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# Share the Road:

## Investment in Walking and Cycling Road Infrastructure



≡ MAKE ROADS SAFE



FIA Foundation  
for the Automobile and Society





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≡ MAKE ROADS SAFE



## Acknowledgements

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## Acronyms

ADB	Asian Development Bank
AfDB	African Development Bank
ASEAN	Association of Southeast Asian Nations
BAQ	Better Air Quality
BC	Black Carbon
BCR	Benefit-Cost Ratio
BRT	Bus Rapid Transit
CBA	Cost Benefit Analyses
CO <sub>2</sub>	Carbon dioxide
CSE	Center for Science and Environment
CTF	Clean Technology Fund
C-XL	Climate Excellence Africa
DALYs	Disability Adjusted Life Years
DTIE	Department of Technology, Industry and Economics
EC	European Commission
EU	European Union
FIA	Federation Internationale de L'Automobile
GAP	Global Atmospheric Pollution
GDP	Gross Domestic Product
GHGs	Greenhouse Gases
GoK	Government of Kenya
GTZ	Deutsche Gesellschaft Fur Technische Zusammenarbeit
HC	Hydrocarbons
ICA	Infrastructure Consortium for Africa
I-CE	Interface for Cycling Expertise
ICT	Information and Communications Technology
IEA	International Energy Agency
iRAP	International Road Assessment Programme
ITDP	Institute for Transportation & Development Policy
km	Kilometres
kph	Kilometres Per Hour
KSI	Killed and Serious Injuries
LOS	Level of Service
MDBs	Multilateral Development Banks
MDGs	Millennium Development Goals
MT	Motorised Transport
NAMAs	Nationally Appropriate Mitigation Actions
NEPAD	New Partnership for Africa's Development
NO <sub>x</sub>	Nitrogen Oxide
NMT	Non-motorised Transport
OECD	Organisation for Economic Co-Operation and Development
PM	Particulate Matter
SO <sub>x</sub>	Sulphur Oxide
SPM	Suspended Particulate Matter
SSATP	Sub-Saharan Africa Transport Programme
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
USD	United States Dollar
WBCSD	World Business Council for Sustainable Development
WHO	World Health Organisation



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## Foreword

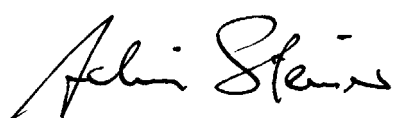
Roads are meant to facilitate mobility, the movement of people and goods. But many roads have become too congested with traffic and no longer meet their main purpose of improving accessibility. Moreover, most roads have been developed with the motor vehicle as the principal user. The results are sobering. Road transport accounts for 17% of the world's energy-related carbon dioxide emissions and 10% of global greenhouse gas emissions. It is also responsible for up to 90% of urban air pollution. More than 1.3 million people are killed every year and more than 50 million are seriously injured; 90% of which is in the developing world. And our cities are losing the vitality and ease of travel preferred by citizens, visitors and investors alike.

To take a more sustainable mobility path, the critical role of non-motorised transport (NMT) needs to be recognized and factored into road infrastructure investments. The most natural and energy-efficient ways to travel shorter distances—walking and cycling—have been sidelined by politicians and planners in many places over the last century in favour of transport systems designed for the motor vehicle. Innovations and new technologies in fuels and vehicles, as well as measures in traffic demand management, need to not only be encouraged but accelerated. It is clear that we need to diversify the options by building integrated, multi-modal transport systems that can propel a transition towards a low carbon, resource efficient, job-generating Green Economy.

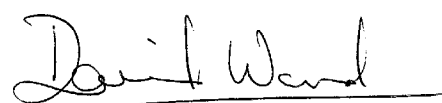
It is a vision that brings together the United Nations Environment Programme (UNEP) and the FIA Foundation for the Automobile and Society (FIA Foundation) through a new campaign—Share the Road. In partnership with governments and donors, Share the Road aims to catalyse decision-making to systematically allocate investments in NMT road infrastructure. A good start would be a set percentage of the project costs set aside for NMT road infrastructure. The core rationale is that such investments are a triple win opportunity in improved environment, safety and accessibility which can contribute to sustainable development.

