. Therefore, cities will need to encourage competition *for* the market and not in the market, through well-designed IPTNs that carve out the market for each mode of transport. Additionally, cities will require a comprehensive fare policy that covers the fare structure across all road- and rail-based transport modes.

The challenge for South African cities is to look beyond their existing practices, to structure fares that promote public transport and penalise private travel. This requires interrogating the array of user charges available to them to achieve these objectives. For instance, cities could consider selling discounted bulk transit passes to employers, who in turn can use them to subsidise the travel costs of their employees, or using congestion and parking charges to discourage private travel into the city.

TOWARDS BUILT ENVIRONMENT INTEGRATION

Distances and density are two important factors for public transport, as together they determine the cost of public transport and, ultimately, influence affordability. Distance and density relates to the city's urban form, and how this form changes over time will influence where public transport networks are built and what services are provided. Conversely, investments in public transport influence where people choose to work and live.

Internationally, spatial planning methods, such as transit-oriented development (TOD), have emerged but are difficult to implement when existing spatial patterns are firmly entrenched in the landscape of cities. Where this happens, governments have focused on and attempted to guide any new developments by creating strong links between transport and land-use planning. Funding arrangements are then tied into these comprehensive

plans over a five-year period. For instance, in Australia the state government compiles a comprehensive transport and land-use plan, with funding instruments and sources of finance tied to specific and approved projects in the plan. Each project must meet certain criteria that demonstrate how it contributes to the spatial vision of the city and integrates with other built environment functions. This detailed and sequenced approach to planning allows cities to understand how transport and land-use interventions will change the city's urban form over the next five years (South Australia, 2013).

South African sprawling cities were not planned and built to meet the needs of a large majority of the population. Therefore, integrating public transport with the built environment is crucial to building compact, inclusive, connected cities. The first necessary step towards this vision was to strengthen the planning environment. Although some progress has been made through the spatial and integrated development planning framework, much more needs to be done. Funding mechanisms cannot improve the quality of integrated planning but can be used to recognise and give weight to these plans.

However, the tendency has been for funding to dictate planning instruments. For example, the Integrated City Development Grant (ICDG) is a positive grant meant to reward cities for integrating their built environment functions to achieve a more compact urban form. It requires cities to develop Built Environment Performance Plans (BEPPs) in addition to their IDPs, which arguably undermines the essence of an integrated development plan and, more importantly, suggests that integration depends on the existence of a separate grant framework that rewards cities for their attempts to integrate.

Using funding instruments to create additional plans around the built environment (as in the case of the BEPP, which is now a requirement for both USDGs and the ICDG) also creates an additional compliance burden on cities (National Treasury, 2014).

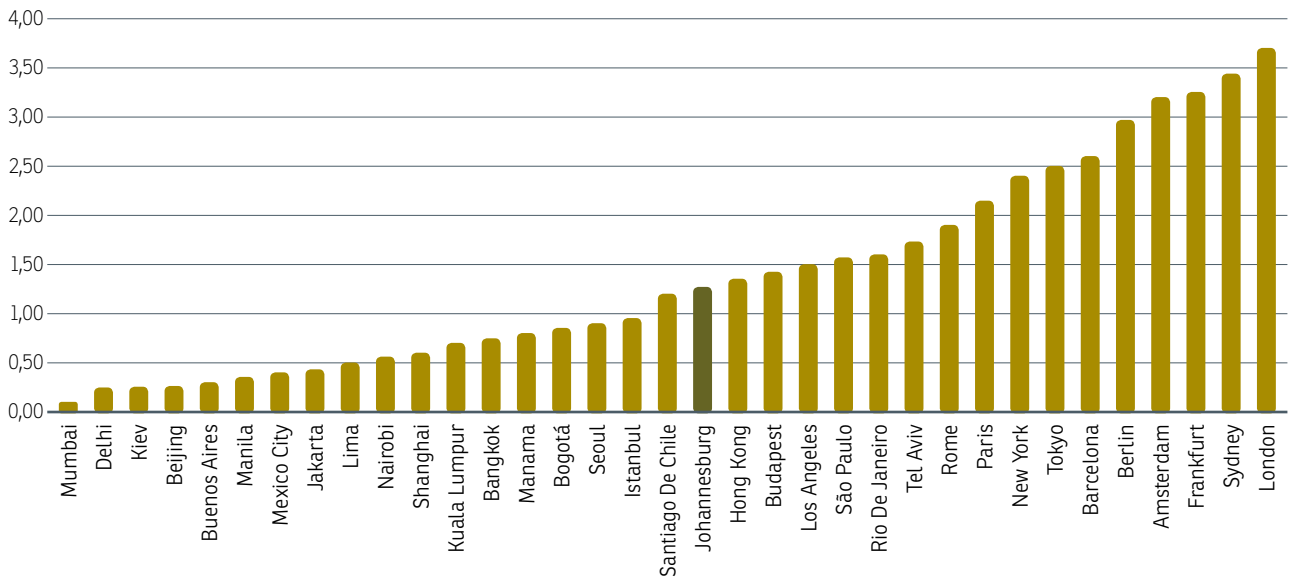
Although funding should not dictate the urban form and long-term spatial planning, the conditional grant framework is a powerful instrument and can be better designed to promote built environment integration. In practical terms, this means that all conditional grants (including the PTIG and PTNOG) should include 'integration' conditions that all cities must meet when developing new infrastructure or subsidising operations. This could include minimum density ratios for priority transport infrastructure. Other grants such as the USDG should include conditions that call for any planned human settlement development to be aligned to the IPTN. Conditions may also include maximum commuting time and distance to transport points, in line with the standards set out in the White Paper. The purpose of these conditions is to ensure that investments in public transport prioritise infrastructure that leads to a compact urban form.

LEVERAGING PRIVATE PARTICIPATION IN PUBLIC TRANSPORT

Historically, governments have funded public transport from taxes and, to a lesser extent, user charges. The sheer scale of investment required in public transport means that government cannot be solely responsible for financing infrastructure investment. In some countries, public-private partnerships have built and efficiently operated BRTs, for the most part without any form of subsidisation.

One example is the TransMilenio system in Bogotá, an integrated BRT system that uses busways, stations and terminals adapted for large-capacity buses, and fare integrated operations with smaller buses on the outskirts of the city. The system consists of 12 lines covering 112 km throughout the city and is one of the world's largest BRT systems. The city government is responsible for providing and maintaining infrastructure (e.g. trunk lines, stations, terminals and effecting the necessary road works), while private operators provide the bus services on a concession basis. TransMilenio S.A. is a public entity, wholly owned by the city government, and established to oversee the performance of bus operators, plan improvements, implement expansion and manage the system. Bus operators are responsible for all direct capital and operational costs associated with providing and maintaining bus services. They purchase buses in line with pre-determined specifications contained in concession contracts, hire bus drivers and maintain their fleets. They operate both trunk and feeder lines (World Bank, 2011: 10). Under this arrangement, efficiencies within the BRT system have driven down fare prices and made travel in Bogota among the cheapest in the world (Figure 11). More importantly, it ensures that operations are financially sustainable over the long term.

Figure 10: Fare comparison across multiple countries



Source: UBS (2012)

Note: Fares based on a minimum of a 10-stop or 10-kilometre bus ride.

In South Africa, the Gautrain experience shows that private sector investment in public transport is possible, but the public sector carries disproportionate risks. The Bombela Concession Company holds the 20-year concession to design, build, partially finance and operate the Gautrain (Gautrain, 2011). Private sector investment in the Gautrain accounts for approximately 11% of the total infrastructure cost, with the remainder being financed by government. The concessionaire derives its revenue mainly from ticket sales but also has in place a patronage guarantee (Dachs, 2011). The latter guarantees the concessionaire revenue if ridership falls below a certain threshold and is part of the risk-sharing arrangements included in the concession contract.

In most instances, the private sector partner is unlikely to be willing to finance the large capital costs associated with immovable public transport infrastructure. However, investing in vehicles and operating public transport networks may be attractive for the private sector. For this to happen, three aspects need to be in place:

1. Government has to clearly define its plans, identify the roles and responsibilities of different spheres and agree on the role of the private sector. At city level, IPTN plans should ideally outline financially viable projects and routes where private operators could operate or maintain infrastructure.
2. The private sector also requires regulatory and contractual certainty. The South African experience with the interim bus contracts demonstrates the impact of contractual uncertainty on private sector investment decisions. Most bus operators on these types of contracts have opted not to invest in upgrading, renewing or maintaining their fleets. As a consequence, the service is increasingly unreliable, which frustrates not only passengers but also government.
3. The risk-sharing arrangements must be appropriate to each party's risk appetite. Private sector companies are driven by bottom lines and profits, and so they are often unwilling to take risks without a commensurate level of return on investment in public transport infrastructure and operations. Similarly, government cannot be expected to bear most of the risks associated with delivering public transport. Sharing risks, in a way that suits both the public and private sector, requires willingness by both parties to engage and negotiate – but mostly a commitment to working together.

To date, the experience of cities in leveraging private sector participation in the public sector has been a less than happy one. Cities have found it difficult to work with the newly formed taxi structures on the BRT and have struggled to find suitable private operators for the BRT control centres. Nonetheless, these initial problems offer valuable lessons for cities in determining the approach to negotiating and determining the right level of risk sharing between public and private sectors.

ENCOURAGING LOW CARBON PUBLIC TRANSPORT

Urban sprawl exacerbates environmental pollution – as car usage rises, so too does the noxious smog that envelopes a city. Public transport in itself is the green option. In general, all measures aimed at increasing the availability and affordability of public transport will reduce greenhouse gas emissions in three ways:

(1) The relative cost of public transport comes down, which leads to higher uptake, so long as the public transport networks meet the needs of users. (2) The level of emissions reduces with a shift from private to public transport, provided utilisation rates are reasonable. With more people using existing public transport, the reduction in emissions from cars outweighs the negligible increase in emissions from public transport. As transport emissions are directly related to fuel use, any measures to encourage off-peak usage will reduce emissions. (3) Densities increase and distances reduce, as TOD and built environment integration take hold. All of this points to the fact that public transport is the 'low carbon option' in most cases.

Grant frameworks can be used to encourage low carbon public transport by influencing the building programme and by offering operators incentives to use more energy-efficient processes and vehicles. The PTIG does this to some extent, by requiring all buses funded by the grant to comply with EURO IV emission standards. In addition, the PTIG funds non-motorised forms of transport that have almost no carbon footprint. Similar conditions could be replicated and included in the PTOG, once it is devolved to metropolitan municipalities.

CONCLUSION

Millions of South Africans who use public transport have to put up with unreliable and unsafe services, and face long commutes across multiple modes of transport. For them, better public transport is about knowing that the service is accessible, affordable, reliable, safe and hopefully fast. But, after decades of under-investment in public transport and the fragmental spatial patterns left by apartheid, car ownership has become an aspirational choice for many South Africans. As incomes have risen, so too has car ownership. For those that already own cars, lifestyles and choices are built around private travel.

Building IPTNs is a necessary step towards changing perceptions about public transport. Over time, these IPTNs can also play an important role in changing the urban form, to compact, low carbon, inclusive and connected cities. Although some progress has been made in developing IPTN plans, what is lacking is a comprehensive approach to funding public transport, which considers all sources of funding and does not just rely on the national fiscus to fund IPTN infrastructure and operations.

While international evidence points to the difficulties in getting the private sector to fund the large capital outlays needed for public transport infrastructure, the private sector has a meaningful role to play in financing movable assets, systems and operating the network. In addition, cities can use their fare policies and an array of other instruments, such as value capture, to finance public transport investment.

While the fiscus remains the primary source of funding for public transport, the grant framework clearly offers an opportunity to encourage modal and built environment integration. However, this means that cities have to strengthen their IPTNs to demonstrate modal integration. The current grant instruments (such as the PTIG) should also be flexible enough to allow cities to sequence the development of public transport infrastructure, e.g. for buses and the minibus taxi, provided it is clearly linked to the IPTN. The conditions in the grant framework

(which currently consists of multiple grants funding road-based transport) are equally important and should be consistent in their pursuit of modal and built environment integration. In this way, the grant framework can be used to add weight to existing planning instruments and not dictate new plans and compliance requirements that place onerous requirements on cites.

Getting public transport right is vital to South African's economic and political future. For this to happen, all spheres of government need to be more assiduous in developing public transport funding arrangements that promote modal and spatial integration. If the funding continues to constrain the country's commitment towards public transport, the vision of a transformed South African city will remain elusive for generations to come.

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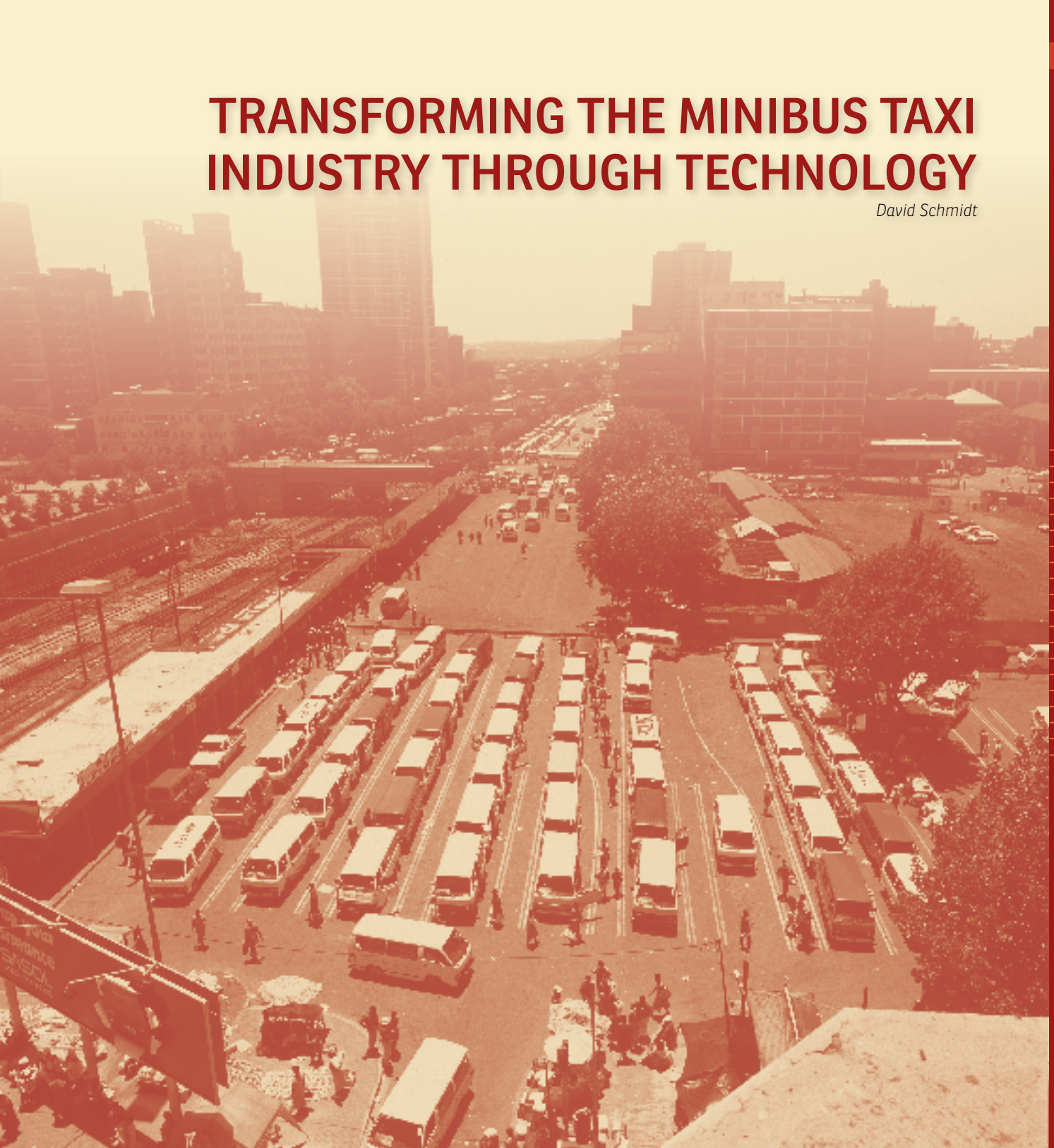
TRANSFORMING THE MINIBUS TAXI INDUSTRY THROUGH TECHNOLOGY

David Schmidt



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INTRODUCTION

THE PUBLIC TRANSPORT NETWORK OF THE IMMEDIATE FUTURE WILL NEED TO BE A HYBRID SYSTEM, COMPRISING THE DIFFERENT MODES

The key idea driving urban public transport reform in South Africa is the establishment of integrated public transport networks (IPTNs). These networks are also emerging as the foundation for organising urban spatial transformation and concentrating future urban development around key nodes and corridors of the emerging public transport network. However, a public transport network is only as good as the public transport modes that service it. And, while considerable resources are currently being used, both to strengthen the rail mode under PRASA and to establish city-controlled bus rapid transit (BRT) systems, a central element is missing: the strengthening of the critical minibus taxi (MBT) component of the network – the largest transport mode used by passengers.

The Public Transport Strategy (DoT, 2007) says very little about the MBT industry and how its capacities and strengths can be used within a multi-modal network servicing a range of settlement types and needs. An assumption of the strategy is that the city, as controlling authority, will incorporate all trunk and feeder services into the IPTN, in terms of a gross contract, which would allow the city to control and manage scheduled services throughout the network.

The high level of integration, with a single multi-modal ticketing system or a complete subsidised and contracted multi-modal service, is very much a long-term goal. While this may be a desirable goal, the necessary financial and institutional resources will not be in place

for the foreseeable future. Therefore, the public transport network of the immediate future will need to be a hybrid system, comprising the different modes (MBT, rail, BRT and bus) working together in a complementary manner, with incrementally increasing levels of integration. This is the assumption of the chapter, which is unashamedly a piece of policy advocacy.

The logical consequence is that a key next-generation public transport intervention is to support major improvements in the MBT mode. The MBT sector has the potential to improve massively through the use of new information and communication technology (ICT), geared to transport management, combined with bold political leadership and innovative responses from the industry.

THE MBT SECTOR HAS THE POTENTIAL TO IMPROVE MASSIVELY THROUGH THE USE OF NEW INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

After a brief overview of the MBT industry and presenting the argument for supporting and developing the MBT sector, four areas of potential performance improvement are explored in more detail: regulation and enforcement, safety and security, fleet management and intermodal integration, and passenger information and interactivity. In each of the four areas, the following questions are teased out:

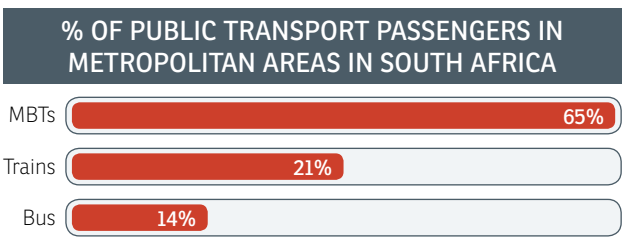
- What are the needs in the South African MBT context (including opportunities and constraints)?
- What can technology do to address the challenge?
- What are the benefits of the identified solutions for cities and citizens, for transport authorities and for the taxi industry?

The four areas are then drawn together in a summary table describing each of the technology solutions. The feasibility of these solutions is examined by reviewing the outcomes of an EU-funded pilot project with the Peninsula Taxi Association (PTA) in Cape Town, where a number of the technology solutions were tested in practice. This is followed by some recommended steps and concluding remarks.

MBT INDUSTRY OVERVIEW

MBTs are the single largest public transport mode serving South Africa's cities: in metropolitan areas, 65% of public transport passengers use MBTs, compared to 21% who use trains and 14% who take the bus (StatsSA, 2014: 4). Interestingly, the modal split – between public transport and private car passengers, and between the MBT, train and bus public transport modes – has changed very little over the past decade and is almost exactly the same as in 2003.