NMT investments are also a significant part of the package of solutions necessary to achieve the poverty-related Millennium Development Goals (MDGs) and the objectives of the UN Decade of Action for Road Safety in 2011-2020. For example by 2015, road crashes are projected to be the leading cause of health losses for children aged 5 to 14 in developing countries. Unless there are sustainable roads for these children to go to school in safety, we risk losing the progress made in reducing the under-5 mortality rate.

There is a critical window of opportunity to make road infrastructure in developing countries accommodate all users and support development efforts. On behalf of the many partners who contributed to this report, we invite all stakeholders in the international community to take part in the Share the Road initiative.



Achim Steiner  
United Nations Under-Secretary-General  
Executive Director  
United Nations Environment Programme



David Ward  
Director General  
FIA Foundation



## Executive Summary

Cities are in urgent need of a new paradigm for envisioning and implementing sustainable transport. While current road transport systems have served as an engine of tremendous economic growth, they have also incurred huge costs in air pollution, emissions of greenhouse gases, injuries and fatalities from road crashes, lost productivity from congestion and, in some cases, the severance of communities. Such problems will be further exacerbated with the projected growth in private light-duty vehicles, namely a tripling of the global fleet by 2050, unless we establish cleaner, safer and more efficient transport systems. This kind of shift is urgent globally, but most acutely in the cities of developing countries where two-thirds of the growth in motor vehicles is expected to take place and where high rates of urbanisation add to the pressures on the environment and society.

Despite the massive benefits of NMT, investments by donors and governments still do not sufficiently finance roads and transport infrastructure to enable safe and enjoyable walking and cycling. The lack of investment in sustainable urban transport is one of the most blatant gaps in government expenditures, development assistance and climate finance. Share the Road draws attention to the missed opportunity and proposes a broad-based partnership to develop the kind of investment policies that will significantly raise the profile and delivery of NMT infrastructure. One possibility lies in linking to the recommendation of the Commission for Global Road Safety that a minimum 10% of total project costs be allocated to safety, inclusive of NMT infrastructure.

Investments in infrastructure for NMT yields tremendous positive impacts in the environment from less pollution and greenhouse gases, in safety from the protection of vulnerable road users from high-speed traffic, and in accessibility itself, by providing the majority of global citizens with a more viable, enjoyable and affordable means of travel.

Depending on the country and city, road investments will need to address an appropriate mixture of measures to preserve the modal share of NMT by preventing the shift to private cars or to increase the modal share of NMT by encouraging the shift to NMT modes. For example, in Nairobi, Kenya, more than half of the population walks or cycles to meet their mobility needs. The paradox is that little, if any NMT infrastructure exists, leaving those who rely on NMT especially vulnerable to road crashes. To rectify the situation and improve the convenience of using NMT, roads must be designed with all users in mind. Whether in rehabilitation projects or new road constructions, there are two common principles – the protection of vulnerable users from high speed impact and the integration of NMT networks with other motorised services such as public buses.

In this context, this report puts forth the following key recommendations to the international community, in particular to donors and to governments, for promoting increased investments in walking and cycling infrastructure:

1. **Recognise the massive benefits of a clean environment, safer roads and better mobility from increased investments in NMT infrastructure:** Current transport systems, overly dependent on motor vehicles, incur high costs from congestion, pollution and road fatalities. Walking and cycling are highly resource-efficient in both energy and space and the ability to use these modes makes our cities more attractive and liveable.
2. **Better balance the share of NMT investments in road and transport infrastructure projects to meet the full range of people's mobility needs:** Roads should facilitate the mobility of people and goods, without preference for some users over others. Sharing the road entails sharing the space and the resources allocated to build, maintain and improve them.
3. **Increase the total amount of investments in NMT infrastructure as part of efforts for greening our economies, improving global road safety and achieving the Millennium Development Goals for reducing poverty:** Sustainable transport is key to multiple agendas of global importance. Investments to address climate change, promote economic growth, improve road safety and reduce poverty should include components on NMT infrastructure as a matter of course.
4. **Collaborate across a wide range of sectors and countries to make investments in NMT infrastructure a matter of policy in donor agencies and government budgets:** The argument is clear, increased investments in NMT infrastructure are necessary for multiple, urgent reasons. Partners must work together to promote this low-cost, high-benefit component to sustainable mobility and institutionalise systematic financing of NMT.



5. **Promote further education and training for engineers, designers, planners and funding proposal writers to raise their capacity to design and finance safe, intermodal transport systems:** Achieving sustainable transport will be a challenging journey that requires a new way of planning, financing and implementing, especially in cities with rapid urbanisation and motorisation. Effective exchange and cooperation across national and sectoral boundaries are needed to cultivate such expertise.
6. **Have creativity and courage in charting a sustainable mobility path:** When faced with particular challenges, a healthy dose of thinking outside the box is necessary. Cities that are now leading examples had to overcome their own difficulties; their champions continue to promote safe, clean, more equitable transport.
7. **Design roads so that vulnerable road users such as pedestrians and cyclists are protected from high speed impact:** NMT facilities that protect users from high speed impact can drastically cut the number of serious injuries and fatalities. Giving NMT users their own space makes these modes of travel more enjoyable and attractive, while also improving traffic flow for motorists.
8. **Integrate NMT networks with other modes, especially public transport, in order to maximise usage and impact:** Walking and cycling are best suited for shorter distances, 3 km to 15 km respectively. Connecting sidewalks and cycling paths to bus stations and other motorised transport expands the possible range of resource-efficient travel and also increases use of public transport.
9. **Develop indicators that can monitor and evaluate roads for their contribution to sustainable development in terms of environment, safety and accessibility:** The traditional method of expressing transport improvements in km paved or the average speed of motor vehicles is outdated. Modern and inclusive ways to measure progress in roads and transport infrastructure must be developed to make investments more successful.
10. **Communicate among donors and governments both at the project and policy level to identify best practices in monitoring and measuring impacts of road investments:** Some donors and governments have already embarked on internal initiatives to improve the effectiveness of investments, as well as to reduce the unintended negative consequences. An open atmosphere of sharing and coordination will help propel a global push for better investments.







© Still Pictures

# 1 Share the Road: A Triple Win Opportunity

Roads enable economic and social development - at a cost. With adequate investment for sustainable road infrastructure that is inclusive of non-motorised users, the benefits of these investments will grow and the environmental and socio-economic costs of road building and use can be minimized.





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## Introduction

In too many cities, pedestrians and cyclists are provided with few, if any, facilities. Moreover, they are often poorly maintained, forcing non-motorised road users on to motor carriageways. Without proper infrastructure that supports travel via non-motorised transport (NMT) modes, users suffer from low safety and security. For those with limited access to alternatives, daily mobility needs are met through literally life-threatening journeys. For those with other options such as driving their own car, walking and cycling are shunned, even for short distances, due to concerns for safety and convenience. As a result, NMT – the most clean, efficient and healthy modes of transport – has been on the decline.

Such a picture of deteriorating environments for walking and cycling is especially pronounced in cities of developing countries, where the provision of basic urban services including transport face serious challenges due to the exponential rate of population growth and urbanisation. But, the fact that many of these cities already have a high proportion of trips made via walking and cycling means there is great potential to reap massive benefits from investment in NMT infrastructure. As shown in Figure 1, this is a central overlapping action that can trigger positive impacts in all three areas of accessibility, safety and environment, i.e. a triple win.

Making provisions for NMT in road infrastructure reduces emissions of air pollutants and greenhouse gases (GHGs), protects all road users by allocating space to different modes according to speed, and increases affordable access to vital services and other transport modes, in particular public transport. All in all, investments in NMT infrastructure are cost-efficient, pro-poor and pro-development measures.