The MBT sector provides a relatively cheap, flexible and convenient service, particularly to poor communities. It represents a creative response to spatial fragmentation and the lack of public transport for the urban poor. It is also an important business and employment opportunity for economically marginalised people, with an estimated annual turnover of more than R16.5-billion – achieved without any public subsidisation.



At the same time, the MBT industry is beset by significant challenges. Inadequate regulation and enforcement has resulted in over-trading on many routes, which has spawned high levels of taxi violence and compromised efficiency and profitability. This in turn reinforces the lack of vehicle maintenance, poor driving practices, and low skills and training in the sector, which is widely seen as being unsafe and having poor customer service.

A decade ago, the industry was characterised as the vanguard of black entrepreneurship in South Africa and as the BEE success story. The industry has subsequently lost that cachet and is often described as a problematic sector, resistant to regulation and innovation, and unwilling to adopt new technologies because of various factors. These factors include low levels of trust, low skills and capacity, and the domination of vested interests with little interest in modernising and formalising the industry.

Yet parts of the MBT industry have consolidated and reached a more mature stage of institutional development. A new generation of forward-looking leaders appears to be emerging, while the potential for partnership and innovation (although uneven) is growing.

Government policy towards the MBT industry has been somewhat ambiguous, vacillating between seeing the MBT as a key part of the mobility solution and as a problem sector. It is important to note that MBT operations were essentially illegal until 1987, when the reality of the emerging industry was accepted and allowed for the first time. Having acknowledged the reality of the MBT sector, government's first major initiative was to build MBT interchanges and associated infrastructure, particularly after 1994. Up until 2005, this was probably the major public transport intervention, and a strong focus in many cities, but has declined in emphasis over the past decade. The operational management and maintenance of these facilities have often been poor since then.

Complementing the focus on MBT infrastructure was a gradual consolidation of the MBT regulatory regime. The permit system was refined, with the intention of addressing conflict in the industry and reducing over-trading. Key principles included (1) only one association would be allowed to operate on any single route (to avoid inter-association conflict), and (2) the cities, through their transport planning functions, would determine appropriate levels of MBT 'supply' on a route, to ensure that the demand could be met while minimising over-trading. However, large parts of the MBT regulatory system are dysfunctional, and significant levels of piracy, non-compliance with operating licence requirements and disregard of traffic regulations prevail.

THE MBT INDUSTRY WILL REMAIN THE LARGEST FORM OF URBAN PUBLIC TRANSPORT FOR THE FORESEEABLE FUTURE.

Government's most recent MBT initiative has been taxi recapitalisation, which sought to incentivise the replacement of older MBTs with new vehicles, as well as to improve service quality and legal compliance. Since 2010, a number of cities have shifted emphasis, focusing on public transport investments that replace or complement the MBT mode, most notably BRT, where the MBT industry is incorporated as shareholders of the BRT operating companies.

ARGUMENT FOR DEVELOPING THE MBT SECTOR

The MBT industry will remain the largest form of urban public transport for the foreseeable future. Other modes, such as rail and BRT, supported by improved non-motorised transport (NMT) facilities, could potentially increase their respective shares of public transport passenger trips, as envisaged in various city integrated transport plans. Similarly, as the urban population stabilises and becomes more middle class, more people will commute by private car, unless a car-competitive public transport system emerges. However, even if these modal shifts happen, the MBT industry will remain the largest single mode of public transport for the current transport planning horizons. The coverage of the planned BRT and rail investments will not be sufficient to displace the MBTs as the largest public transport mode. Furthermore, the MBT mode is potentially also a very useful feeder system to the rail and BRT modes, providing the 'last kilometre and more' services that scheduled services cannot viably provide.

The relatively dispersed and low density spatial patterns characteristic of South Africa's cities make the MBT a critical element of the overall public transport mix. More expensive, rapid public transport modes can only be sustained in the long term along core higher-density corridors. The MBT is ideally suited to dispersed lower-density areas, which need a more flexible mode that does not require the investment levels of the rail, bus and BRT modes. With its flexibility, adaptability and responsiveness to demand, the MBT mode can also address some mobility requirements better than traditional, scheduled 'hub and spoke' public transport modes, which run on defined routes (the 'spokes') to major interchanges (the 'hubs'), where transfers to other routes on the same mode or other modes are made. A leading MBT operator described MBTs as 'fluid like water. They take the shape of whatever container they find themselves in. This is why we will always outcompete other forms of transport'. The essential point is that the MBT sector is sufficiently flexible to adapt to the changing requirements of both passenger and public policy and will remain the key public transport mode. The public policy issue is how to 'contain' the industry in a manner that optimally complements other modes and delivers improving levels of service.

Regulatory dysfunction has limited the potential of the MBT industry to evolve in terms of safety, cost efficiency, service quality, service range, working conditions and profitability. Effective regulation is arguably a necessary condition, providing stability, predictability and protection

from over-trading needed to justify investment in innovation and new practices. Some critical elements of a regulatory framework are already in place, in particular two key principles. The first principle is that only one association per route is permitted. The intent of this principle was to reduce violent conflict between associations competing on the same route. However, the added advantage is that it creates the basis for members of the association to work together to manage their individual vehicles jointly to improve efficiency – and ultimately to organise them into single companies to operate optimally their jointly owned fleet. The other principle is that operating licences are issued based on supply and demand and that only enough licences to meet passenger demand on a particular route are to be granted. If properly implemented, this principle creates the certainty and protection from unregulated competition required to improve safety, driving practices and vehicle quality.

The economic logic of MBT improvement

A challenge in the MBT industry is resistance to change, and previous efforts to introduce monitoring technology in the industry met with strong resistance. Yet there is also a powerful economic logic for the industry to evolve and modernise. Irrespective of the number of MBTs trading, the number of potential MBT passengers (and thus the potential revenue) on a particular route is more or less constant in the short-term. Over-trading results in reduced profitability, not only because this revenue is shared among a larger pool of operators, but also because MBTs incur significantly higher costs per km, as they are competing against each other for the fixed pool of passengers, rather than cooperating to deliver a better service. The operating costs of driving safely and slowly within the speed limit are considerably lower per kilometre than racing in order to run additional peak trips or driving dangerously. A well-maintained, relatively new vehicle also has lower operating costs per kilometre compared to an old, poorly maintained vehicle. However, to achieve these benefits, operators working on a route will have to cooperate in order to achieve the efficiencies of running a better service and share the benefits. The essential point is that the need for improvement should be framed as a commercial rationale for 'embracing change', not as a regulatory and punitive 'case for change'.

Improving the regulatory and enforcement regime has proved to be very difficult for provincial governments, who have been responsible for this function thus far. However, the shift of regulatory, contracting and planning roles to cities (allowed by the National Land

Transportation Act (NLTA) No. 22 of 2000) creates the potential for a new purposeful approach driven by the cities. Given the problems associated with the current regulatory status quo, it would be very risky for the cities to take on the function without having an agenda of substantial reform. In this regard, the NLTA provisions create a major impetus for cities, as the new managers of the regulatory system, to take bold steps to improve the situation, notwithstanding the institutional capacity and funding deficits that will be taken over from the provinces when the function is transferred.

ICT-based transport management has the potential to catalyse major innovation in the MBT sector to ensure safer, more efficient, more integrated and better quality service, as outlined later in this chapter. These new technologies also have the potential to compensate for at least some of the inadequacies of current regulatory systems and personnel. However, realising the potential ICT-led MBT reform will require considerable levels of collaboration by the cities and the MBT industry. The cities will need to invest patient and consistent effort to improve regulation and to develop the right package of incentives to promote desired behaviours and innovations. The MBT industry, in turn, will need to accept more formal arrangements than the current ones, as well as greater transparency and accountability to both regulators and their passengers. This will require a deepening of partnership between the cities and the taxi associations at national, metropolitan and even route levels.

Reform is achievable in return for relatively low levels of financial investment, and the benefits are real and tangible – a safer cheaper and more legally compliant industry that is more integrated with other public transport modes, and delivers a better service to passengers and much higher returns for the operators.

IMPROVEMENTS THROUGH ICT

There are four major areas where introducing proven ICT technologies can improve the performance and compliance of MBTs: regulatory monitoring and enforcement, safety, security and traffic law compliance, intermodal integration, and user information and interactivity.

Regulatory monitoring and enforcement

The many problems with MBT regulation and enforcement across the country include:

- The lack of a reliable and stable national data platform on which all MBT operating licence information is stored and accessed. The current national data platform is outdated and unstable, making data entry by the various Provincial Regulatory Entities (PREs) time-consuming and unreliable.
- In many provinces PREs are administratively weak, have poor systems, decision-making processes based on limited information, and significant levels of corruption in the processes of issuing, renewing and amending operating licences.
- Poor supply and demand information. As the planning authority, a municipality must prepare a Current Public Transport Record (CPTR) that details all the transport services in its area of jurisdiction.[1] This must be updated annually and must take into account the supply and demand of MBT services.

1. National Land Transportation Act (NLTA) No. 22 of 2000, Section 23.

The CPTR becomes the basis for issuing operating licences by the PRE. Current practice is to use rank and route surveys to determine such information, which is not very accurate.

- The lack of systems that provide law enforcement officers with immediate and accurate information about the regulatory status of a particular vehicle. For example, operators may have only one valid operating licence but commonly use duplicate licences to operate a number of MBTs.
- Weak and often corrupt law enforcement, with arbitrary and inconsistent encounters with MBT drivers and operators, as traffic officers do not have the information to manage the interaction properly.

Many of these issues have a strong institutional dimension that cities will need to address as part of taking over the regulatory function. However, institutional change management is not part of this chapter's brief. Nevertheless, adopting ICT technologies to support regulation can facilitate these institutional changes.

The most obvious technology to support improved regulation is Global Positioning System (GPS) technology, which is well-established internationally, as well as in South Africa, where vehicle tracking is required for security, fleet management, or driver monitoring.

As part of their BRT rollout, major metropolitan cities, such as Johannesburg, Cape Town and Tshwane, have put in place state-of-the-art control centres, which have the capacity to monitor MBTs provided with GPS and to assess their compliance with their route conditions, as well as speed regulations.

THE MOST OBVIOUS TECHNOLOGY TO SUPPORT IMPROVED REGULATION IS GPS TECHNOLOGY

Another technology with major potential is on-board counting technology. A South African company has developed a passenger counter using sensor equipment and software that detects people and is supplemented by two internal cameras monitoring the sliding door and front rows and the back rows (Van Zyl and Labuschagne, 2008).

The technology outlined above is in line with the Public Transport Strategy and its associated Action Plan, which envisages that MBTs will have electronic equipment installed and monitored by the regulatory authorities (DoT, 2007).

The technology brings significant benefits for the city, operators and drivers.

For the city, GPS plus passenger counters fitted to an MBT radically changes the ability to monitor and enforce compliance with the route conditions of MBT licences, passenger load limits and speed regulations. Having GPS installed in all MBTs on a route or an area would give the city an accurate and comprehensive picture of all MBT passenger trips, which could be used in compiling CPTRs. The provision of real-time information about MBT movement patterns, enabling the identification of problems, could also help traffic management.

For the operators, vehicle monitoring allows them to assess driver movements and can be used to lower insurance premiums on vehicles. The passenger-counting technology also enables them to calculate the income earned by the MBT and so to negotiate a split of income between owner and driver, based on accurate information.

MBT drivers might resist this technology because it will make them much more accountable for compliance. It may also mean they have to pay owners more than is currently the case because the actual income earned will be transparent. However, if the income benefits of a better regulated system are shared between driver and owner, there is potentially a net benefit for the driver.

Safety, security and traffic law compliance

MBTs clearly have major safety issues, particularly with regard to driver behaviour. An Automobile Association of South Africa study calculated that 70 000 minibus taxi crashes occur annually in South Africa, double the number of accidents involving other passenger vehicles.[2]

Reckless driving by taxi drivers is considered one of the most important transport-related problems for 6.9% of all passengers, 9.9% of Gauteng households and 9.7% of Western Cape households (StatsSA, 2014: 90). Not only do MBT drivers often drive at speeds considerably higher than the speed limit to reduce trip time and to secure more loads, but MBTs are also often poorly maintained and overloaded. Poor maintenance increases the risk of accidents and injury, particularly as a result of brake and tyre failure, while overloading can alter vehicle dynamics (including stopping distances and cornering) and can result in reduced driver control. The other concern, for both passengers and drivers, is crime on taxis.

MBTS CLEARLY HAVE MAJOR SAFETY ISSUES, PARTICULARLY WITH REGARD TO DRIVER BEHAVIOUR.

Progress in low-cost telematics[3] makes it possible to improve driving behaviour, through monitoring the vehicle's acceleration, cornering and braking patterns. All that is required is to install a small device in the motor vehicle that submits the data to a processing unit, which then generates reports on driver behaviour. The reports can be used to penalise bad practices and incentivise good driving habits. This technology is used in the global motor vehicle insurance market and is being pioneered in South Africa by Discovery Insure using largely local expertise.

Vehicle maintenance telematics (which is discussed in more detail in the section below) can also be used to assess and improve vehicle roadworthiness, particularly with regard to brake and tyre management.

To deal with the security issue, cameras can be installed in the MBT and linked to a control centre using internet protocol technologies. For instance, one camera facing forward over the driver and two facing the passengers. Images from the cameras are stored on an on-board computer for up to three days and can be forwarded to a control centre using General Packet Radio Service (GPRS).

2. Arrive Alive website - http://www.arrivealive.co.za/pages.aspx?i=2850.
3. Telematics is a combination of the words telecommunications and informatics. It refers to the integrated use of computers and telecommunications technology. It can be used to send, receive and store information relating to vehicles, and thus can be used to monitor the location, movement, status and behaviour of a vehicle.

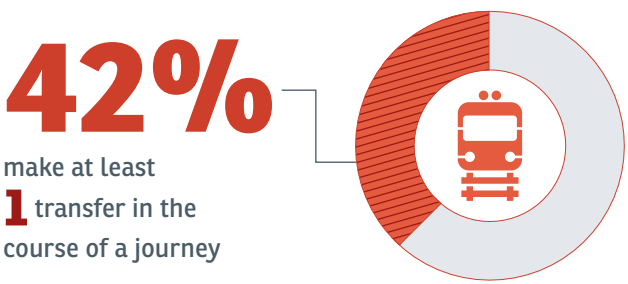
These technologies bring considerable benefits to the regulatory authorities, the operators and passengers.

For regulatory authorities, the use of these technologies will reinforce good driving practices, reduce the frequency of accidents and increase the overall security of the system. Driver behaviour telematics provides a wide range of information that can be used to formulate MBT policy and regulation. Information from the cameras can also be used to evaluate accidents or other incidents, including theft or other criminal activities.

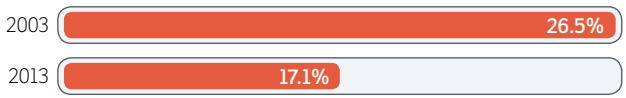
For operators, the benefits of improving their drivers' driving practices are significant. Improved driving practices reduce fuel consumption, and hence fuel costs, and result in less wear and tear on vehicles, which lowers maintenance costs. They strengthen the hand of operators in negotiating insurance rates. The cameras and GPS plotted information can also potentially protect taxi operators themselves against traffic law enforcement officials who engage in fraudulent enforcement.

Passengers will benefit from the additional security and improved driver behaviour.

THE % OF TRAIN USERS MAKING TRANSFERS



THE % OF PUBLIC TRANSPORT USERS MAKING TRANSFERS DURING THEIR JOURNEY



Intermodal integration

The car competitiveness and cost-efficiency of the public transport network is highly dependent on the degree of intermodality that exists to make transfers between modes as seamless, simple and fast as possible. Currently, in South African cities, intermodal integration is very limited, especially with MBTs, apart from ensuring close proximity of rail, bus and MBT interchanges in major nodes. There is no alignment of schedules, no shared ticketing system and very poor common information about schedules and routes across the different modes. This limits the ability of the MBT sector to support rail and bus trunk services in areas where a significant percentage of public transport is intermodal and where MBTs are the only public transport service available.

The percentage of public transport users making transfers during their journey declined from 26.5% in 2003 to 17.1% in 2013 (StatsSA, 2014: 4). This probably largely reflects the increasing importance of whole journey services that MBTs are able to provide, where a single MBT taxi collects passengers close to their homes and drops them close to their destination. However, this also suggests inefficiencies, as MBTs are running long-haul journeys, which larger vehicles such as buses can provide more efficiently. As anticipated, less flexible services, such as rail, require a much higher level of intermodality, with 42.4% of train users making at least one transfer in the course of a journey (StatsSA, 2014: 47).

The overall efficiency of public transport mobility appears to be decreasing: in 2013 nearly 15% (14.4%) of passengers had to wait more than 15 minutes for their first public transport trip, an increase of 4.4% in metropolitan areas since 2003. Accessing mobility is also more difficult for passengers, as illustrated by the increase in the time taken to walk to the nearest taxi, bus or train stations. In 2013, over a fifth (22.4%) of households had to walk for more than 30 minutes to get to the taxi rank or to the train station, compared to 17.6% (to taxi rank) and 17.4% (to train station) in 2003. This suggests a need to provide a more comprehensive feeder system of MBTs serving the trunk-type mode, so that fewer passengers have to walk considerable distances to access public transport.

Two established ICT technologies can facilitate greater integration of the MBT mode with other modes and more efficient deployment of the MBT fleet to meet passenger needs: a multi-modal ticketing system and Demand Responsive Transport (DRT).

A multi-modal ticketing system[4] allows passengers to access MBTs and other modes with a single card or alternative payment device such a cell-phone. Ultimately, the idea is to have integrated ticketing, where a single ticket allows travel on one or more modes of transport provided by one or more operators. The technology to achieve fully integrated ticketing is available, and current smart card systems being adopted for the BRT systems would have this functionality. However, a range of institutional and funding challenges need to be overcome before a fully integrated system can be achieved. A first step would be to have a single card that enables access to MBT, BRT, bus and rail modes but which charges separately for each trip made on a single mode. Suitable ticketing technologies do exist, such as multimodal smart cards, where money and the 'ticket' are stored on the smart card, and mobile phone ticketing, where passengers use their cellphones to buy tickets, which are then sent to them by SMS.

DRT technology is rapidly evolving and is already being used by carpools, car-sharing schemes and specialised bus services for the mobility impaired. Thanks to new developments (such as GPS, on-screen information in vehicles and routing software), services can be created that respond more directly to the requirements of the individual passenger. DRT software is a proven flexible scheduling application, whereby passengers book a journey via a call centre, website or a smartphone, and then the system aggregates bookings in a particular area and organises the most efficient schedule for the bus or MBT to pick up people along a route. The route may be fixed, with prescribed pick-up points, or more flexible, collecting passengers in an area from their respective locations.

The traditional fixed route services are ideal for clustered travel demand areas but not for certain parts of South Africa's sprawling cities. The widespread reality of low-density informal settlements on the urban periphery creates mobility needs that are not suited to fixed-schedule bus or rail services, from either a cost or passenger need perspective. MBTs using a DRT system represent an intermediate service that complements the conventional passenger transport modes, particularly at low-demand times or in weak-demand areas. This is different from the service offered by metered taxis

4. See chapter 'Integrated Ticketing and fares for equitable access' for more about integrated ticketing.

because other passengers, who have similar requests within a given zone, share the MBT. Therefore, the journey may take longer than a metered taxi, but the advantages are that the service can be of high quality, cheaper, almost door to door and available on a regular basis. Smart cards can also be incorporated into DRT services to help identify passengers, to serve as electronic tickets and to provide proof of transport performance where the MBT is running a contracted service.

Intermodal integration using these technologies brings benefits to passengers, transport authorities and taxi associations.

Passengers will save time and money, and public transport will be more convenient, if electronic ticketing (whether partially or fully integrated) is available and DRT systems create new pick-up and drop-off points closer to homes or workplaces.

For transport authorities, integrated ticketing will enable them to implement more complex pricing strategies that can influence passenger behaviours (e.g. shifting more passengers into off-peak periods), to distribute income among the operators or different modes, and to obtain extensive passenger information that will help improve services and schedules. DRT will also help improve transport planning and management, as more efficient feeder services for the rail and BRT networks will be possible, thereby optimising the strengths of the MBT and minimising system costs.