There are an increasing number of examples found all around the world – from established leaders like Amsterdam and Copenhagen to new models such as Bogota and Huangzhou – that show the positive impact of promoting non-motorised transport on the quality of life and attractiveness of cities. However, a catalytic intervention is needed by all stakeholders to ensure a paradigm shift away from car-centric to multi-modal transport occurs fast enough and wide enough. Investments in NMT infrastructure is the key missing link in the effort that this report addresses.

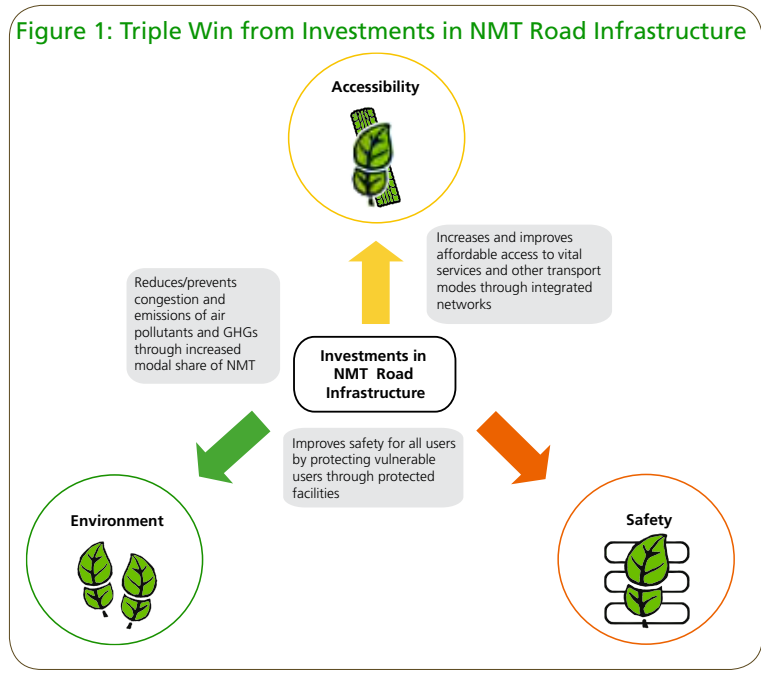
This first chapter elaborates on the aspects of NMT with respect to safety, environment and accessibility and the need to invest in NMT as part of road investments and other efforts for the MDGs and sustainable development. Chapter 2 looks closer at the financing of roads and transport infrastructure by donors and governments and advocates various possible funding mechanisms and policies. Chapter 3 includes recommendations for key stakeholders at various levels and next steps for Share the Road.

In addition, there are two technical annexes: Annex A outlines key principles for the design of sustainable roads with guidelines on the essential factors to consider for pedestrian and cyclist infrastructure; Annex B presents a preliminary set of indicators to better measure and understand the impacts of road investments on sustainable development.



# Non-Motorised Transport: Bridging Environment, Safety and Accessibility

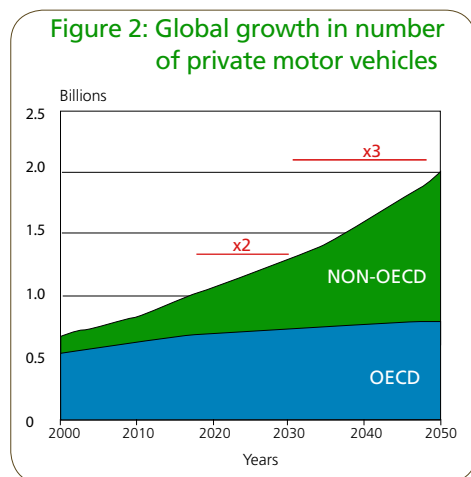
## Environment



While an engine of economic growth, the transport sector, and road transport in particular, has major impacts on the environment. Road transport accounts for 25% of world energy demand, 90% of which is derived from fossil fuels. In 2005 the road transport sector produced 17% of the world's energy-related CO<sub>2</sub> emissions, making it a key contributor to anthropogenic climate change.<sup>1</sup> Phenomena from climate change include temperature change, heavy precipitation events, drought and sea level rise. Due to the wide-ranging implications of such impacts, the UN Secretary General Ban Ki-moon has said climate change is 'the defining challenge of our era.' Transport is the fastest growing sector in GHG emissions at a forecasted rate of 2.5% yearly until 2020. Mitigating climate change will require drastic improvements in the sustainability of the transport sector.

International Energy Agency (IEA) scenarios predict that the transport sector's contribution could double by 2050 under business-as-usual scenarios. The fastest growth is expected to come from private motor

vehicles, road freight, and air travel, with road transport accounting for the bulk of growth. The world's light duty motor vehicle fleet is set to triple by 2050, at which time two-thirds of the global fleet will be found in non-OECD countries; currently the non-OECD fleet is a quarter of the total (Figure 2). Some estimates say the global fleet will even grow to 3 billion by 2050. The consequences of this growth will multiply at an unprecedented rate. CO<sub>2</sub> emissions from developing countries will increase from 30% in 2006 to 45% of the global total by 2030.<sup>2</sup> In order to dampen the exponential rate of motorisation and concomitant adverse impacts, investments in infrastructure for walking and cycling are critical. This is especially in the case of developing countries where most new vehicle growth will take place. Although not historically responsible for climate change, developing countries also stand to benefit greatly from choosing a sustainable mobility path. For instance, the cost savings from importing less fossil fuel for transport can be invested in measures to adapt to climate change.



Source: IEA, Energy Technology Perspectives, 2008

Urban air pollution, currently causing an estimated 800,000 deaths per year, will be exacerbated, with the greatest burden of death and illness experienced by children and the poor. Emissions from transport are responsible for 70-90% of air pollution in urban areas, making it the largest source in most cities. Pollution exceeds air quality standards set by the World Health Organisation (WHO) and costs more than 5% of GDP in many developing countries. Particulate matter – black carbon, in particular – nitrous oxides, sulfur oxides, and carbon monoxide emissions have major health effects, triggering respiratory problems including bronchitis and asthma, as well as cardio vascular diseases and even brain damage. In fact, black carbon is also the third largest contributor to climate change.

The combined hazardous impacts of urban air pollution, largely caused by current transport systems, are serious. EU researchers found that the biggest killer on UK roads was pollution. In another study, the Netherlands Environment Agency reports that, by 2050, about 100 million premature deaths caused by respiratory health problems linked to air pollution could be avoided through sustainable transport measures. In areas with poor fuel and vehicle quality, the health risk can be especially acute for pedestrians and cyclists. Where this is the case, it is ironic because daily walking and cycling have been shown to be a great source of daily exercise with many health benefits.



NMT is a core component of environmentally, economically and socially sustainable transport systems. The IEA reports that GHG reductions in transport will come from three main sources, one of which is modal shifts, e.g. in urban short-distance travel made by NMT (Box 1). A 1% shift in distance undertaken by car to a non-motorised transport mode reduces energy consumption and pollution emissions by 2–4%.<sup>3</sup> Improved infrastructure can lead to 2,500 people driving 5 fewer kilometres per day and would save 1 kiloton of CO<sub>2</sub> per day.<sup>4</sup> The use of NMT results in reductions in noise, vibration and non-CO<sub>2</sub> emissions, with tangible economic benefits derived from the increased productivity and reduced morbidity of an active, healthy population. Cities, where the share of public transport, walking and cycling is over 55%, on average, emit 2.4 fewer tonnes of CO<sub>2</sub> emissions annually from passenger transport compared to cities where private transport has a share of over 75%.<sup>5</sup> Increased investments to make travel by walking and cycling more convenient, enjoyable and safe are necessary.