For taxi associations, electronic ticketing will reduce the risk associated with cash payments and make splitting income between the driver and operator easier and more objective. In particular, it can create an incentive to move away from the 'target system', where drivers have to provide owners with an agreed daily payment, which is an important cause of much observed reckless driving behaviours. DRT will also help improve profitability: managing all the MBTs on a route as a single fleet will avoid inefficiencies of over-competition, particularly in off peak periods.

User information and interactivity

Despite steady improvements in the information available to bus, BRT and Metrorail passengers in recent years, most of the information is static and related to the fixed schedules. Timetables are available in accessible electronic form for Metrorail (GoMetro), the BRT services and most scheduled bus services, but are not updated in real time to accommodate delays, cancellations and other schedule changes. For users of MBTs, very little passenger information is currently available, apart from route signs at taxi ranks. Knowledge about the MBT routes and departure times is spread informally, by word of mouth. Functional multi-modal route planners are not yet available. Yet a variety of applications for cellphones and other digital devices let users access information about taxi routes, journey times and intermodal connections.

Globally, multi-modal route planners are now the most common form of travel information used by passengers. While passengers in the past relied on printed timetables, call centres or desktop computers to access schedule and other travel information, passengers can now access travel information en-route via smart phone applications. Such route planners can either be static (providing information on regular services under normal conditions but not on delays or disruptions) or dynamic (updating information to advise passengers of changes in schedules and traffic conditions). Such dynamic, real-time information can also now be conveyed to passengers via LCD monitors on the MBT, bus or train, or even via electronic information boards at stations or on roads.

All these systems require a strong 'back-office' component, so that real-time traffic and public transport information is collected and processed, and updates on traffic and transport conditions are immediately circulated to users via the available communication channels. Many of the metropolitan cities have the capacity to do this through their traffic management control centres. The route planners and on-board monitors simply provide accessible and affordable channels for circulating this information.

GLOBALLY, MULTI-MODAL ROUTE PLANNERS ARE NOW THE MOST COMMON FORM OF TRAVEL INFORMATION USED BY PASSENGERS.

The benefits of improved passenger information are considerable.

It promotes intermodality and makes public transport more accessible and understandable. Journey planning is more accurate and dynamic, and so public transport is more competitive. The interactive nature of the new passenger information technologies also provides public transport users with greater choice, allowing them to rate particular vehicles and drivers and enabling them to choose not to use particular vehicles. The potential in this area has not really been explored and developed, and there is scope for cities to enter a range of partnerships to effect significant change.

Table 3 summarises the various technologies outlined above and assesses their feasibility in the South African context.

Table 3: Technological assessment

Technology	Application examples	Operator opportunities	Regulatory and planning opportunities
Monitoring and regulation systems			
Automatic vehicle location devices	Widely applied technology that is extensively used in bus operations management including BRT and vehicle tracking.	Insurance reductions and driver monitoring.	Route and traffic law compliance.
Passenger-counting systems	PTA pilot project (South African innovation).	Accurate revenue information.	Accurate passenger information.
Vehicle recognition systems using cameras linked to vehicle databases.	Already extensively used internationally for traffic law enforcement.	Fleet management.	Provides enforcement officers with extensive information when linked to working data bases. Can be used to verify route compliance.
Safety and security systems			
On-board CCTV camera systems often with forward and passenger-facing units that enable internal security and outside incidents to be monitored.	On-board CCTV cameras are now extensively used within the sedan taxi industry internationally and are increasingly a mandatory requirement in many cities. Australia has been a leader in this area.	Driver monitoring, revenue verification, safety.	Accident reports, driver behaviour monitoring, improved safety and security.
Driver behaviour telematics systems.	This technology, which has been used by operators with large fleets, is now being mainstreamed particularly in the area of motor vehicle insurance. Discovery Insure is a local leader.	Reduced fuel consumption. Reduced insurance premiums. Safer driving behaviours.	Safer driving behaviours and driver behaviour analysis to support regulatory change.
Drug and alcohol testing devices	Extensively used internationally by regulatory agencies and operators to test drivers.	Safety.	Safety.

Technology	Application examples	Operator opportunities	Regulatory and planning opportunities
Co-modality and fleet deployment and management systems			
Maintenance and operations telematics	Such systems are increasingly being used by large fleet operators. C-Track is a leading local provider of this technology.	Proactive maintenance reduces costs.	N/A
Demand responsive transport (DRT) – passenger booking aggregators.	Extensively used in car-sharing schemes such as Zapcar, CarShare.	No longer necessary to fill MBT at rank but can be done along route.	More efficient passenger movement.
Integrated electronic ticketing	Electronic ticketing is already extensively used internationally and in South African public transport such as Gautrain, Rea Vaya and MyCiti. It has also been piloted in the MBT industry by Santaco and PTA. The technology can allow a single ticket or single fare across different modes where modal integration and an integrated funding mechanism is in place.	Better revenue management. Potential for subsidy sharing.	Supports improved car competitive public transport.
Passenger information and interaction systems			
On-board information screens	Extensively used in large public transport systems and piloted in MBT industry by PTA.	Advertising revenue.	Public interest announcements and public transport information.
Single-mode schedule information	Applications in place for single modes in South Africa such as GoMetro.	Improved passenger service.	Can be extended to taxis where appropriate .
Multi-modal journey planners	Many applications internationally but no complete multi-modal planner in South Africa yet.	Improved passenger service.	Strengthens PT car competitiveness.
Trip evaluation aggregators	Growing applications such as Better Taxis and Uber.	Service quality feedback.	More passenger choice and voice.

THE STADIUM PILOT PROJECT

Many of the technologies outlined in this chapter were tested in a European Commission-funded project involving the Peninsula Taxi Association (PTA) based in Cape Town and a consortium of ICT companies. This project formed part of a larger study to assess the potential long-term benefits of Smart Transport Applications Designed for large events with Impacts on Urban Mobility (STADIUM) in the context of the FIFA Soccer World Cup (European Commission, 2012).

The project had monitoring, security and demand-responsive components and involved a monitoring control centre linked to a fleet of 19 PTA MBTs. It focused on the'last mile' service, as an extension of the BRT airport shuttle during the World Cup, with a view also to testing the viability of the technology.

Each MBT was equipped with a complete set of ICT tools, included a GPS antenna and GPRS modem, a door sensor, a passenger-counting device, an LCD monitor for relaying service information and advertising, webcams for security and a smart card reader aimed at a future integrated e-ticketing system. The technology was intended to enable PTA MBTs to offer a broader range of public transport services including:

- A loop service based on current operations, where the driver deviates slightly from existing routes to pick up potential passengers who book through the call centre or using an application or website;
- A point-to-point service for groups of passengers at hotels;
- Employee contract services;
- A 'last mile' service to complement other public transport services, by providing transport from major BRT (or rail) stations to the passenger's final destination.

The pilot project confirmed that the monitoring technology made it possible to track the position, speed, number of passengers, opening of doors and ticket printing of vehicles. The GPS system forwarded the GPS coordinates to a back-office, where they were plotted on a map using Mapinfo and processed to give an accurate track of the travelled route. The system was able to plot from additional door sensor information when people boarded or alighted. The City of Cape Town confirmed the usefulness of the tracking information, which could be used to determine route adherence. However, the raw data would need to be converted to a database that links the location data to routes and operating licenses (Van Zyl and Labuschagne, 2008). The passenger-counting technology was also applied in the pilot with some success (ibid). The reliability of this technology caused some difficulties, which is inevitable with a new technology. The City of Cape Town further confirmed that passenger number information linked to a geographical position could be a helpful input for compiling the CPTR.

The pilot project also provided clear guidance on the costs of installing the technology. The capital costs of the on-board equipment (including installation) came to R55,000–R60,000 per vehicle. The monthly operating cost was between R3000 and R5000 per vehicle, including on-site maintenance, advertising management, equipment lease and sundry costs. The pilot also suggested that the

advertising revenue of R6000–R10,000 per month could be generated through the LCD monitor supplemented by the passenger-counting device. This could potentially cover both the monthly operating costs and the repayment of a loan to cover the capital costs. The PTA back office was set up for R75,000, but a municipality should be able to provide such a service largely using existing control centre capacity.

The study assessment conclusions included the following:

- The introduction of BRT systems generates a need for an integrated transport system linking the proximate areas with the BRT stations. A widespread system of minibus taxis could supplement mass transport lines and would be able to serve remote lower-demand areas if optimised with a DRT service that minimises inefficiencies (e.g. empty MBTs) and provides the service only if necessary. The pilot showed that DRT can allow an MBT to continue boarding passengers along the route, while at the same time providing a service to booked passengers, either by making planned route variations or real-time route changes optimised by the DRT technology (European Commission, 2012: 115).
- A viable DRT service requires that MBT drivers secure a minimum 'basic' number of clients to serve throughout the day along an itinerary scheduled upon requests. Such a DRT service, integrated with regular MBT service (and BRT and rail services), potentially allows the drivers to work in 'less stressful and less dangerous conditions, as the driver does not constantly have to worry about drawing the attention of potential clients met along the route, and therefore avoids distractions when driving' (European Commission, 2012: 30).
- A DRT service managed by a call centre, with high-tech, on-board devices for security (webcam), infotainment (monitor) and fare rules (printer and contactless validator), makes transport by MBT more appealing to a wider range of passengers.

Interviews with ten owners revealed that the benefits of the installed technologies for the owners outweighed any 'negative' feelings of being monitored by the regulatory authorities, and that both taxi owners and the municipality benefit from the implementation of these applications (Van Zyl and Labuschagne, 2008).

MAKING IT HAPPEN

Transforming the MBT industry through technology will require a number of implementation phases.

Preparation phase

Systematic attention will be given to improving urban regulatory and enforcement systems. Possible actions include:

- A thorough institutional assessment of the current state of the regulatory function linked to the transfers of functions to metropolitan municipalities.
- The development of national information systems to create a much stronger ICT platform for managing the function.
- The establishment of public transport control centres in metropolitan centres (if not already in place).

- The implementation of a range of pilot projects to test the technology applications, evaluating the outcomes (including unintended consequences), to explore the costs and funding of installing and operating the systems, and to demonstrate the potential benefits to MBT operators and secure their buy-in to the envisaged changes.
- The facilitation of partnership brokering involving the metropolitan municipalities, the MBT industry and private sector partners, such as the insurance companies and technology providers.

Initial implementation phase

The agreed scheme will be implemented on identified routes in participating metropolitan areas. This incremental approach means that a two-tier parallel regulatory system will evolve: common regulations would apply to all areas, but a new monitoring system, supported by an agreed incentive/penalty arrangement, would apply to the routes participating in the scheme. Participation by taxi associations in the scheme would be voluntary, but all members of the association operating on a route would be obliged to participate. Key elements of the new system would include:

- As a minimum, the installation of an automatic vehicle-location device, on-board cameras and a driver behaviour telematics device in all participating taxis, linked to a monitoring control centre.
- Various incentives for participating, such as preferential ranking, dedicated lane and intermodal access, reduced insurance and other premiums, and financial incentives for compliance.
- An agreed penalty regime for non-compliance.

Consolidation and expansion phase.

Once the scheme is functioning effectively on the initial routes (and the institutional, regulatory and technology mechanisms have been refined and consolidated), it can be incrementally rolled out to other routes. This rollout will depend on the readiness of the municipality and the taxi associations on a route and will accelerate over time: over 5–10 years, the scheme will extend to all routes in the metropolitan areas and other major cities. The model (and its associated systems and innovations) could potentially expand to other developing countries, as MBTs will be the dominant public transport mode in African urban centres and a key mode in many Asian, Middle Eastern and Latin America countries. There are definite economic opportunities for South African companies to export the expertise and products developed through this kind of intervention.

CONCLUSIONS AND IMPLICATIONS

The establishment of IPTNs is key to the emerging urban public transport networks. However, the ideal of a fully integrated, multi-modal service – supported by a single multi-modal system – is very much a long-term goal. The public transport network of the immediate future will need to be a hybrid system comprising the different modes working together, including the MBTs. As a public transport network is only as good as the public transport modes that service it, and MBTs are the single largest public transport mode serving South Africa's cities, the MBT industry needs to be included.

However, the sector faces significant challenges, including inadequate regulation and enforcement, resulting in over-trading and consequent high levels of taxi violence, and poor vehicle maintenance, driver behaviours and customer service.

New technologies offer the MBT sector a way of improving massively and becoming an integral part of the urban public transport network. The four areas of potential performance improvement are: regulation and enforcement, safety and security, fleet management and intermodal integration, and passenger information and interactivity. Some of the technologies that will enable better integration and service of MBTs include the introduction of GPS, passenger counters, telematics and cameras in the vehicles, supported by DRT technology, and multi-modal ticketing system and route planners. A pilot project involving the PTA in Cape Town and a consortium of ICT companies tested many of these technologies. Taxi owners who participated agreed that they (and the municipality) would benefit from the installed technologies.

Given the size of the MBT industry as a public transport mode, interventions as proposed in this chapter are arguably the single most important area of focus to improve mobility, reduce distance and trip times and create a more spatially inclusive city. The NLTA empowers cities to take over the full MBT regulatory function from the provinces. With this shift comes the opportunity to bring about a step change in regulatory practices through improved capacity, new tools and philosophies and improved accountability.

The ability of the MBT industry to harness new technologies will require political will, institutional development and innovation. This will require a shift in paradigms or mindsets for many affected operators – from seeing themselves as small stand-alone operators to being shareholders, from a 'pirate' culture to a service culture, from an informal ethos to a formal ethos. Such changes require time and will need to be carried out on an incremental and experimental basis that enables the case for innovation and change to be made in a gradual and systematic manner.

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INTEGRATING TICKETING AND FARES FOR EQUITABLE ACCESS

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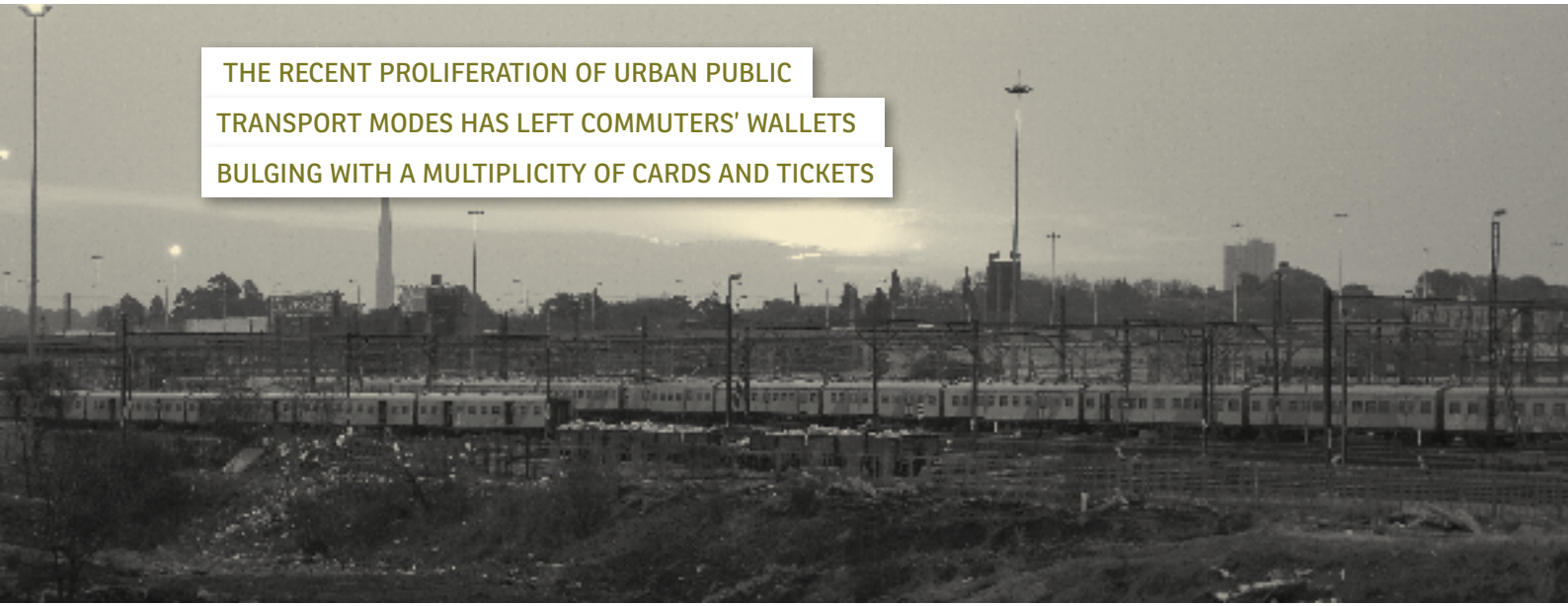
INTRODUCTION



THE RECENT PROLIFERATION OF URBAN PUBLIC TRANSPORT MODES HAS LEFT COMMUTERS' WALLETS BULGING WITH A MULTIPLICITY OF CARDS AND TICKETS

The majority of South African commuters travel and will continue to travel by multi-modal public transport. The expansion and integration of multi-modal public transport is central to every major urban transport policy in the country (e.g. City of Cape Town, 2013b; City of Johannesburg, 2013; City of Tshwane, 2007; ETA, 2010; Gauteng Roads and Transport Department, 2013a). However, the recent proliferation of urban public transport modes has left commuters' wallets bulging with a multiplicity of cards and tickets. Generally, a commuter will need a separate ticket for each mode of transport.[1] This means that, for instance, a commuter who lives in Johannesburg and works in Tshwane could take the following modes of transport everyday: a minibus taxi, the Rea Vaya, the Gautrain, the A Re Yeng and another minibus taxi. On the journey, the commuter would need cash (for the minibus taxis), two EMV cards (for Rea Vaya and A Re Yeng) and a contactless smartcard (Gautrain).

This fragmentation is not just an inconvenience but is contrary to the goals of South African spatial planning. The CSIR's 'Red Book', which contains guidelines on human settlement planning and design, recommends in the chapter on public transport that '[t]he potential for transfer between routes should be maximized' (CSIR, 2000: 4). In addition, '[s]eamless services that contribute to the concept of a centrally operated and controlled public transport system should be developed', which

1. The exceptions include the Gautrain train/bus/parking system, which uses the Gautrain Gold Card, and the three bus systems in eThekwini, which share the Muvo Card.

means that 'a uniform and shared fare and ticket system [applies] to all modes, and customers can transfer between travel modes with a minimum of delay and discomfort' (ibid., 5).

The importance of integrating transport modes, fares and ticketing is found in legislation and policy. The DoT's Public Transport Strategy calls for multi-modal integration designed 'to achieve maximal physical and fare integration' and 'extend the range of destinations available to a user for a single, affordable Network fare'. Such integration will require 'an electronic fare payment system which uses a smartcard' (DoT, 2007: 7). The National Land Transport Act (NLTA) No. 5 of 2009 requires interoperability of fare collection and ticketing in any given area, and empowers the Minister for Transport to set standards for fare media.

This chapter first defines fare and ticket integration, and e-ticketing, and explains the technicalities of e-ticketing at point of sale. Then, after discussing the benefits of integrating fares and tickets, and smart ticketing, transport integration is assessed in South Africa's three largest urban centres (eThekwini, Cape Town and Gauteng City Region). Finally, the transport policy paradox is examined, options for a progressive[2] fare policy presented, followed by some concluding remarks.

FARE INTEGRATION, TICKET INTEGRATION, AND E-TICKETING

Integration consists of two related issues: intermodal[3] integration of the physical medium used to pay for transport (the ticket) and intermodal integration of the fares themselves. These are conceptually distinct and can each be implemented alone or together, with different technical and social implications.

Fare (or tariff) integration is 'the possibility offered to passengers to travel from origin to destination by applying the same fare' regardless of the mode of transport (Mezghani, 2008: 28). In many public transport systems, this takes the form of 'through-ticketing', whereby one fare allows the passenger to make any number of transfers on multiple modes of transport within a fixed time of the first boarding. For example, the Barcelona transit system allows free transfers within 75 minutes for a one-zone journey, or 150 minutes for a six-zone journey.