In Bogota, the CicloRuta is one of the most extensive cycle path networks in the world, covering over 340 km and connecting with major bus rapid transit (“TransMilenio”) routes, parks and community centres. From 2000 to 2007, the cumulative CO<sub>2</sub> emission reductions have been calculated as more than 36,000 tons CO<sub>2</sub>eq, based on 7% of CicloRuta users leaving their cars at home, i.e. shifting from high to low-impact modes. The rapid increase in the total reductions is also noteworthy, which is due to the cycling modal share rising from 0.2% at the beginning of the project to 4% in 2007.<sup>6</sup>



**Box 1: GHG emission savings from NMT<sup>7</sup>**



Cycling is best adapted to city centres and densely populated areas. 1.5 billion people are expected to live in cities with 1 million or more inhabitants by 2050. If a 5% increase in mode share for cycling could be achieved in these cities, and an equal impact were achieved in towns and villages containing another 1.5 billion people, car travel would be cut by around 600 billion km a year world-wide, saving 100 million tonnes of CO<sub>2</sub> emissions.

If it cost an investment of USD 5 per person per year to achieve this 5% mode shift the total investment required would be of the order of USD 15 billion a year. But this would be more than offset by the direct cost savings for fuel alone which, at USD 60/barrel, would be around USD 25 billion per year. With other benefits including a healthier population, reductions in traffic congestion and emissions and time savings, the total cost of the cycling infrastructure would probably be very small compared to the net benefits, and the CO<sub>2</sub> savings would come at negative cost.

**Safety**



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According to the WHO, road traffic injuries were the ninth leading cause of death around the world in 2004.<sup>8</sup> In 2030, it is expected to rise to be the fifth leading cause of death under a business-as-usual scenario. Over 90% of this global toll in road fatalities occurs in low-income and middle-income countries, which have only 48 percent of the world’s vehicles.<sup>9</sup> The disproportionate amount of road traffic deaths and injuries pose a huge burden. The economic costs alone are estimated at USD 64.5 billion to USD 100 billion – nearly equivalent to the total bilateral overseas aid to low- and middle-income countries in 2005 which amounted to \$106.5 billion.<sup>10</sup>

Road traffic fatalities are forecast to increase from an annual 1.3 million currently to over 1.9 million globally by 2020. According to the Commission for Global Road Safety, 5 million deaths and 50 million serious injuries could be prevented by 2020 by scaling up investment in road safety.<sup>11</sup> The sheer scale of this problem has been recognised by the UN General Assembly which has declared a Decade of Action for Road Safety, 2011–2020 – a major success for the Make Roads Safe Campaign (Box 2 and 13).





**Box 2: Make Roads Safe and Share the Road: A Complimentary Relationship**



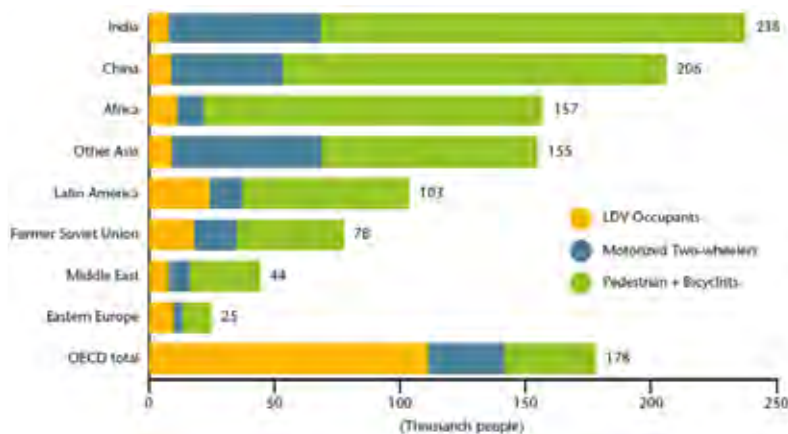
© Make Roads Safe Campaign

The Make Roads Safe Campaign and the Share the Road Campaign work towards the same goal: sustainable roads, which by definition, are safe, clean and affordable. Actress Michelle Yeoh, Ambassador for the Make Roads Safe Campaign, sees road safety as “a symptom of the wider sustainability problem.” She acknowledges “the chances are that an unsafe road is also a road that is not encouraging non-car users, cyclists or pedestrians” and is particularly enthusiastic about the ‘Share the Road’ campaign as an attempt to “ensure that the poor and the vulnerable who will never own a car still have a fair and safe stake in our transport system.”<sup>12</sup>