Ticket integration is 'the possibility to use the same ticket (with possible limitation in time) to travel from origin to destination', regardless of the mode of transport (ibid.). An example is Creditrans, a travel card that works on the metro, bus, regional trains and national trains within the Basque region of Biscay.

The two examples are distinct forms of integration both in theory and in practice. The Barcelona system represents fare integration without ticket integration (different tickets are issued on different modes but can be used on all modes), while the Biscay system represents ticket integration without fare integration (each operator deducts its fare from a single value-holding ticket).

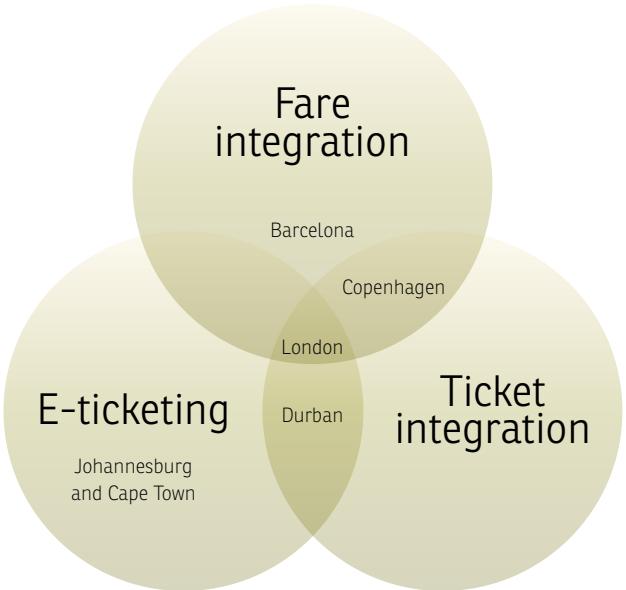
Many public transport systems combine fare and ticket integration to a greater or lesser extent. An example of complete ticket integration with partial fare integration is the Paris transit system, where the single ticket 't+' will

2. Progressive here means equitable, i.e. favours the poor. For example, distance-based fares, whereby travelling longer distances costs more, discriminates against the poor who mostly live on the periphery of cities, as a result of apartheid spatial planning.
3. South African policy most frequently uses the term 'multi-modal', but the broader literature frequently uses 'intermodal'; both terms are used interchangeably here.

allow unlimited transfers between the metro and trains (within Paris) or unlimited transfers between buses and trams within 90 minutes, but no transfers between the metro/bus, train/bus and train/tram. An example of complete ticket and fare integration is the 'klippekort' (clip-card) of Greater Copenhagen, which gives access to all modes of public transport for a single fare, although the fare varies according to the zone. Many transit systems are more complicated, with ticket and fare systems that are more or less integrated depending on the fare product bought. For example London's Oyster card allows an adult traveller who stays in zone 1 to ride a bus for £1.45 per trip or the metro for £2.20 per trip (ticket integration; no fare integration). However, the total fare will be capped at £8.40 (or £4.40 if only buses and trams are used) if the traveller takes several trips within zone 1 in a 24-hour period. This is a form of ticket and (partial) fare integration.

The other concept is **e-ticketing** which refers to tickets that are 'sold and stored in an electronic device, such as smart cards or mobile phones' (Puhe et al., 2014: 9 citing Haneberg, 2008). E-ticketing may vary in technical specification and implementation, which will be discussed later in this chapter, but is also distinct from fare integration and ticket integration. Barcelona's fare integration and Helsinki's ticket integration both use 'dumb' magnetic cards, while relatively complex fare structures are possible without e-ticketing: Barcelona has 27 different intermodal tickets offering a range of fare products and passenger-based discounts. Copenhagen's klippekort offers full fare and ticket integration with a card that does not have a magnetic strip and uses only time-stamps and small pieces physically 'clipped' from the card.

Figure 11: The relationship between fare integration, ticket integration and e-ticketing



TECHNICALITIES OF E-TICKETING AT POINT OF USE

E-ticketing, also called smart ticketing is characterised by the use of electronic fare media that is more complex than a simple magnetised ticket. Although these media can in principle take many forms, the two most relevant are **smart cards** and **mobile ticketing**

Smart cards

A smart card is a plastic wallet-sized card with an embedded integrated circuit. This is not new technology: the first smart card was patented in 1968, and current cards are based on patents filed in the 1970s. By 1983 smart cards were used to pay for public telephones in France and were integrated into all French *Carte Bleue*

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debit cards from 1992 (Puhe et al., 2014). Today smart cards are internationally ubiquitous and can be contact (or EMV), contactless or hybrid cards.

Contact smart cards (or EMV cards[4])

These can take the form of 'chip and pin' credit and debit cards. The technology involved is mature and secure, so the cards are used for financial transactions worldwide. However 'the inconvenience of actually inserting contact cards in a reader is off-putting when passengers are boarding vehicles or paying a fare at a barrier/entry gate. The time required to complete the payment may be perceived as quite long (in practice, usually only a few seconds)' (Blythe, 2004: 48).

Contactless smart cards

Unlike EMV cards, which have their circuitry exposed for contact with a reader, contactless cards have an integrated circuit that is embedded entirely within the plastic of the card along with an antenna. Therefore, these cards need only to be placed near to a card reader to be processed, and for this reason are also called proximity cards. This is the standard that has been implemented in the new South African Smart ID Cards, as well as the Gautrain Gold Card, and is common in public transport systems around the world.

Hybrid smart cards

These cards have a chip that works both with contact and proximity readers. This allows greater security for high-value transactions (by requiring insertion of the card in a reader and entering a PIN) but greater convenience for low-value transactions (such as paying for the bus), which can be completed by just placing the card on the reader. The smart card used to ride the Rea Vaya is one example of a hybrid card. The Rea Vaya card's EMV functionality is used for adding value to the card (and requires a PIN), but fare collection is contactless.

Mobile ticket

This refers to the piggybacking of ticketing on smartphone technology. These applications require no additional capability in a smartphone, just an internet connection to purchase or receive the ticket and a screen to display a barcode. At its most simple, a mobile ticket can be an email containing a barcode, which is effectively a paper ticket bought without visiting a kiosk or station. There are also smartphone apps, such as Apple's Passbook, that collect e-tickets and stores them together. In principle, these barcodes are usable for public transport – they commonly function as 'virtual' tickets for air travel and are used for other public transport in Denmark. Mobile ticketing has caught on especially for uses that do not require particularly quick transactions, such as rail travel in many parts of Europe, air travel worldwide, concerts, and tourist attractions.

However, simple bar-coded tickets (even when on a mobile phone) require much more complex fare structures than one-ticket-one-ride. Newer forms of mobile ticketing use a two-way interface between the mobile phone and the point-of-use terminal, as is offered by smart cards. Near Field Communication (NFC) technology is increasingly being integrated with smartphones (Chaumette et al., 2011). NFC technology embeds a contactless chip (similar to a smart card) in a mobile phone, allowing two-way high-speed proximity communication between the phone and point-of-use terminals. The integration of

4. After Eurocard, Mastercard, and Visa who together developed the standard.

smart-card capabilities with the processing power and connectivity of smartphones has enormous potential for e-ticketing: fare products could be bought directly from a smartphone app or mobile website and would be instantly available through NFC. Additional features not possible with other ticketing technology include user verification using PIN or (on certain phone models) fingerprint; and 'be-in/be-out' transport, where the phone automatically registers a user's presence on the mode of transport without requiring them to check-in (Mezghani, 2008). However, NFC ticketing, which some believe will 'revolutionise the speed and ease with which passengers can use public transport' (Stroh et al., 2007: 6), has had limited real-world trials (Noll et al., 2006).

Clearing mechanisms

In most South African cities, integrated ticketing would require coordination between various separately owned and funded transport providers (as is frequently the case in other countries). Therefore, an extensive back-end is needed to coordinate the relevant financial and administrative entities, including a clearing mechanism for money collected from passengers, so that each operator can be appropriately remunerated. In non-fare-integrated ticketing systems, each operator need only count the number of tickets sold, or (in the case of a value-holding e-ticket) deduct the appropriate amount from the e-ticket. However, this is inadequate for integrated fares, and particularly through-ticketing, as the value of a ticket bought to ride one bus and then used on another must be apportioned between the two operators in some way.

In some cases, a clearing mechanism is not necessary. For example, many public transport operators in South Africa operate on gross-cost contracts and are paid a fixed amount regardless of how many people use the relevant service. In this case fare integration is simple: all ticket revenues go to the funding authority (usually the transport authority of the relevant metropolitan government), regardless of the fare structure or through-ticketing. However, a clearing mechanism is necessary when public transport operators are paid according to ridership levels or keep some proportion of ticket revenues. This is the case even if only one operator on the network is not on a gross-cost contract. A clearing mechanism is also necessary if gross-cost revenues are to be split between multiple transport authorities, as will likely be the case if Gauteng's transport network is integrated as planned.

Most clearing mechanisms involve assigning a reference price to each mode of transport, and compensating operators according to that price and their relative ridership (Mezghani, 2008). Ridership statistics can be established by manual counting and surveys but are immediately available if the integrated ticket requires a 'check-in/check-out' procedure, meaning that ridership can be established more easily, more accurately, and at lower cost.

THE ESSENTIAL GOAL SHOULD BE A FARE STRUCTURE THAT COVERS ALL MODES OF TRANSPORT AND IS RATIONAL, EASY TO UNDERSTAND, EQUITABLE AND, ULTIMATELY, SUPPORTS SPATIAL TRANSFORMATION.

FARE/TICKET INTEGRATION AND SMART TICKETING

The more dramatic benefits of integration for passengers come not from the convenience of smart ticketing and ticket integration, but 'the integration of the fares themselves [...] because it makes public transport more seamless and more affordable' (City of Johannesburg, 2013: 62). Therefore, the extension of smart ticketing in South Africa needs to be accompanied by fare integration. The essential goal should be a fare structure that covers all modes of transport and is rational, easy to understand, equitable and, ultimately, supports spatial transformation.

Transport is a major cost to poor South Africans (who often have to travel the furthest for work), and this cost is frequently identified as a primary source of dissatisfaction with public transport (e.g. City of Johannesburg, 2013; City of Tshwane, 2007; GCRO, 2011; Moodley et al., 2009). For example, in eThekwini poorer households spend a greater proportion of their income on transport, and black households spend nearly ten times as much on transport as white households (Moodley et al., 2009).

In principle, fare integration and well-designed tariffs can make public transport more accessible and equitable. Extending better public transport into underserved areas will reduce the commuting time, but user costs will rise in the absence of through-ticketing. People may also choose to take less-direct routes that require fewer transfers because it's more economical. This reduces the utility of the trunk-and-feeder system and makes it less likely to 'maximise network utilisation and to minimise travel distance and time' (DoT, 2007:8). Through-ticketing and fare integration is thus an important first step to making public transport work for people who are currently least-served.

However, an integrated fare system is not equitable if the poorest people are still paying the most. The most straightforward tariff in an integrated-fare system is a distance-based fare, where cost increases with distance travelled. This is the integrated fare structure that Gauteng, eThekwini, and Cape Town will eventually use (City of Cape Town, 2013b; City of Johannesburg, 2013; ETA, 2005). Distance-based fares are fair if poor people travel shorter distances than rich people, but this is not the case in South Africa. The spatial form of South African cities means that distance-based fares would be inequitable, with poor people paying more than rich. The City of Joburg implicitly recognised this by introducing a fare reduction in February 2014 for people travelling further than 25km.[5] An integrated distance-based fare structure may be better than what currently exists but can still be inequitable and incompatible with social transformation

5. Rea Vaya. 2014. 'Rea Vaya now cheaper than ever', 28 March 2014. Online available at: http://www.reavaya.org.za/news-archive/march-2014/1021-rea-vaya-now-cheaper-than-ever (16 April 2014).

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Benefits

South African cities are taking fare integration, ticket integration, and smart ticketing as a single package of innovations, and the overall benefits 'are large and come from factors such as modal shifts, cost savings, increased revenue, fraud reduction, better service, and improved access to and integration with other services' (Welde, 2012:136). Passengers, transport operators and the public transport system as a whole, all benefit. For example, quicker fare validation saves individual passengers time, increases throughput for modal operators and helps planners by making public transport more appealing.

PASSENGERS, TRANSPORT OPERATORS AND THE PUBLIC TRANSPORT SYSTEM AS A WHOLE, ALL BENEFIT.

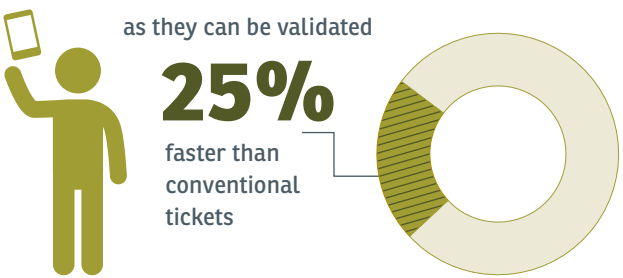
Passengers

The people travelling on the public transport system gain the most visible benefits of fare/ticket integration and smart ticketing, as '[t]he way in which fares, tolls, and other fees for the use of a transport service are collected is one of the most important aspects in determining customers' satisfaction with both new and existing transport schemes' (Blythe, 2004: 48). Passengers have to carry and manage fewer tickets, and only have to deal with a single account or fare product. Switching from paper tickets will dramatically reduce the time taken to process fares (Iseki et al., 2008), as travellers will be able to top-up their smart card at ATMs or in shops, thereby reducing queues at station kiosks, while internet-ticketing will eliminate the need to queue altogether (Urban ITS Expert Group, 2013), albeit only for those with adequate access to internet and financial services. Mobile ticketing goes a step further, by allowing passengers to top-up or purchase fare products on the go.

Operators

The potential benefits to operators are equally important because '[c]onventional means of revenue collection are labour-intensive, can be insecure and cause delays in boarding times and are relatively inflexible' (Blythe, 2004: 48). Throughput is much quicker, as smart tickets can be validated 25% faster than conventional tickets (Urban ITS Expert Group, 2013). Increased gate throughput reduces delays and increases overall service capacity (Perkins, 2012: 13). Faster passenger loading also means that terminals can be smaller and have fewer validation points without sacrificing service. For example, faster bus loading means that fewer buses are needed to transport a given number of riders in a given time (Urban ITS Expert Group, 2013). Smart ticketing has the potential to reduce insecurity, delays and transport uncertainty, is cheaper to operate and maintain than conventional ticketing (Ampelas, 2001; Urban ITS Expert Group, 2013), and can dramatically reduce fare evasion (GAL, 2013; Turner and Wilson, 2010).

THROUGHPUT OF SMART TICKETS IS MUCH QUICKER



Smart ticketing makes available large amounts of new information to operators, on both a service and an individual passenger level (Blythe, 2004). Detailed information about where and when passengers use public transport can inform future route design, improve service levels and allow operators to adjust capacity supply in real-time to meet demand. Information about individual passengers may also allow fare products to be tailored more closely and can be combined with origin/route information for planning purposes. For example, if the ticketing system differentiates between learners and commuters, planners might respond to a particular density of learners on a particular route by increasing service levels only before and after school.

Many transport fare structures already differentiate passengers by offering concessionary fares for pensioners or students – Barcelona even offers discounted fares for members of single-parent families. Smart ticketing would allow more sophisticated targeting of fares: an operator might let students ride for free only during the week, or offer reduced fares after rush hour for pensioners or free transport to a concert for anyone who loads the concert ticket onto their smart card. Such options are possible without smart ticketing or ticket integration, but each would require specific ad-hoc arrangements that increase the complexity in the system and reduce usability. With smart ticketing, the complexity can be 'back-ended', thus increasing usability for passengers.

Transport system as a whole

For South Africa, the main concerns for public transport are to increase ridership and attract private-car users. Both integrated ticketing (FitzRoy and Smith, 1999; Matas, 2004) and integrated fares (Abrate et al., 2009) have been shown to increase ridership. Done correctly, 'simple and unified ticketing' can result in ridership growing by between 6% and 20%, and even up to 40% (CBT, 2009: 1). Smart ticketing makes public transport more attractive (Blythe, 2004) and helps create the image of a modern transport system (Urban ITS Expert Group, 2013). The greatest promise of integrated ticketing is the increased ridership, which supports the major goal of South African transport policy, to shift from cars and towards public transport.

INTERMODAL INTEGRATION IN SOUTH AFRICAN CITIES

Although transport developments are ongoing (and controversial) in places such as Rustenburg and Nelson Mandela Bay, this section looks at the three most extensive urban transport systems, located in South Africa's three largest urban centres: eThekwini, Cape Town, and the Gauteng City Region.

Smart ticketing makes public transport more attractive and helps create the image of a modern transport system.

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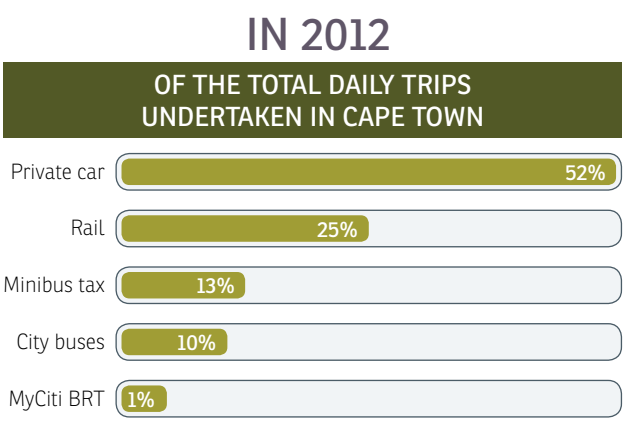
Cape Town

Of the three urban centres, Cape Town has the highest usage of private cars. In 2012, of the total daily trips undertaken, 52% were taken by private car, 25% by rail, 13% by minibus taxi, 10% by city buses and under 1% by MyCiti BRT (City of Cape Town, 2013b). Buses are particularly poorly integrated with other modes, and 'the public transport system in the City of Cape Town would be greatly improved through the implementation of integrated operations with longer operating hours, greater service frequencies and scheduled services on all routes' (City of Cape Town, 2013b: 94). E-ticketing in Cape Town is limited to the MyCiti BRT, which uses the myconnect contactless smart card and so fares and ticketing are not integrated. However, the City promises to 'roll out the myconnect fare collection system to all road based public transport services as and when these services are contracted' (ibid., 125). The ultimate aim is to have one ticket that allows 'the public transport user to purchase one ticket (a myconnect card) that is valid for use on all modes' (ibid., 128) and, ultimately, 'a fully distance-based fare structure' (ibid., 132).



The City's plans for integration have been underway since at least 2001 (Jeffares & Glean et al., 2001). The intention is to expand the fare system to includes 'all public transport modes administered by the city' and to develop a uniform fare 'for all public transport modes within the city (i.e., BRT, other contracted bus services, commuter rail, dial-a-ride etc.)' (City of Cape Town, 2013a: 6). The future integrated fare will work on a zone-based distance tariff, where 'fare will be fixed at a constant level for a specific travel distance' (ibid. 10) with unlimited transfers and fares capped at a certain level. Fares will also be differentiated by time of travel (peak/off-peak), passenger discounts and fare product. The system will be based on the myconnect card already in use for the MyCiti buses.