In Nairobi, Kenya, vulnerable road users – pedestrians, cyclists and motorcyclists – accounted for 54% of all road fatalities,<sup>13</sup> and in Mumbai, India, 78% of road fatalities were pedestrians.<sup>14</sup>



**Figure 3: Proportion of NMT users in road fatalities**



Source: WBCSD, Mobility 2030, 2004

Almost half of those who die in road traffic crashes are NMT users such as pedestrians, cyclists and users of motorised two-wheelers – collectively known as “vulnerable road users.” The proportion of NMT users in road fatalities is substantially higher in developing countries, largely due to the lack of proper sidewalks and cycling lanes that are protected from high-speed impact. As a result, vulnerable road users make up the majority of road fatalities globally (Figure 3) and children are at particular risk (Box 3).

In order to improve road safety, the needs of pedestrians and cyclists need to be addressed. Facilities which protect NMT users are key. For example, research by the International Road Assessment Programme (iRAP) in Nairobi, Kenya, found that NMT infrastructure features prominently in the top 10 most cost-effective countermeasures to build safe roads for the network, in order of number of deaths and serious injuries (KSI) prevented (Table 1). The top four are either NMT facilities or can be used as such and most of the others lead to improved travel conditions.



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The same often holds true for other major cities in the developing world. Indeed, there is wide overlap between safe road design and engineering and NMT infrastructure. Furthermore, all engineering measures to promote safe road infrastructure benefit multiple road users and most of these measures benefit NMT users in particular. This is because most safe engineering interventions, such as the 35 ‘treatment types’ in the iRAP Road Safety Toolkit, are either directly related to NMT facilities (e.g. additional lane, bicycle facilities, pedestrian crossings, pedestrian footways, pedestrian refuge island), provide multi-functional infrastructure that can be used for NMT (e.g. central hatching, central turning lane, shoulder sealing), or lead to improved travel conditions for vulnerable road users (e.g. regulate roadside commercial activity, road surface upgrades, roadside safety, speed management, traffic calming).



**Table 1: Top 10 cost-effective countermeasures for the road network in Nairobi<sup>16</sup>**

Countermeasure type	Sites / length	Estimated cost (20 years)	KSI saved (20 years)	Value of safety benefit (20 years)	Cost per KSI saved	BCR
Pedestrian Crossing Management	50km	\$7.7m	10,300	\$246m	\$748	32
Pedestrian Footpath (separated from road)	88km	\$1.9m	4,200	\$100m	\$465	51
Roadside Safety - Barriers	26km	\$2.0m	1,400	\$34m	\$1384	17
Additional Lane	6km	\$1.3m	900	\$22m	\$1376	17
Delineation	44km	\$0.6m	500	\$12m	\$397	20
Road Surface Upgrade	11km	\$0.3m	300	\$8m	\$539	26
Regulate Roadside Commercial Activity	6km	\$0.1m	300	\$7m	\$233	61
Parking Improvements	6km	\$0.1m	300	\$7m	\$278	51
Intersection - Roundabout	6 sites	\$0.2m	200	\$4m	\$1084	22
Duplication	1km	\$0.3m	100	\$3m	\$1284	11

KSI = killed and serious injuries. Ratios and rates computed on unrounded values. Rounded values except for Cost per KSI  
 BCR = Benefit Cost Ratio

### Box 3: Children and NMT<sup>15</sup>

Young road users are at particular risk of road traffic injury. In developing countries it is more likely to be child pedestrians who bear the greatest burden of injuries, whereas in high income countries fatality rates are highest among young car drivers and occupants. Children in low and middle income countries are much more likely than children in high income countries to be involved in a road traffic crash.

In South Africa, for example, more than 26 child deaths per 100,000 occur as a result of road traffic crashes compared to 1.7 per 100,000 in the EU as a whole. A recent study by the Global Road Safety Partnership found that in Bangladesh one in every four road deaths and one in six serious injuries experienced by the poor involve a child. In Bangladesh an alarming trend was also identified which found that although male road fatalities greatly outnumber females at any age, Bangladeshi girls accounted for a larger share of total female road fatalities and serious injuries (32%) than did boys (12%).