In short, Cape Town's public transport is still unintegrated, but the City has ambitious plans for both ticket and fare integration. As regards e-ticketing in the private sector, the Peninsula Taxi Association is currently testing a smart card-based payment system on 40 minibus taxis traveling between the city centre and the V&A Waterfront. The system is based on a contactless EMV system, is compliant with Department of Transport standards, and could be a foothold for ticket or fare integration between public transport and taxis. As will be discussed later, such integration outside of public transport is a key feature of smart ticketing. The credit on a myconnect card can already be used for the purchase of goods and services like any other debit card, albeit with a transaction limit of R200.

eThekwini

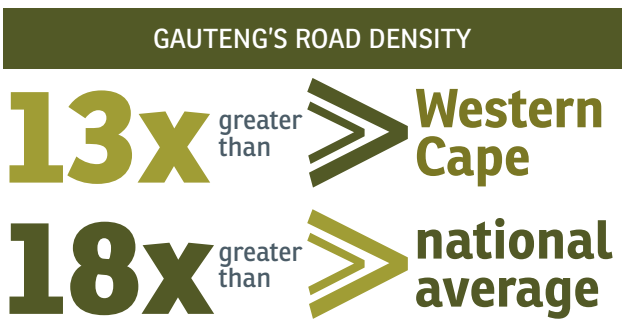
Compared to Cape Town, eThekwini is more transit-dependent, with 40% of daily journeys undertaken by public transport and only 33% by private transport (Moodley et al., 2009). The city's existing transport network comprises commuter rail and three different bus services: the newer People Mover and older Mynah and Durban Transport buses. Like other public transport systems in the country, eThekwini's system has developed in a somewhat haphazard manner. Consequently, public transport is 'economically inefficient with many services in direct competition with each other, resulting in unprofitable rail and bus trips and in some instances, taxi trips' (ETA, 2010: 6.9).

Like Cape Town and the Gauteng metropolitan municipalities, eThekwini is in the process of implementing an Integrated Rapid Transport Network (IRTN), which will consist of rail trunk routes on both existing and new tracks, with new rolling stock, and BRT feeder routes. As of March 2014, eThekwini had only just broken ground on its IRTN.

Unlike Gauteng metropolitan municipalities and Cape Town, eThekwini introduced e-ticketing and ticket integration into existing bus services, rather than waiting for the new public transport services. The contactless EMV Muvo Card has been available for use on eThekwini's three bus systems since July 2012 and the only way to pay bus fares since 1 April 2014. The Muvo Card allows cash to be loaded for individual fares or for service-specific fare products, such as 10-trip coupons (Pearton and Hughes, 2013). The Muvo Card will eventually be used to pay for all travel on the transport network and so will be the fare medium for ticket integration in eThekwini. However, fare integration is still not in place and each bus service uses its own fare products held on the same card and is not planned for, other than a reference to 'electronic fare integration when making transfers' (eThekwini Municipality, 2013). Like Cape Town's myconnect card, the Muvo Card will eventually be usable for purchases under R200 in participating stores.[6]

Gauteng City Region

Gauteng contains three metropolitan municipalities, Johannesburg, Tshwane and Ekurhuleni, each with separate local governments and separate public transport systems. However, at the same time, the three municipalities make up a single urban place, with a closely integrated labour market, and have large cross-flows of commuters. As a result, Gauteng's road density is 13 times greater than the next most congested province (the Western Cape) and 18 times greater than the national average (National Treasury, 2009).[7] This congestion is a major driver behind efforts to promote public transport and modal integration in the province (see Garner et al., 2001), as '[t]he implementation of integrated urban transport systems, along with the expected reduction in private vehicle usage, will go a long way to address urban traffic congestion' (National Treasury, 2009: 130).



6. The Muvo website (http://muvo.co.za/about/goods-and-services/) claims that the functionality already exists, but a spokesperson indicated that it was not yet possible.
7. Gauteng has 498.6 cars per kilometre of road, compared to 38.3 in the Western Cape and 27.3 nationwide. Incidentally, the Northern Cape has the longest road network but the fewest cars, with just 3.2 cars per kilometre.

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In 2007, of the trips taken in Gauteng, 41% were by private car, 42% by minibus taxi, 12% by bus and 5% by train (Gauteng Roads and Transport Department, 2013b). Over the last two decades, public transport use has steadily declined, which is contrary to Gauteng's undertaking to 'promote the growth of public transport modal share' (Gauteng Roads and Transport Department, 2013a: 42). New rapid transit links have been introduced in an effort to increase public transport's share of the modal split and include the Rea Vaya BRT in Johannesburg, the imminent A Re Yeng BRT in Tshwane, the forthcoming BRT in Ekurhuleni and the Gautrain rapid rail link between a number of stations in Johannesburg, Tshwane and Ekurhuleni. To date, the flagship new rapid transit links are not realising the potential for smart cards, nor are the older services, which still depend on cash and paper tickets. Smart ticketing systems are in use on the Metrobus and the new rapid transit links (Rea Vaya, Gautrain and A Re Yeng), resulting in a proliferation of smart tickets: the Gautrain Gold Card is a non-EMV contactless smart card, the Rea Vaya Card is an EMV/ contactless hybrid smart card (as will be the A Re Yeng Card), the Metrobus Tag is a contactless smart card. Furthermore neither fares nor tickets are not integrated.

However, Gauteng's 'One Province One Ticket' initiative envisages a single fare medium for all public transport and, through 'One Tariff', some degree of fare integration. The provincial strategy calls for fares to be harmonised 'to establish a consistent approach towards fare setting across all networks and modes' (Gauteng Roads and Transport Department, 2013a: xxi). However, consensus across the three municipalities still has to be reached. According to Johannesburg's Integrated Transport Plan, over the long term 'fares should be uniform across all modes and related more or less to distance travelled' (City of Johannesburg, 2013: 62), while Tshwane policy simply mentions an 'integrated fare structure' (City of Tshwane, 2007: 7–36). Ticket integration is a medium-term priority for the Gautrain and only one technical approach is proposed (Churcher, 2009; van der Merwe, 2005), whereas the City of Johannesburg identifies the Rea Vaya card as 'the only fare system in Gauteng that

In Gauteng, over the last two decades, public transport use has steadily declined. , which is contrary to Gauteng's undertaking to 'promote the growth of public transport modal share'

meets national Department of Transport regulations for interoperability' (City of Johannesburg, 2013: 62).

THE TRANSPORT POLICY PARADOX

A policy can be equitable, neutral or inequitable depending on 'whether poor people gain more, stay the same, or lose more than rich people, when these gains or losses are expressed as a proportion of disposable income (gross income, plus refunds, less taxes)' (Grey and Lewis, 1975: 297).

Apartheid spatial planning resulted in the urban poor living mostly on distant peripheries, where local economies were suppressed, to force black South Africans into wage-labour. Therefore, many poor South Africans live on the urban periphery, far from their place of work, and have to commute great distances – usually by public transport or minibus taxi – and at considerable expense. Those who are unemployed also have to find money to travel to the distant urban centres to look for work. Therefore, the current fare structure and the relative costs of transport are inequitable. Along with the legacy of historically inequitable spatial policy, and the economics of land and housing, this is a major burden on the poor of South Africa. Hence, it is also a large part of the need for spatial transformation.

However this results in a paradox. A major plank of the spatial transformation necessary in South African cities is densification – people moving from the periphery to the centre – and the formation of 'mobility corridors' (NPC, 2011) – for those who remain outside the centre. In other words, policy needs to encourage the urban poor to move from where they currently live (the urban periphery) to urban centres or to places that have good transport links to urban centres. A distance-based fare structure can be part of that encouragement, by providing cheap travel within the city centre and expensive travel to the periphery in order, presumably, to make the centre more attractive for poor people. However, such a solution is clearly inequitable because poor people travel disproportionately far; thus the relative and absolute cost of distance-based fares will be greater for the poor. Conversely, a flat fare (or even more radical, a fare structure that is cheaper for long distances, which would be progressive) will actively work against the densification programme, by taking away the reason for poor people to move. However, such a fare structure is unlikely to drive spatial transformation, as poor people will largely continue to live where land prices are low, which means in places that make their commute long and expensive. In theory, transport policy could be designed in such a way that discourages poor people from settling far from their place of work, by making distance travel more expensive. However, in practice this cannot work in South Africa because it would increase the burden on the poor.

TOWARDS A PROGRESSIVE FARE POLICY

This section discusses some of the options for achieving a radically progressive fare policy within the South African urban context.[8]

8. Distance-based fares are not covered here because they do not favour the poor (as illustrated above). Also, note that cross-subsidies can make a fare structure more progressive (i.e. in the South African urban context, favours those who have to travel long distances). For example, using sales taxes to pay for low fares. However, the financing of public transport is beyond the scope of this chapter, and so the discussion is confined to how various fare structures can be more progressive, assuming all else is equal.

Flat fare/fare-free

An integrated flat-fare structure is a fare payable for all modes of public transport, with unlimited through-ticketing, for a specified journey duration. A subset of the flat fare is fare-free public transport, which is not as radical as it may seem: more than 60 cities and regions worldwide offer at least some fare-free public transport (FPT, 2014). The most prominent example is Tallinn, Estonia, which in January 2013 became the first capital city (and the second-largest city after Changdu, China) to offer fare-free transport for all its residents. Within three months traffic congestion decreased by 15%, and within six months public transport ridership was up by 12.6% and car use was down by 9% (European Commission, 2013). Outside the OECD, a number of Brazilian, Chinese, and Thai cities boast free public transport for residents.

A public transport system that is fare-free makes ticketing and integration dramatically easier. While such a system is not inherently progressive because rich and poor both benefit from free transport, the benefits are skewed towards poor people, as rich people will remain more likely to take private transport. Although fare-free transport is unlikely in South Africa without a political commitment to greatly expand public transport funding, it is nonetheless useful to consider in this discussion.

A PUBLIC TRANSPORT SYSTEM THAT IS FARE-FREE MAKES TICKETING AND INTEGRATION DRAMATICALLY EASIER.

A flat fare can be either equitable or inequitable, depending on the level at which the fare is set. A very low flat fare (as was introduced in Hasselt, Belgium, after budget constraints meant the end of its fare-free system) can have similar effects to a fare-free system. In contrast, a high flat fare can drive away the poorest passengers, impose high costs on those poor passengers who have no alternative, and disproportionately favour rich passengers.

Passenger-differentiated fares

A fare structure that differentiates passengers is most likely to be politically and fiscally acceptable and result in greater equity. Flat fares and distance-based fares are indifferent to passengers, as passengers pay the same for the same distance, and so are relatively crude at achieving socioeconomic objectives or equity. In the case of a flat low-fare structure, any rich person who chooses to use public transport will pay less as a proportion of their income than poor people. Under a distance-based fare, people travelling from Dainfern Golf Estate and people travelling from Diepsloot informal settlement (both about half an hour from Johannesburg city centre) would pay the same fare, but the Diepsloot residents would pay more as a proportion of their income. In contrast, passenger-differentiated fares can target fares at specific passengers and help achieve equity objectives.

Internationally, passenger-differentiated fares are found across the UK and Europe. In London, various groups (including students, military veterans, apprentices and registered job-seekers) are entitled to travel concessions

using a special integrated ticket, while pensioners and people with disabilities can travel for free. Paris has a similar system, and free travel is also extended to many people who receive unemployment benefits and to single parents. One of the most comprehensive systems of passenger-differentiated fares exists in Barcelona, where a complicated system of tickets offers discounts or free travel to pensioners (multiple categories), children under 14, members of large families, members of single-parent families, people with disabilities, passengers accompanying people with disabilities, school groups and others. These systems often require those who are entitled to discounts to apply for a special identity card (equivalent to a student card), which then allows easy purchase of discounted tickets or (increasingly) can be used for travel.

Similar systems are already in use in South Africa. In Johannesburg, Metrobus makes different colour smart cards available to adult commuters, schoolchildren, people with disabilities, pensioners, and occasional riders. Each smart card offers a different set of fare products with varying levels of concession. For example, frequent users get discounts over occasional users, and pensioners get a 50% concession. As yet, it is not clear what effect the planned ticket- and fare-integrated transport system in Johannesburg will have on Metrobus's existing passenger-differentiated fares. In contrast, Durban already has a ticket-integrated system, and the Muvo card offers passenger-differentiated fares. However, Muvo is not yet fare-integrated, and so passengers with concessions have a different discount on each bus service.

Passenger-differentiated fares have enormous potential for expansion in South Africa and could be used to integrate transport into the broader social wage. The core of the system could be built around the existing social security system, whereby grant recipients are given discounted or free travel. A database of grant recipients already exists, which would make implementation as simple as registering a ticket to an identity document number (and perhaps including a photo on the ticket, to discourage its use by other people). This is easier with smart tickets, but possible with other ticket types. Extending the system to other groups of people would be as quick as adding their details to a database – for instance, scholars and people receiving unemployment insurance would be relatively easy to include. Similarly, Cape Town identifies certain poor households for rate reductions and service discounts, and so extending public transport discounts to members of these households would be relatively simple. Johannesburg's Expanded Social Package programme, Siyasizana, already includes transport subsidies, which could be implemented and extended through a passenger-differentiated fare system.

PASSENGER-DIFFERENTIATED FARES HAVE ENORMOUS POTENTIAL FOR EXPANSION IN SOUTH AFRICA

Apart from being progressive, certain forms of passenger differentiation could be used to promote local economic development. Seeking work can be expensive and time-consuming, and so offering job-seekers free public transport would decrease the cost of looking for (and

increase the likelihood of finding) work. Evidence also shows that commuting is relatively price-inelastic, but non-work travel is not (Baum, 1973). Thus targeting non-commuters for public transport discounts could encourage shifts in how people move within the city and inspire people to make greater use of public spaces.

Passenger- and time-differentiated fares

Combining passenger differentiation with time-differentiated fares could be most useful. For instance, scholars could receive free transport only in the hour before school starts and after school finishes. Job-seekers, who are likely to be more time-elastic in their demand for transport than commuters, could receive free transport only in off-peak times, supplemented with a concession targeting casual workers or day-labourers who have to travel at peak hours. Fare discounts could also persuade commuters to travel outside of peak hours, reducing congestion on the public transport system and distributing demand more evenly throughout the day. Similarly, lunch-hour discounts might mean that commuters choose to run errands in the middle of the day, which would reduce evening congestion.

In May 2014, Gautrain announced the introduction of time-differentiated fares in three tiers: trips in the 'red' period (peak hours) will be the most expensive, trips in the 'green' period (off-peak hours) will be the least expensive, and trips in the 'orange' period will be somewhere in between. Notably the most expensive 'red' fare applies only to trips in certain directions on the Gautrain. These time-differentiated fares appear to be an experiment in demand management, rather than the introduction of a progressive tariff, but demonstrate the possibility of using creative fare structures to achieve various public transport goals.

Smart ticketing proves itself when passenger differentiation and time-based fares are stacked on top of a flat or distance-based fare structure. Although complex fare structures and progressive fares are possible without smart ticketing (as in Barcelona), smart ticketing enables ever-finer targeting of fares without inconveniencing commuters. On top of the progressive measures listed above, a smart ticket would make it relatively simple to introduce ad-hoc fare products, such as free transport on voting day for registered voters, or including a free ride to the stadium in the price of a soccer game ticket. In theory, integrated ticketing would allow fare products to be tailored right down to the individual rider, enabling a public transport system that charges passengers neither more nor less than they can afford to pay. Although easing the movement of poor people around the city in this way might not drive spatial transformation, it will mean that the costs of transformation do not obstruct spatial transformation driven by other factors.

CONCLUSION

South Africa has recognised the importance of integrating transport modes, fares and ticketing. Plans for integrated smart tickets in South African cities are in place and steadily moving forward. Integration relates to integrating tickets as well as fares. Fare and ticket integration can exist independently or be combined to a greater or lesser extent. When smart cards and mobile ticketing (which are forms of e-ticketing or smart ticketing) are combined

with fare and/or ticket integration, the potential for smarter and better-designed fares for public transport passengers is greater.

This is no silver bullet for South Africa's public transport problems, which are infrastructural, institutional, cultural and above all socioeconomic. Integrated tickets will be a convenience and a moderate money-saver, but by themselves will be little more. The use of integrated ticketing or fares alone will not address the spatial transformation agenda but can support South African transport policy, which has a progressive social agenda (to alleviate the historical burden placed on the poor by apartheid spatial planning) and objectives like local economic development. Transport policy and integrated fares won't end urban poverty, but they can help ensure that the poor have equal access and can participate fully in the social and economic life of their cities.

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USING LAND-USE MANAGEMENT TO CREATE TRANSIT-FRIENDLY CITIES

Stuart Denoon-Stevens

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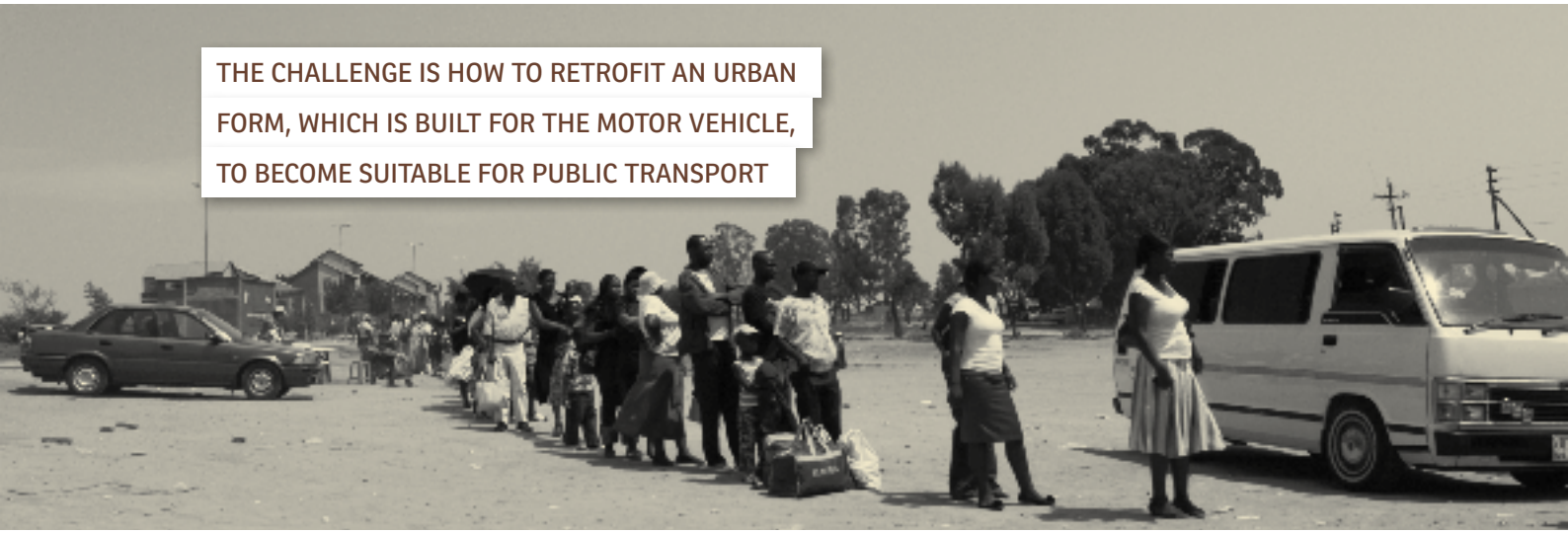
INTRODUCTION



THE CHALLENGE IS HOW TO RETROFIT AN URBAN FORM, WHICH IS BUILT FOR THE MOTOR VEHICLE, TO BECOME SUITABLE FOR PUBLIC TRANSPORT

The accepted wisdom is that the urban form evolves according to changes in the dominant mode of transport. Before the era of motorised transport, cities were generally limited in extent to a 'walkable' area (from city edge to city centre), which was typically a maximum of 45 minutes. The emergence of rail allowed cities to spread, with the urban form clustering around railway stations, resulting in a 'string of pearls' urban pattern. Then, the motor car freed the city to expand indiscriminately, with freeways typically having the largest influence on how cities spread, resulting in the phenomena of urban sprawl. This form of urban development is neither sustainable nor equitable, given that in third-world cities the majority of households do not have access to a motor vehicle. In other words, the evolution of urban form has reached a new epoch, and so the challenge is how to retrofit an urban form, which is built for the motor vehicle, to become suitable for public transport.

This chapter argues that through integrated transport and land-use planning, three core concepts can be achieved:

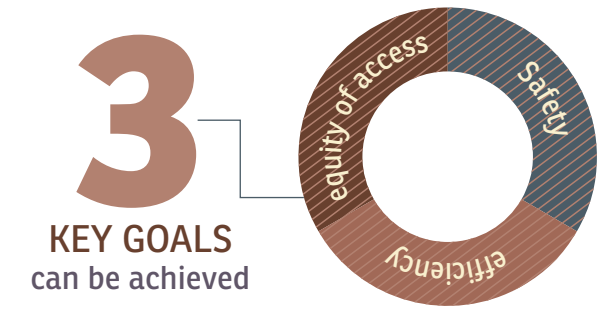
- *Equity of access:* A car-centred urban form is often inequitable and inaccessible to public transit and pedestrians, thus excluding these users from enjoying the full benefits of the city.
- *Safety (a safe built form):* The built environment and the land-use process have a significant impact on the design of streets and, in turn, on the behaviour of pedestrians, cyclists, public transport operators and private vehicle drivers. This behaviour is one of the leading contributory factors of vehicular accidents (or prevention thereof).
- *Efficiency (improved efficiency and financial sustainability of public transport)*: The provision and extent of public transport depends on pedestrians being able to access public transport

stops, stations and interchanges within a 20-minute (or ±2-kilometre walk).

While recognising that land management cannot alone transform the built environment – such transformation also requires political will, competent officials, a supportive institutional environment, adequate resources and so forth – this chapter provides a starting point and structure that can guide reforms.[1] Specifically, the chapter looks at possible tools and incentives that can realise the principles of transit-oriented development (TOD), and how these can be packaged to foster improved coordination between land use, property development and public transport in South African cities.

After establishing why equity of access, safety and efficiency are the goals, the chapter looks at what interventions could increase the safety, accessibility and viability of public transport within metropolitan areas. The procedural mechanisms needed to encourage and make possible these interventions are then discussed, followed by some concluding remarks.

THROUGH ALIGNING LAND MANAGEMENT WITH PUBLIC TRANSPORT



THE GOALS OF EQUITY OF ACCESS, SAFETY AND EFFICIENCY

Land management's general mandate comes from two key sources, the Constitution and the Spatial Planning and Land Use Management Act (SPLUMA), Act No. 16 of 2013 (Sections 7 and 25) which contains some key considerations for land use management applications, including:

- Create spatial justice, by redressing past spatial imbalances, specifically through improving access to (and use of) land, and including persons and areas that were previously excluded, in particular disadvantaged communities and persons.
- Develop land with minimal impact on public health, the environment and natural resources.
- Ensure that land development is within the fiscal, institutional and administrative means of the country, as well as the broader notion of environmental, social, economic and agricultural preservation and sustainability.
- Optimise the use of existing resources and infrastructure when developing land.

Within these broad principles, this chapter has identified three key goals that can be achieved through aligning land management with public transport: equity of access, safety and efficiency. It should be noted that minimum consideration is given to environmental sustainability and health in this chapter, which is not due to a perceived lack of importance of these concerns. Land management arguably has an indirect impact on environmental sustainability and health. If the type

1. This chapter should be read in conjunction with Denoon-Stevens (2014), which addresses the issue of land management in Sustainable Human Settlements. These two chapters have been written to deal with different facets of many of the same problems but have consciously been written to be separate yet complementary.

of built environment promoted encourages a greater usage of public transport (and thus a lower usage of private vehicles), the knock-on effect will be significant for broader environmental goals, such as reducing a city's carbon footprint and reducing air pollution (Geels, 2012; Srinivasan et al., 2003). Therefore, creating a built environment that encourages public transport usage (i.e. by creating an equitable, safe and efficient built form) is the best way to use mobility (within the context of land management) as a means to achieve environmental sustainability and health.

Equity of access

This is the expression of a broad concept – spatial justice – in the context of transport mobility. It reflects the idea that all residents of a city should be able to access the majority of employment opportunities within a 60-minute commute, and quality educational, entertainment, cultural activities and health, welfare and police services within a 30-minute commute. Also included in this goal is that transport costs should not be more than 10% of a household's income.[2]

Yet the current urban form in South Africa is generally geared to the needs of the wealthy car-owning minority, not the majority (67%) of households within metropolitan areas who use public transport at least once a month, with 18.7% using buses and 19.9% using trains (StatsSA, 2014). Commuters in metropolitan areas predominantly use non-motorised transport (NMT) or public transport to get to work (48.3%)[3] or to school (66.1%) (StatsSA, 2013a). Despite this, the majority of urban development is tailored primarily to cater to the motor vehicle, neglecting the multi-modal nature of the urban road network (Beukes et al., 2011). This is best reflected in the stark difference between the travel times of those using private vehicles compared to those using public transport. For instance, the average journey to work takes 40 minutes by car, compared to 81 minutes by train, 70 minutes by bus and 49 minutes by taxi (StatsSA, 2014).

SOUTH AFRICA HAS AN UNACCEPTABLY HIGH TRAFFIC FATALITY AND INJURY RATE.

Safety

Creating a safe built form responds to the goal of reducing the impact of the built form on public health, specifically the impact of traffic accidents on drivers, passengers and pedestrians in terms of fatalities, injuries and cost (WHO 2013).

South Africa has an unacceptably high traffic fatality and injury rate. In 2010, the country had one of the highest proportional traffic accident fatality rates worldwide (ibid), with 13 923 road fatalities between 1 April 2010 and 31 March 2011 (RTMC, 2011). Traffic accidents were one of the leading causes of non-natural deaths in South Africa, accounting for around 2.54% of all deaths in 2010.[4] What is particularly worrying is that in certain metropolitan cities, the percentage of deaths of pedestrians is much higher than in the rest of the country. For instance, in 2012, pedestrians accounted for 35% of traffic fatalities

2. The issues with this crude benchmark as outlined by Venter and Beherns (2005) are noted.
3. Compares to 41.8% who use (or get lifts in) private vehicles and 9.8% who work from home (StatsSA, 2012a).
4. This figure is derived from the cause of death statistics (StatsSA, 2012b) for the total number of deaths in 2010 (which was 543 856), whereas the road fatalities are from the Road Traffic Management Corporation (RTMC, 2011) traffic report – it should be noted that the time periods for these two sources are not synchronous, and so a margin of error must be allowed for. In an ideal setting, the cause of death statistics should suffice but because of the varying reporting standards in South Africa, the figures for fatalities from traffic accidents are only around one-third of those quoted in the RTMC report. The RTMC report has been the primary source of data used, as the RTMC figures are specifically focused on this issue, and use data collected from reputable and verifiable sources (police records, accident reports).

across South Africa (International Transport Forum, 2013), compared to around 57% in Cape Town[5] (City of Cape Town, 2013) and around 62% in eThekwini[6] (derived from Erasmus, 2013).

The design of the built environment, and the extent of public transport use, is a critical factor in lowering accident rates. Dumbaugh and Rae (2009) argue that, for every 1.6 kilometres of arterial road in the study area (of San Antonio), total crashes increase by 15% and fatal crashes by 20%. At a more micro level, the lack of pedestrian facilities, crossings and even basic measures such as an adequate sidewalk contribute to the high pedestrian accident rate at certain intersections (Albers et al., 2010). Linked to the safety goal is the issue of crime and public transport, which may deter individuals from using public transport: according to the Victims of Crime Survey (StatsSA, 2012b), 11.6% of households claimed that fear of crime prevented them from using public transport.

Efficiency

Land management has a crucial role to play in achieving efficiency and financial sustainability, as the viability of providing fixed-line public transit systems depends on there being an adequate number of passengers living within the catchment area of a public transport service.

LAND MANAGEMENT HAS A CRUCIAL ROLE TO PLAY IN ACHIEVING EFFICIENCY AND FINANCIAL SUSTAINABILITY

The density of commercial and/or residential land abutting public transport interchanges underpins the supply and viability of public transport facilities. Substantial literature supports the notion that public transport is best served by a dense city, with some arguing that a minimum density of 3000 individuals per square kilometre is required for cost-effective public transport (UN-Habitat, 2013). One famous example is the comparison of Atlanta and Barcelona, whereby Atlanta, which is 28 times less dense than Barcelona, would need to build 2800 new stations in order to provide the same level of accessibility to the rail network as Barcelona (i.e. 60% of the population within 600 metres of a station), whereas Barcelona has just 136 stations (Bertraud and Richardson, 2004).

This argument is relevant in the South African context, with Grey and Beherns (2013) demonstrating how Phase 1a of the MyCiti BRT network in Cape Town will not achieve maximum capacity usage in the short to medium term primarily because the density of the built environment (and modal share) is not sufficiently high to allow full usage of the available public transport capacity – in fact, only 26% of capacity will likely be used. Furthermore, using the proxy of 3000 individuals per square kilometre as the minimum threshold for cost-effective public transport, Tshwane, Ekurhuleni, Johannesburg and Nelson Mandela Bay all have densities too low to provide a cost-effective public transport network, based on data from the SACN (2011).

5. This source does not state the specific time period it was calculated on, hence a margin of error should be allowed for.
6. Erasmus J. 2013. 'R5,1 bln: Durban's killer traffic costs.' *The Witness*. 2 October 2013.

Compared to the 'conventional' density profile, whereby the inner city is the densest part of the city, South African cities have an inverted profile, with pockets of extremely high densities (mostly in townships and informal settlements) and areas of very low densities (mostly in higher-income areas) found on the peripheries of cities (SACN, 2011). As a consequence, the bulk of the metropolitan population travel long distances to access their place of work, placing an abnormally large strain on the movement network.

Accessibility has long been a concern of urban planners.

LAND MANAGEMENT AND PUBLIC TRANSPORT

This section looks at interventions that could increase the safety, accessibility and viability of public transport within metropolitan areas.

Equity of access

Accessibility has long been a concern of urban planners. One definition of accessibility is 'the ease with which activities may be reached from a given location using a particular transportation system' (Morris et al., 1979) and has a strong equity dimension. A location that is accessible by motor vehicle might be inaccessible (or have very poor accessibility) by NMT or public transport. Thus the use of the word accessibility specifically refers to the goal of ensuring equal or higher accessibility throughout the city for public transport, and for NMT users over that of private vehicles (Harvey, 1973).

Accessibility is both a macro (city level) and a micro (urban design) concern. At a city scale, accessibility is about encouraging residential and non-residential land use to cluster around public transport interchanges, thereby shortening the added walking time between trip origin and destination (UN-Habitat, 2013). Equally important is the micro dimension that relates to the urban design of the built environment, which can act as a deterrent to commuters. For instance, poorly maintained and too-narrow (or no) pavements, frequent changes in pavement level, busy roads with infrequent crossings, lack of public toilets, and unlit public environments without surveillance (resulting in a perceived threatening environment) deter commuters from either walking or using public transport (Hanson,

2004). Therefore, to create a truly accessible city will require matching trip lengths at the macro level and urban design interventions at the micro level.

Given the above, an accessible city should aspire to achieve:

- Most attractors (schools, places of work, municipal offices etc.) are accessible within a five-minute walk from a dedicated public transit drop-off facility.
- Dedicated pedestrian paths/routes run between the entrances of places of employment, schools, municipal offices etc. and the public transit drop off area.
- Access roads to retail and residential areas are designed for public transport and NMT users and pedestrians, with the car being a secondary not a primary concern.
- Pedestrian routes are designed to minimise the actual and perceived threat of crime.
- Pedestrian routes are designed to ease the movement of marginalised/disadvantaged groups, including the elderly, mothers and the disabled.
- Amenable and safe-for-cyclists commuter routes are within 10 kilometres of all major attractors (schools, places of work, municipal offices etc.).

Safety

Within the context of road design and the township establishment process, the following aspects could be incorporated to improve the safety of NMT and public transport users, some of which are found in the Fan Walk in Cape Town (see box 1):

- Pavements, over- or under-passes, marked crossings and raised medians (Abu Dhabi Urban Development Council, 2010).
- Driveways designed as curb cuts, not as interruptions to the pavement, thus prioritising pedestrians (ibid).
- Speed reduction measures, including raised crossings, lateral shifts, chokers (curb extensions that force narrowing of road), and central-island narrowing (ibid).
- Improved visibility of pedestrians, through lights and signals and removing obstacles that obstruct vehicular awareness of pedestrians (ibid).
- Pedestrian streets designed to have low speeds, and limited pedestrian and vehicular access points to high-speed roads (Dumbaugh and Li, 2010).

An alternative approach to the above suggestions is the shared streets concept, whereby the majority of markings, signs and regulations are removed, which is appropriate for streets with heavy pedestrian usage and a desired low vehicular speed (Hamilton-Baillie and Jones, 2005).

Equally important is the perceived and actual threat of crime faced by public transport users along the whole route (i.e. from house, to public transport, to final destination). Some aspects that increase perceived and actual feelings of safety include (Kruger and Landman, 2007):

- Adequate lighting and subways on pedestrian routes, which should not cross vacant land and are regularly maintained and managed (to avoid the 'broken window' syndrome[7]).
- Road layouts that enable pedestrians to use the fastest, most direct route to public transport.
- Public transport waiting areas with seating, signage, lighting and informal trading.

7. Broken window syndrome suggests that the inability to maintain and monitor *urban environments* in a well-ordered manner will lead to further *vandalism* and escalation into more serious crime.

Box 1: The Fan Walk, Waterkant Street, Cape Town

There are very few examples of complete, or liveable, streets in South Africa. One notable exception is the Fan Walk in Cape Town, which was retrofitted as part of the 2010 FIFA Soccer World Cup upgrades. This converted an otherwise normal street into one that prioritises pedestrians over vehicles.

2005

Before

(1) Plaza abutting un-signalised intersection, resulting in conflict between pedestrians and vehicles.
(2) Narrow median in centre of Buitengracht Street, three-way un-signalised intersection.
(3) & **(5)** Normal two-lane road with on-street parking..
(4) Conventional signalised four-way intersection.

2014

After

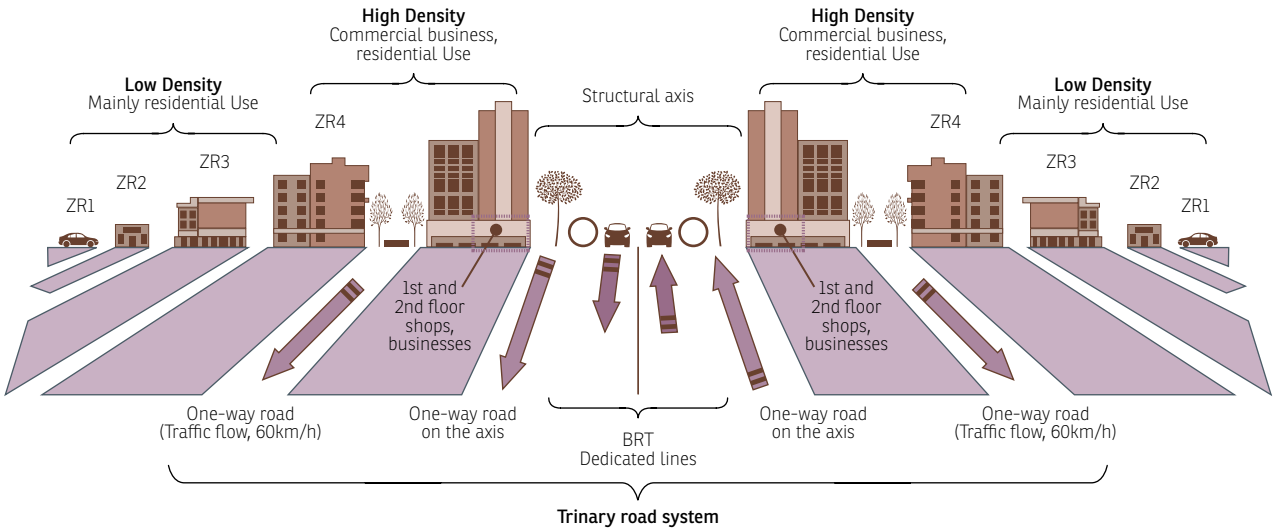
(1) Plaza abutting dedicated pedestrian crossing, intersection only allows one way movement, thus avoiding conflict with pedestrians.
(2) Dedicated pedestrian crossing and pedestrian bridge constructed, separating pedestrians from vehicles.
(3) & **(5)** Streets resurfaced, landscaped and street furniture added, thus obstructing and slowing vehicles. Access to Buitengracht closed off, thus reducing the number of vehicles using this street to those accessing the shops on this street.
(4) Roadway replaced with redbrick, giving clear guidance to pedestrians, and pedestrian ramps installed, enabling easier access for disabled users.

Efficiency

A viable public transit system can be achieved using two approaches, which are separate ideologically but can operate in parallel to one another: increasing density throughout the city and selling 'air rights' and land adjacent to the public transport facility.

The first approach is increasing (residential and non-residential) density, which undisputedly affects the number of stations/stops and network length required to serve the residents of a city (UN-Habitat, 2013; Bertraud and Richardson, 2004) and so is critical for public transit viability. One of the primary ways is to allow higher densities closer to public transit interchanges, which has been done in a number of Latin American cities, such as Curitiba, Bogota and Guatemala City. As Figure 13 shows, these interventions aim to increase the permitted land uses and densities parallel to the bus rapid transit (BRT) route, with densities dropping moving outwards from the BRT route (UN-Habitat 2013).

Figure 12: Curitiba's trinary road system and permitted land uses and density



Source: UN-Habitat, 2013

However, viability goes beyond simply requiring that the city should be sufficiently dense to promote an efficient public network structure. For instance, Mexico City (which has sufficient density for a sustainable public transport system) has seen a shift to collective taxis and a decline in modal share for rail and bus usage. This is largely due to the dispersion of employment throughout the city, resulting in taxis becoming more effective than rail or bus (Bertraud, 2010). The lesson for South Africa is that investments made in fixed-line transit (BRT or rail) must be matched by a land-use policy that encourages (or requires) major employment generators

to locate within these areas, within a walkable distance of the public transport network (which will likely result in a combination of nodal and corridor development). If not, the investment in these transit assets might not be recouped.

The other approach is to sell 'air rights' and land adjacent to the public transport station or interchange to private sector developers, and to use these developments to fund the cost of public transit upgrades (African Development Economic Consultants, 2010). The poster child for this approach is Hong Kong's Metro Transit Rail Corporation (MTRC), which receives a grant of land/development rights for the land on, above ('air rights') and adjacent to the station, instead of money from the Hong Kong government for building new stations (Cervero and Murakami, 2008). The MTRC brought in about US$5.6-billion (at constant 2008 value) through selling these development rights to the private sector, equivalent to about half of the MTRC's total revenue between 2001 and 2005 (Cervero and Murakami, 2008).

This approach not only brings financial viability but also ensures that a significant number of potential public transport users are located literally on top of the public transit network. Other benefits include improved station environments, mixing of land uses (retail–residential–work–transit), and property value created through the transit upgrades, that is captured by the public sector (Cervero and Murakami, 2008).

In South Africa, an example of this type of approach is the proposal to sink the railway in Cape Town between Woodstock and Cape Town station. The ±50 hectares of land above the railway could accommodate around three million square meters of bulk, divided into four precincts with a variety of proposed uses.[8] However, such projects are highly complex and would need intergovernmental coordination: this proposal would require the buy-in of Intersite, PRASA, the Western Cape Provincial Government and the City of Cape Town.

8. Cape Times. 2010. 'R80bn project to transform Cape Town by 2030'. Online available at: http://www.makekadesigns.com/news/r80bn-project-transform-cape-town-2030-0 (9 April 2014)

Box 2: Two examples of air rights developments

Source: Google Earth

The Avenir – Boston, USA is a ten-storey, mixed-use development consisting of 241 flats and ±2787m2 of retail space built over the railway lines. The development cost around US$150-million but brought in around US$20-million to the transit authority for the use of the land (Friedman, 2012; Trinity Financial, 2014).

Source: Google Earth

Mater Hill – Brisbane: an air-rights development over a BRT station. The air rights were sold to Mater Health Services, which built hospital operating theatres above the busway. This has also allowed for retail development adjacent to the station, providing a synergy where medical, transport and retail services can all be accessed from one location (Rathwell and Schijn, 2002; UN-Habitat, 2011).

IMPLEMENTING THESE GOALS THROUGH LAND USE MANAGEMENT

This section discusses the procedural mechanisms that can promote, mandate or permit the implementation of the measures described in the previous section. It should be noted that this discussion does not include land-use incentives, which the author considers to be one of the weakest tools available to the land management sector in the South African context. A more prescriptive approach towards regulation will be considerably more effective (and viable) than an approach based upon land-use incentives.

Build new buildings above and adjacent to public transport facilities

In response to the goal of efficiency (i.e. the challenge of creating an efficient and sustainable public transport system), where possible, the public sector should build new buildings above or on land that is adjacent to public transport infrastructure. Developing the space above stations and the land adjacent to stations is a complementary strategy to ensuring that public transit is financially viable and a key strategy for increasing the accessibility of public transit infrastructure.

The most viable way (at least initially) is to move public sector offices and facilities, which are leasing office space from the private sector, into (new or existing) buildings adjacent to or above public transport infrastructure. A policy goal could be to encourage the state to construct new buildings where possible near to public sector infrastructure, which would increase the efficiency of public expenditure and public land. National government alone spent around R2.932-billion on leases in 2011 (DPW, 2012), while provincial governments spent around R7.098-billion on the construction of new non-residential buildings in 2012 (StatsSA, 2013b). Instead of giving money to the private sector for leasing or purchasing land, the money would be retained within the public sector and used both to fund public transport infrastructure and to house public facilities.

Land above and around stations can also be developed for private sector use. A Land Availability Agreement (LAA) offers a better alternative to simply selling off the land (Thellane, 2008, referring to social housing). With an LAA, the municipality puts the development and construction of land out to tender, but the land is only transferred to the private sector *after* the on-site structures have been completed. Both private and public sector partners benefit from this arrangement: the risk for the private sector developer reduces, as they have no holding costs or do not need to obtain financing for a large portion of the development; the public sector can monitor and have greater control over the final product, minimising any cost escalation due to speculation and profits. The LAA method could be used to increase the provision of social housing or other public amenities such as schools or hospitals in close proximity to public transport or, in other circumstances, to fund the provision of public transport infrastructure. The nature of the LAA and the final built product will differ substantially, according to the type of amenities being built.

Lastly, the zoning scheme needs to be amended, as many zoning schemes do not permit business or residential uses in the same zone as a public transport station (or other infrastructure), or only permit these uses as ancillary to the site's primary use as a transport facility.

ZONING REGULATIONS CAN BE USED TO MAKE THE CITY MORE TRANSIT-FRIENDLY AND HELP CREATE A SAFE AND EQUITABLE URBAN FORM.

The zoning scheme could be rectified by including a provision that automatically considers any public transit station (BRT, bus/taxi interchange, or rail station) as falling into a specific zone (either a specially created zone, or a transport or general business zone). Then, the zone in question needs to be modified to allow the full variety of uses that are likely to occur in a station precinct, and to remove or amend any regulations that could impede such uses – for instance, the Cape Town Zoning Scheme Transport Zone 1 that requires the land be used predominantly for transport purposes could severely threaten the viability of this proposal.

Prioritise public transport and pedestrians

Zoning regulations can be used to make the city more transit-friendly and help create a safe and equitable urban form. Transit-oriented development has traditionally been accomplished through amending the zoning scheme, relaxing certain regulations and imposing new regulations that favour public transport over private vehicles. Locally, this thinking has begun to permeate into current practice. The most notable example is the City of Cape Town's PT1 and PT2 parking standards, which allow for lower parking requirements closer to public transport facilities (City of Cape Town, 2012). Some ways[9] in which the zoning regulations could be amended to prioritise public transport and pedestrians are offered below:

- Include a specific chapter in the zoning scheme covering street design guidelines that promote and prioritise pedestrian, public transport and cyclist movement and safety (perceived and actual)**.** Having certain broad street design aspects in the zoning scheme is not a new concept. For instance, Sections 74 and 75 of the old Cape Town Zoning Scheme specified minimum street widths for certain types of buildings, while the new City of Cape Town Zoning Scheme requires certain types of buildings to provide Council with a Site Development Plan, including access and parking considerations (City of Cape Town, 2012). However, as far as can be ascertained, no zoning scheme has stipulated minimum requirements for pedestrian movement in any depth.
- Impose standards for cycle-friendly roads, with varying degrees of intensity depending on the likely usage of that route by cyclists. Other measures could include requiring office or commercial developments to provide bicycle lock-up facilities, as well as showers within the building for employees who cycle to work (DfT, 2009).
- Amend zoning schemes to include certain minimum standards for pedestrian thoroughfares (e.g. minimum pavement width, grade, number of street lights, etc.), according to the assigned zoning or area type. In certain areas, additional requirements could include verges to accommodate street lighting and trees.
- Require the owner of a building to upgrade the pavements abutting the property in order to meet the minimum criteria (if the road network does not comply with these requirements), when requesting

9. These suggestions draw heavily from the Miami 21 Zoning Scheme (City of Miami, 2013) and SmartCode Version 9.2 (The Town Paper, 2012) but modified for a developing world context, while certain recommendations were derived from Kruger and Landman (2007).

floor area departures or rezoning, or at Council's discretion. This protects owners of private land with existing rights from unreasonably severe demands from Council, while still obligating owners applying for new rights to create a higher degree of accessibility and pedestrian safety.

- Require traffic-calming measures or medians to be provided in the abutting roads when applying for a floor area departure or rezoning to a particular zone. This could be accompanied by sketches showing design guidelines and principles that must be adhered to in the design of the road and pavement upgrades.
- Require all developments over a certain threshold (e.g. construction of more than 30 dwellings units or more than 1000m^2 of floor area) to provide a minibus drop-off bay. This should also have locational requirements, for instance requiring that the drop-off bay be within 100m of the entrance of the main building.
- Allow (through the zoning scheme) Council to request at its discretion a multi-modal transport assessment, which would determine the drop-off bay requirement, traffic calming and pedestrian upgrades. This would be similar to the City of Cape Town's requiring a Site Development Plan even when the development is permitted as of right.
- Oblige waiting areas at public transport areas to have certain design requirements, such as mandatory provision of seating, signage and space for informal traders. This would potentially improve the amenity and safety of these areas.
- Create an 'automatic' overlay zone for a prescribed distance (for instance 800m walking distance) at all rail and BRT stations and taxi interchanges. Within this area, second dwellings and greater residential/commercial floor area would be permitted as of right. Specific design stipulations could also be prescribed, to allow for better pedestrian movements, while a limited number of non-residential land uses could be permitted on general residential properties (such as educational uses, limited retail, etc.) as of right, based on a percentage of overall land use (e.g. 'up to 33% of the total floor area may be used for …').
- Offer incentives, such as providing substantial floor area bonuses for paying into a fund for upgrading the pedestrian and public transport infrastructure in the area (similar to what happened in New York).
- Reduce parking requirements in areas that either have adequate public transport capacity or where car capacity is low. The City of Cape Town is currently implementing this with the PT1 and PT2 zones and could be replicated in other metropolitan municipalities. For example, a flat in a standard parking area requires two parking bays, but only 1.25 bays in a PT1 zone and only one bay in a PT2 zone.

Guides do currently exist for the appropriate design of roads, pavements, and pedestrian and cycle facilities in South Africa (e.g. DoT, 2003; City of New York, [n.d.a, b]) but are not legally binding. They also do not distinguish between the requirements that municipalities can impose on owners with existing rights versus owners applying for new rights. Also, and most importantly, only the municipality has executive authority to decide on the appropriate design of municipal roads, given the constitutional division of responsibilities and powers.

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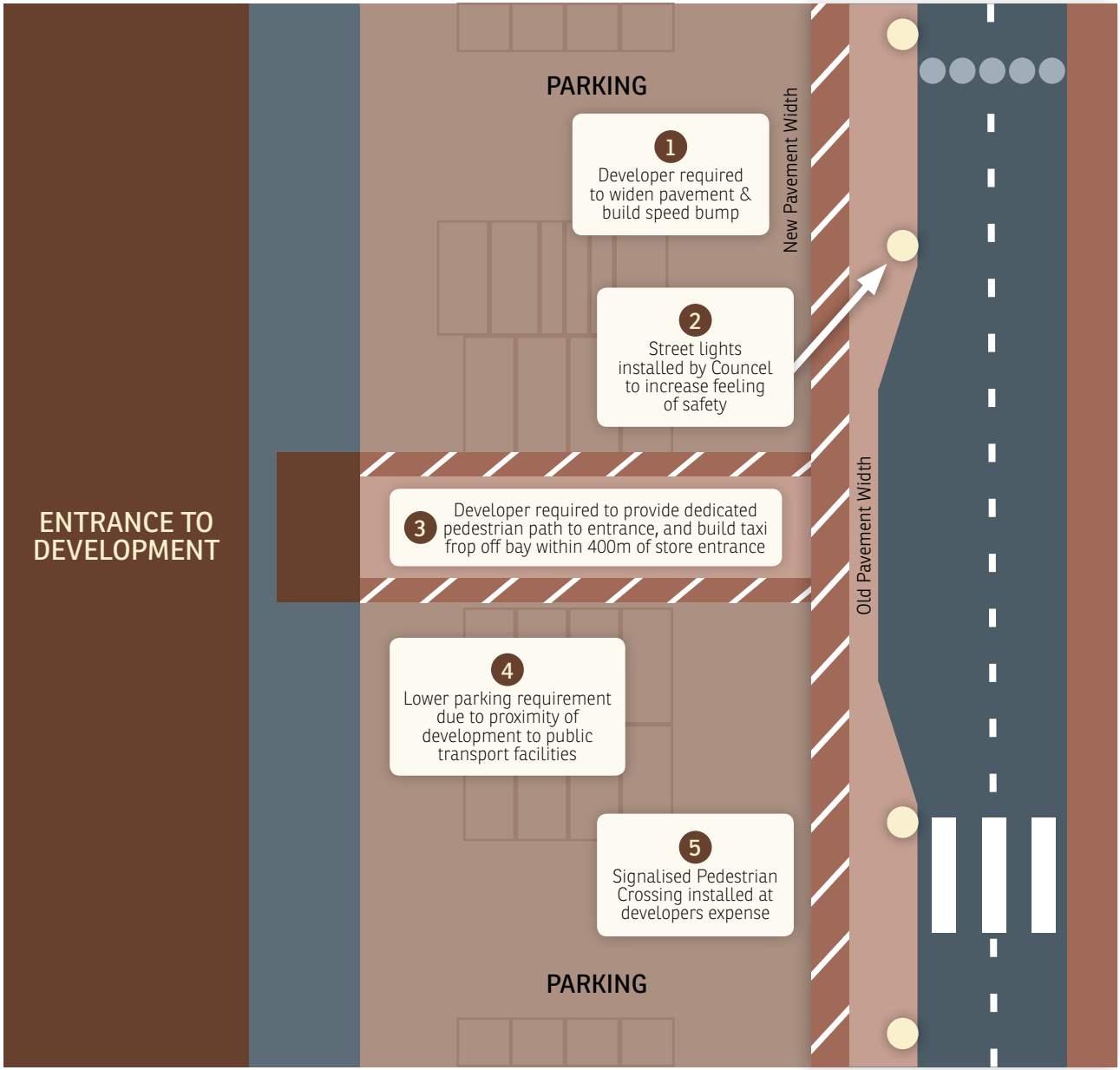
Figure 13: Radical schematic of zoning scheme proposals applied to a commercial development of 10 000m²



Encourage dense development in areas accessible to public transport.

In response to the challenge of creating an equitable, efficient and financially sustainable built form, zoning maps and spatial development frameworks (SDFs) can encourage dense development in areas that are accessible to public transport.

In terms of spatial transformation, SDFs and zoning schemes have linked but different roles. Whereas zoning schemes are about existing rights (noting that some discretion is permitted in the case of new development applications), SDFs speak to the creation of new development rights and guiding capital investment in cities. The role of SDFs is likely to be strengthened when SPLUMA comes into force, as SPLUMA (Section 21) requires the mapping of a municipality's capital spending for a defined five-year period and a spatial plan of the five year plan, elevating to a parallel status to that of the IDP.

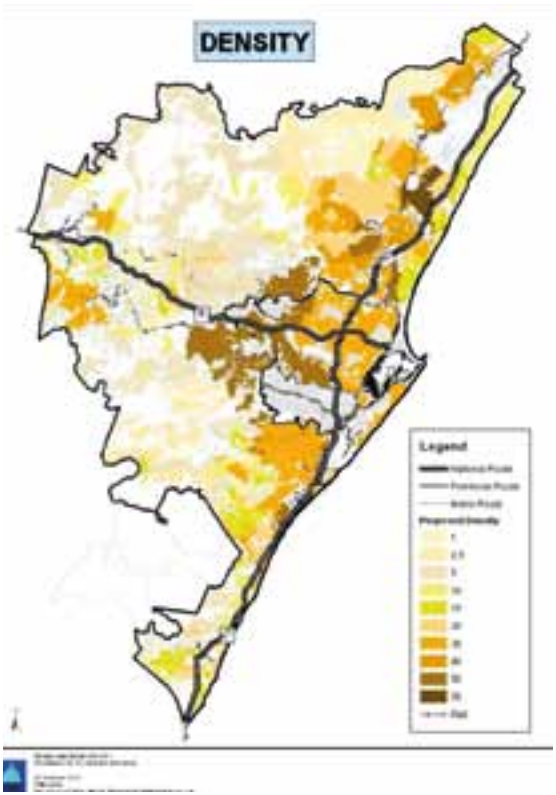
Three measures are suggested for SDFs:

1. Prioritise public and private investment in areas within the city that are most accessible by public transit (for example, Johannesburg's Growth Management Strategy (GMS) divides the city into five distinct zones as shown in Figure 15). These priority areas could require more detailed land-use plans and shortened land-use processes, as per Section 21(l) of SPLUMA.
2. Map specific desired densities for future developments in the city (as was done for eThekwini, illustrated in Figure 16, and required by Section 21(f) of SPLUMA). Highest-density areas could be within 15 minutes by NMT or public transport of major economic nodes/employment generators, while areas more than 45 minutes away could have no suggested development.
3. Impose decision-making guidelines that do not allow any significant residential developments to occur more than a 45-minute commute by public transit from the city's major economic nodes/employment generators (or the reverse, e.g. development of economic nodes more than 45 minutes from residential areas). This in effect creates a limit to urban expansion that is aligned to, and changes with, the dynamic growth of the city. Developments beyond the 45-minute limit could still be permitted as a site-specific deviation from the (Section 22(2) of SPLUMA). However, the guidelines send a strong message to the public and private sector that such developments would only be permitted as an exception to the norm.

Figure 14: Johannesburg GMS 2010

Johannesburg Growth Management Strategy (City of Johannesburg 2010)
The GMS divides Johannesburg into five zones: public transport areas, marginalised areas, consolidation areas, expansion areas and peri-urban areas. More importantly this plan shows that growth is focused within the public transport areas. Where growth is proposed outside of these areas, the plan clearly states that the developer will need to make significant contributions to bulk infrastructure upgrades.

Figure 15: eThekwini density map 2013



eThekwini Density Map (eThekwini 2013)
eThekwini provides explicit spatial guidance about what density is appropriate where in the City. The advantage is that the private and public sectors can use this map as a guide to establish the highest and best use of land (with regards to density). This helps prevent the underuse of prime urban land (and overuse of areas lacking in infrastructure and public transport facilities.

The experience of the Johannesburg GMS shows that if these suggestions are left at a SDF level, significant spatial change is unlikely. Johannesburg's GMS is an excellent spatial plan but lacked the incentive and teeth needed for the proposal to be implemented. Therefore, both the zoning map and the development control process needs to be reformed.

International experience shows that reforms to the development control process and the zoning map are necessary if cities are to develop a transit-friendly urban form. Highly successful, transit-orientated cities, such as New York, Curitibia, Barcelona and Freiburg, share a common thread, that of not waiting for the private sector to make a development application before changing development rights. Rather, at some point, all of these cities took control of and amended the zoning map to encourage density in public transit-friendly locations.

Some guidance for the South African context is provided in Sections 24 and 28(1) of SPLUMA:

> A municipality may amend its land use scheme by rezoning any land considered necessary by the municipality to achieve the development goals and objectives of the municipal spatial development framework. [...]
>
> A land use scheme adopted in terms of subsection (1) must [...]
>
> (e) include land use and development incentives to promote the effective implementation of the spatial development framework and other development policies; [...]
>
> (g) give effect to municipal spatial development frameworks and integrated development plans.

In other words, when SPLUMA comes into force, municipalities will be obliged to use their land-use management scheme as one of the tools to implement the SDF, which for the purposes of this chapter can include creating a transit friendly city.

The question is practically how to do this? To a certain extent, this issue is addressed by Görgens and Denoon-Stevens (2013), who suggests allowing a shorter land-use process in appropriate areas, as identified by the SDF. Locations would be identified as suitable for urban intensification or restructuring, and then a study would be carried out and would form the basis of a bulk amendment to the zoning scheme. SPLUMA has made this proposed process much more feasible (and easier to implement), given that 'Site Specific Proposal' could be dealt with as a rezoning application initiated by the municipality, which could be approved subject to the submission of a SDP that complies with the broad parameters of the rezoning application. In addition, this is also required by §21 of SPLUMA. (See also Denoon-Stevens (2014) for suggestions on how to deal with environmental authorisations.)

In other words, instead of simply coming up with policy plans for areas where development is to be promoted (which happened with the Gautrain precinct plans or the draft Milnerton South–Paarden Eiland Local Area Spatial Plan in Cape Town), the municipality makes a progressive attempt to rezone the area that surrounds public transit interchanges to increase the permitted development rights.

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This approach has two main advantages:

1. The private sector is far more likely to buy into these projects, given the far greater development rights (compared to the rest of the City) and the very modest and fast development control application that is required. This is because the benefits now greatly exceed the risks of investing in areas and in projects that are traditionally considered to be of too little value or too risky to undertake (thanks to the reduced holding costs and quicker construction timeframes).
2. The density proposed will be closer to the area's carrying capacity. Instead of relying on the private sector and the public sector's housing departments to make an educated guess of the appropriate number of units a site can hold, developers will have certainty regarding what can occur on the site. Therefore, the brief given to the designer will likely match, or come close to, the maximum number of permitted units, as shown on the SDF/zoning map.

CONCLUSION

In exploring the values that should underlie land management when dealing with issues of mobility, three key goals were established: equity of access, safety and efficiency (or viability). South African Cities Network cities are performing weakly in terms of providing an equitable, safe and efficient built form. For instance, travel times are too long and cost too much, the accident rate is extremely high (with the majority of fatalities being pedestrians), and densities are too low to support a viable fixed line public transit system. However, land-use management can help create a safe, accessible and viable public transport system and built form.

An *equitable* environment can be created by ensuring that the majority of destinations (place of employment, educational institution, etc.) are accessible within a 30 to 60 minute commute, depending on the service in question. A built environment can be created by retrofitting and installing safety features on roads and designing roads that provide areas of safety and priority for pedestrians. Lastly, an efficient and financially sustainable public transit system can be achieved through developing the land adjacent to and the space above stations, which both brings in revenue and ensures a guaranteed market for the public transit service.

To achieve these goals through land use mechanisms, four key ideas are proposed.

1. *Build precincts not stations.* The use of LAA and reform of the zoning scheme will enable the selling of the rights to develop other buildings (hospitals, schools, flats) above and adjacent to stations.
2. *Prioritise public transport and pedestrians, not private cars,* in the zoning regulations. This could be achieved through reforming the zoning scheme regulations to oblige developers when building to construct facilities for public transit and pedestrians (such as taxi drop-off bays and dedicated pedestrian crossings).
3. *Orient and reform zoning maps, SDFs and the development control process,* to encourage dense development in areas that are accessible to public transport. This has two levels, first proposing on the SDF, followed by proactive rezoning of the applicable properties (where the municipality, not the land owner, rezones the land).

The interventions proposed in this chapter will result in a better, safer and more inclusive urban structure, especially if cities remember that: 'God made us walking animals—pedestrians. As a fish needs to swim, a bird to fly, a deer to run, we need to walk, not in order to survive, but to be happy.' (Enrique Penalosa, Mayor of Bogotá 1998–2001).

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CONCLUSION

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EVEN PEOPLE WHO WERE PREVIOUSLY SEEN AS 'CAR CAPTIVE' ARE WILLING TO USE PUBLIC TRANSPORT GIVEN THE RIGHT SERVICE

In the last decade, cities in South Africa have seen major public transport interventions that are still ongoing. Johannesburg and Cape Town have started operating bus rapid transit (BRT) systems that are completely changing the perception of the reliability and pace of bus services. Many more cities are planning or have started constructing BRT systems or alternative public transport networks. The Passenger Rail Agency of South Africa (PRASA) is investing heavily in upgrading and replacing infrastructure and coaches to ensure that commuter rail services are safe and reliable and therefore competitive, compared to other modes of transport. The Gautrain and its bus services, used by commuters between Pretoria and Johannesburg, show that even people who were previously seen as 'car captive' are willing to use public transport given the right service. Yet not all public transport interventions need to start with huge investments in infrastructure, as shown by eThekwini's introduction of an integrated ticketing system.

These public transport improvement measures are necessary because of the spatial and socioeconomic conditions of South African cities. As a result of the population distribution effects of the Group Areas Act, historical car-friendly city design and the neglect of public transport over decades, poorer people live further away from education and job opportunities, and often only have unaffordable or unreliable public transport

access options. Providing these people with improved public transport is crucial for human development, as well as for economic growth.

Over the past decade, public transport interventions have not only started addressing these historical problems, but have also shown the limits of public transport interventions in isolation. Simply expanding public transport is not enough because spread-out low-density cities require either high fares or high subsidies, which a population with high unemployment[1] and poverty rates or a state trying to improve access to other infrastructure and social services cannot afford.

The findings of the 2003 and 2013 National Household Travel Surveys revealed some worrying trends:

- The percentage of workers who had to wait more than 15 minutes for some form of public transport increased from 11% in 2003 to 14.4% in 2013. In contrast, in rural areas only, this percentage was the same in 2013 as in 2003. As cities are unlikely to have fewer services and stops now than in 2003, greater congestion and increased sprawl perhaps explain why more people in cities are having to wait more than 15 minutes for public transport.
- The percentage of households in metropolitan municipalities that have to travel more than 60 minutes to a medical service increased from 6.6% in 2003 to 13% in 2013. This may be because of the inclusion of new metropolitan cities and municipal boundary changes, or because cities are continuing to grow outwards, with public transport provision and other infrastructure and services being unable to keep up.
- The percentage of households that walked more than 30 minutes to the taxi rank increased from 17.6% in 2003 to 22.4% in 2013, while those that walked for more than 30 minutes to train stations increased from 17.4% to 22.4%. Only those walking more than 30 minutes to bus stops decreased, from 11.2% to 4.4%. Given no significant reduction in rail and taxi services, this suggests that services are not being provided to new, spreading settlements, although bus services possibly have expanded slightly.

While these findings need further exploration, they also indicate that expanding (and improving the quality and affordability of) public transport services may not be sufficient to increase accessibility and mobility for all citizens of cities. Furthermore, public transport usage is limited by how safe and easy it is to use, and how safe it is to walk in the vicinity of stops and stations. As long as how cities are built favours car users, cars will remain an aspiration for all South Africans, which in turn will increase congestion, pollution and accident rates.

Public transport needs to be considered in the wider urban space for cities to be accessible to all with low congestion, pollution and accidents rates and high levels of safety, convenience and affordability. The debates about how South African cities should look and feel like in the future have begun, triggered by the public transport interventions. Johannesburg is planning transit-oriented development (TOD) along its Corridors of Freedom, where public transport will be combined with pedestrian facilities and higher density, mixed-use buildings. Projects that were meant to provide walking-friendly areas for the FIFA World Cup in 2010, such as the Durban Waterfront or Waterkant

1. The 2011 Census revealed that the official unemployment rate in metropolitan municipalities was between 23.9% and 36.6%, with the national rate being 29.8%.

Street in Cape Town, have shown how public spaces can become safe social gathering areas that improve the quality of life for all citizens. Most cities have now started to think, and even implement, public transport projects in conjunction with other built environment interventions. One example is in Tshwane, where inner-city rejuvenation includes closing certain roads to cars in conjunction with providing public transport.

The rollout of BRT and rail infrastructure takes many years and is expensive, while the existing form of cities cannot be changed quickly and will not be without opponents. This publication has sought to establish how to achieve the vision of a city that is accessible to every citizen in the face of these limitations. It has looked at areas that are pertinent to the transformation of public transport in South African cities, including the political and institutional arrangements, funding mechanisms, the minibus taxi industry, integrated fares and ticketing, and land-use management.

POLITICAL AND INSTITUTIONAL ARRANGEMENTS

Rehana Moosajee describes an alternative vision for South African cities, where the most polluting modes of transport are used the least and the non-motorised options are used the most, out of convenience, not necessity. Achieving such a vision does not entail completely rebuilding the city. She suggests that municipalities can take small steps, such as not providing employees with travel allowances and parking spaces, incentivising car-sharing, walking, cycling and the use of public transport, and considering flexi-hours, communication technology and home offices. The public sector employs many people in the city and so can drive behavioural change. This requires strong political leadership. Moosajee therefore advocates that politicians and city officials should use public transport and walk in cities as often as they can, so that they can understand the fragmentation of systems, the costs to passengers, the limitations imposed by operating hours and the sense of insecurity within their city.

Cities can be encouraged to move towards denser and pedestrian-friendly cities by understanding the costs of not changing. These costs include transport subsidies for long-distance services, expensive construction and maintenance of network infrastructure, lost working and living hours resulting from congestion, illnesses from pollution, low accessibility to labour markets for the poor and low productivity. While having a national vision is important, and cities should learn from each other as much as possible, Moosajee stresses that each city needs to develop its unique plans and capacity. As each city's circumstances are different and public transport budgets are limited, each city needs to be able to tailor its subsidisation for the most effective integration across modes. This requires a single organisation at city-level that is able to make all decisions across transport modes. Until this is the case, cities must take greater part in decision-making at provincial and national level.

The required integrated public transport will involve collaboration, learning and communication by all departments, from planning, environment, safety, health, community development and economic development, to human settlements and transport. Such collaboration is vital, as public transport provides access not only to employment

but also to health and education facilities, and reduces traffic deaths and pollution. To improve collaboration between municipal departments, Moosajee recommends that the scorecards of senior managers are revised to ensure cross-departmental collaboration. This is an equally valuable proposal for senior managers at provincial and national level. The scorecards should also be customer-centric, as stakeholders and interest/civil society groups need to be part of the process. Plans need to be fully integrated, which will mean interrogating zoning, incentives, densification, and planning of social and community amenities through a public transport lens. Human settlements must be built with public transport access in mind and have pedestrian and cycling infrastructure.

Moosajee provides suggestions for ways in which public transport can be improved and used for more than just mobility. For instance, public transport stations could be used for health testing and awareness, municipal information dissemination and libraries, and could accelerate the bridging of the digital divide by providing wifi broadband access. Moosajee makes a persuasive case that city leaders have to recognise that there is no choice but to use a fragmented and ageing transport system and built environment designed to divide in order to transform cities into spaces for all by locating functions at the right institutions, improving cooperation across all stakeholders and setting the right incentives for public transport users.

PUBLIC TRANSPORT FUNDING

Amanda Jitsing explores the role of funding in building inclusive and integrated cities, and how to improve the design and application of funding mechanisms. She also touches on how funding can be used to lower carbon emissions from public transport. In the current public transport system, funding and implementation are fragmented, despite the sensible principles outlined in existing legislative frameworks and increased public transport expenditure over the last decade.

Historical reasons explain the different approaches to subsidising public transport modes, as different levels of government hold responsibility for planning, funding and implementing public transport systems. Jitsing's analysis implies that subsidies are not necessarily targeted at providing public transport in underserviced areas, or at ensuring equity across population groups and better health, education, employment and productivity. Her view is that change can only come through a review of the public transport subsidisation system, and a funding strategy is needed that outlines the key principles of public transport subsidisation for all modes. The strategy should set out the key objectives of public transport provision, such as access to specific population groups, improved health outcomes and denser cities. It also needs to weigh up conflicting principles such as the user-pay-principle versus affordability.

Changing historically entrenched institutional responsibilities and existing subsidises is difficult. Therefore, like Moosajee, Jitsing suggests that all public transport provision and subsidisation should be managed by one local authority. This will require national government to devolve all public transport functions and funding to local level and to develop a subsidisation policy that splits public transportation funding into the different modes. This could be phased-in within a specified time

frame to allow alternative funding mechanisms to be established and new investments to be made. The devolution will result in costs that national government should carry because improving public transport will help government achieve many of its objectives.

Like Moosajee, Jitsing stresses the importance of integration across government. All public transport projects should show how they comply with the spatial vision and what revenue they generate. While funding mechanisms cannot improve the quality of integrated planning, they can be used to give weight to the plans, although they should not dictate additional planning instruments. Grant frameworks can be used to improve modal and built environment integration, and so Jitsing proposes that grant frameworks should include integration conditions, such as the alignment of human settlement plans to integrated public transport network plans, maximum commute times or distance to transport access points.

The cost of public transport is determined by distance and density, which determine the infrastructure and vehicles needed, as well as occupancy levels. As South African cities will remain fairly spread out for many years to come, the high cost of public transport will persist. Therefore, Jitsing offers some suggestions of how cities might generate revenue for public transport, including business taxes, land value capture, station rents, station air rights, advertising, and congestion and parking charges. She points out that private sector investment in public transport is possible but limited, and requires regulatory and contractual certainty, as well as appropriate risk sharing. The provision of public transport can be made cheaper if the behavioural impacts of fares are understood. For instance, offering cheaper or free public transport during off-peak hours spreads ridership and reduces the need for infrastructure.

The strong message from this chapter is that all spheres of government must develop public transport funding arrangements that promote modal and spatial integration, including appropriate funding strategies and institutional and financial arrangements that are aligned to achieving the overall objectives.

THE MINIBUS TAXI INDUSTRY

David Schmidt explains that the minibus taxi (MBT) industry will remain the largest single mode of public transport for current transport planning horizons. MBTs supply a very useful feeder system to the rail and BRT modes, providing the 'last kilometre and more' services that scheduled services cannot viably provide. The need for a more extensive feeder system, which only MBTs can provide at this stage, is supported by the National Household Travel Survey statistics quoted at the beginning of this chapter.

The challenge is to ensure that MBTs and other modes complement each other rather than engage in destructive competition. This requires the MBT industry to be regulated, which it already is to some extent. For instance, only certain associations can operate on certain routes. For effective regulation, it is also important that licences are based on demand from commuters. Through proper regulation, MBTs can be integrated into the networks, which Schmidt shows would make economic sense for

operators, resulting in lower operating costs and a stable revenue stream.

Similarly to Jitsing, Schmidt argues that ICT technology, funded by the state, offers the MBT sector a way of improving massively and becoming an integral part of the urban public transport network. Jitsing warns that integration could lead to higher costs for the minibus taxi operators, whereas Schmidt seems to think that it can be viable for the industry to voluntarily integrate. However, this will require the deepening of the partnership between the cities and the taxi associations at national, metropolitan and even route levels. The use of ICT technology can provide the taxi industry with many advantages, such as improved safety and security, better fleet management and passenger information. However, for MBT drivers to buy into such a system requires that the benefits of regulation and integration are shared between drivers and owners.

After explaining the different ICT technologies' applications, Schmidt provides a good overview of the opportunities associated with each. One of the more innovative opportunities is demand responsive transport, or transport that can react to the needs of individuals. This would allow passengers to book journeys online and the different bookings to be aggregated in order to provide the most efficient route and schedule. MBTs could thus continue to be the most flexible transport mode. Technology would also allow passengers to plan their journeys and get real-time information. A pilot example from Cape Town showed that the advantages of ICT technology can outweigh disadvantages for the taxi industry and convince them to be regulated in that way.

The main argument from Schmidt is that the MBT industry should be the single most important area of focus to improve mobility, reduce distance and trip times, and create a more spatially inclusive city. It needs to be integrated into the public transport networks, assisted by effective regulation and the appropriate use of technology. However, he advises that such changes take time and will need to be introduced gradually and systematically.

INTEGRATED TICKETING AND FARES

Every major city's transport policy promotes the expansion and integration of multi-modal public transport, which is used by the majority of South African commuters. However, as Jesse Harber shows, the recent proliferation of urban public transport modes has resulted in a multiplicity of cards and tickets, causing great inconvenience to users. This multiplicity is also contrary to the guidelines on human settlement planning and design, which refer to a uniform and shared fare and ticket system that applies to all modes and allows travellers to transfer easily between modes. Harber explores how integrating ticketing and fares can bring equitable access, as well as increase ridership and municipal revenue. He explains the differences and connections between integrated ticketing, integrated fares and e-ticketing, using international examples to illustrate how they work. He also looks at how integrated fares and tickets operate in Johannesburg, Cape Town and eThekwini, the three cities with the most extensive public transport networks.

Harber points out the benefits of a truly integrated ticketing and fare system to passengers, transport operators and the public transport system as a whole. For example, quicker fare validation saves individual passengers time, increases throughput for modal operators and helps planners by making public transport more appealing. Integration of fares (if set appropriately) can make public transportation cheaper for poorer households, which currently spend a large portion of their salaries on transportation. Unlike many other countries, fares cannot be set according to distance because in South African cities the poor live far away from economic nodes. However, technology can be used to differentiate fares according to age, work status or disability etc., for example through linking smart cards to identification documents, school and university registrations and the social grant system. The fares charged can then be subsidised and made cheaper for specific groups.

Harber discusses these and other options to achieve a radically progressive fare policy, and concludes that the potential for better-designed public transport fares will be greater if smart cards and mobile ticketing are combined with fare and/or ticket integration. He does not suggest that integrated ticketing and fares will transform the urban space, but they can support the objectives of providing the poor with equal access to social and economic opportunities in cities.

LAND-USE MANAGEMENT

Public transport can create denser cities, so long as the overall cost of living close to public transport is not higher than that of living further away and needing alternative transport. Land-use management is crucial for maximising public transport use and enabling public transport interventions to be the change agents for the built environment. In this chapter, Stuart Denoon-Stevens argues that integrated transport and land-use planning can achieve equity of access, safety and efficiency (or viability). He outlines some interventions that could increase the safety, accessibility and viability of public transport within metropolitan areas. For instance, road design and township-establishment processes could include the provision of pedestrian infrastructure, road markings, pedestrian-friendly driveway design, speed reduction measures, safety-enhancing lighting and signals, and comfortable public transport waiting areas.

In discussing the procedural mechanisms that can support the suggested interventions, Denoon-Stevens does not include land-use incentives, as he believes they are too weak in the South African context and that a more prescriptive approach would be more effective. It may be true that incentives to change land-use may have a small impact. However, it may be useful to explore what incentives there are in each city that are currently entrenching land-use and may be preventing changes. The proposals include building new buildings above and adjacent to public transport facilities. Here Denoon-Stevens supports Moosajee's view that the public sector could drive the shift to public transport, proposing that government departments move their offices closer to public transport facilities. The development of stations could be used to include commercial and cultural spaces, which could generate revenue and make living close to public transport even more attractive. Municipalities could also look at using land available for these type of developments and would have to amend

the zoning scheme, so that business or residential uses are permitted in the same zone as a public transport station (or other infrastructure).

The zoning scheme could also be amended to prioritise public transport and pedestrians, for example through street design guidelines stipulating minimum requirements for pedestrian movement, standards for cycle-friendly roads, drop-off bay requirements, reducing parking requirements in areas with adequate public transport and traffic-calming measures. Zoning maps and spatial development frameworks (SDFs) can also encourage dense development in areas that are accessible to public transport. For example, significant residential developments would not be allowed beyond a 45-minutes commute to the major nodes.

Denoon-Stevens argues that equitable, safe and viable cities can be achieved through key land-use ideas: building precincts (not stations), prioritising public transport and pedestrians (not private cars) and encouraging dense development in areas accessible to public transport. All of this is done by maximising the use of spatial development frameworks, zoning schemes, building approvals, street design standards and other land-use management instruments.

KEY EMERGING THEMES FROM THIS PUBLICATION

The consensus in this publication seems to be that compact cities, in which citizens can get everywhere easily, are desirable for the environment, the economy and citizens' quality of life. While broadly supportive of the changes in public transport provision that are currently underway, the chapters recognise that progress is neither fast nor comprehensive enough for cities to transform spatially over the next few years.

The following are some of the key themes that emerge as recommendations for government officials and political leaders of all three spheres of government, as well as for citizens, businesses and all other actors influencing the shape of South African cities:

Each city's vision must be clear and supported by citizens, politicians and administration. The city leadership should outline the social costs of not attaining the vision. Cities may share similar visions and proposed interventions, but the details will differ, and so policy, regulatory and financing instruments should provide some flexibility. Cities also need to take the lead in urban transformation, through practical interventions, such as providing transport subsidies to employees, flexible work hours and locating offices close to public transport facilities.

All interventions in the city space should be analysed from a public transport, low emissions, spatial and inclusivity perspective. The (un)desired impacts of existing planning tools and regulations, and how these can be changed, must be clear. The regulations influencing the built environment of every city need to be scrutinised, to establish whether they promote non-motorised transport, intermodal integration and spatial integration. If not, they must be changed so that they actively support these objectives. Aspects here include

road design and township establishment processes, zoning schemes and regulations, as well as spatial development frameworks.

Coordination between all three spheres of government, state-owned entities and sectoral departments is a prerequisite. Coordination is not only important for integrating infrastructure and services provision but also for funding. Having different mechanisms for funding different modes of transport is counter-productive, when the aim is to ensure that cities integrate modes to provide convenient services to the public in a cost-effective manner. Having recognised the historical reasons for the funding mechanisms, a subsidisation policy must now set out the principles and then the required changes must be phased in.

Devolution of functions to local level is necessary for integrating planning, funding and implementation of public transport and built environment functions. This includes commuter rail. It will then be in the interest and ability of cities to use all possible levers to ensure integrated cities that are liveable for citizens and to maximise the impact of available resources to achieve that vision within that city's context. As long as devolution processes are under way, there should be clear agreements that ensure cooperation.

There should not be too many planning instruments, although cooperative planning between departments in a city and between different spheres of government is seen as very important. Work is needed into how to better implement existing planning instruments, including understanding and including citizens' needs much more.

Existing funding streams should be conditional on modal and built environment integration. A review of which conditions make most sense to achieve the overall spatial vision, as outlined in the National Development Plan, would be useful for all grants that fund the urban built environment, infrastructure and operations. Funding should also be flexible enough for cities to make choices about which infrastructure and services are needed within the built environment.

The investments and regulatory changes being made must be accompanied by successful operations. This involves cities having the appropriate skills and training for new functions and getting integrating ticketing and fares right to increase ridership. Distance-based fares disadvantage the poor and so cannot be used to encourage densification in South African cities. However, the fare system can promote spatial integration if the right technology and data systems are used to target subsidies. Fare regimes for South African cities should be explored and piloted, while understanding that behavioural impact is important, as fares that maximise ridership, but are spread throughout the day, allow the most cost-effective provision of public transport.

Integrating the MBT industry, which carries the most public transport passengers, can have a large-scale impact on mobility and spatial transformation. The industry should be included in plans for areas not yet targeted by bus or rail services, it should make better use of ICT technology and be better regulated. The key to success is that integration makes economic sense to the taxi owners and drivers.

This publication has made very clear how important it is to get public transport right in order to improve the quality of people's lives. The focus should not only be on big infrastructure, especially in light of the limited fiscal resources and individuals' affordability. Large investments need to be implemented in conjunction with 'smaller steps' to achieve the biggest possible impact. The urgency is to move forward with public transport investments that will make cities accessible to all, and experiments should be allowed, even if they lead to mistakes. The longer it takes, the more cities will be allowed to spread and the more difficult it will become to provide citizens with the services needed to make cities liveable and inclusive.

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