In a recent survey of children in Kabul, carried out by Save the Children and co-funded by UNICEF, road traffic was singled out as the biggest danger that children feel they face in their daily lives. Many had also experienced the sadness of loss of a family member in a road crash.



## Accessibility

Accessibility is the key factor in ensuring mobility for all users – it is facilitated by both the proximity of destinations and convenient, affordable transport. NMT modes are well-supported by compact cities which tend to be more sustainable than sprawling cities. As a recent World Bank report states, “denser cities use less energy for transportation, with lower transport-related gas emissions, and are able to provide services at lower cost and can implement more energy-efficiency measures.”<sup>17</sup>

As transport modes, walking and cycling are extremely energy and space efficient (Box 4). Few methods of reducing carbon emissions are as effective as substituting the automobile with a bicycle on short trips. In urban areas, distances of 3-5 km are ideal for trips on foot, bicycle or low-emission electrified transport (scooters, electric bikes, low emission vehicles). According to the IEA, “walking still is the widest used mode of transport in terms of trip share. But its share of distance travelled has declined very significantly during the last century as other faster modes of travel have grown. It is still today in most countries the most used mode for trips shorter than 3km.”<sup>18</sup> Cycling can often extend the range of travel to 15 km or more and is the most energy-efficient way to move, making it especially valuable in rural areas where distances between destinations can be longer.



It is important to note that in developing countries the characteristics of travel and transport differ from those in industrialised countries. One of the most significant differences is the large modal share of walking. Personal travel characteristics in several developing country cities show a high proportion of NMT travel: 44% in Chennai, India, 44% in Dakar, Senegal and 61% in Wuhan, China.<sup>19</sup> This results from a lack of choice rather than an attractive walking and cycling environment in which people choose to use NMT. With rapid urbanisation and the continuous influx of rural to urban migrants, the rising demand for mobility will be met primarily by NMT, the most affordable option.

For the future, this creates an opportunity, if and only if walking and cycling facilities are provided. In terms of modal choice, the majority of the trips are being undertaken by sustainable modes: public transport, cycling or walking. These modes should be defended, by transforming this choice from a captive one to a free choice through investments in safe NMT infrastructure. In fact, it is essential to prevent the shift of current NMT users to using private motorised vehicles for two reasons: first, the consequences of such a shift would be disastrous on the environment (land-use, air quality, climate) and second, preventing the shift from NMT to motorised modes is easier to accomplish than encouraging the shift from motorised to NMT modes.

In Sao Paulo, Brazil the average daily travel time for the poorest quintile is 4 hours and 25 minutes, compared to 3 hours and fifty minutes for the middle quintile.<sup>20</sup> In Mexico City, 20% of workers spend more than three hours travelling to and from work each day, and 10% spend more than 5 hours.<sup>21</sup>



#### Box 4: NMT and Decongestion

Decongestion is a key concern for cities and increasing the modal share of NMT can have a significant impact. For instance, bicyclists need less than a third of the road space that is used by a private vehicle, and a pedestrian needs only a sixth of that space.<sup>22</sup>

Following rapid urbanization and growing prosperity, new roads are too often constructed with the purpose of accommodating the growing number of motorized vehicles. However, governments are increasingly recognising the need to promote a variety of modes for urban mobility. For example, cycling is gaining more and more attention with cities like Paris, Mexico City and Huangzhou all starting bicycle renting schemes and cities investing in creating and expanding cycling networks. Some like Shanghai and Beijing have now reversed their policies to provide cycling lanes with the explicit goal of reducing congestion.



#### Share the Road Key Recommendation #1

Recognise the massive benefits in a clean environment, safer roads and better mobility from increased investments in NMT infrastructure: Current transport systems, overly dependent on motor vehicles, incur high costs from congestion, pollution and road fatalities. Walking and cycling are highly resource-efficient in both energy and space and the ability to use these modes makes our cities more attractive and liveable.

## Improving the Conditions for Sustainable Development and the Millennium Development Goals

Safe NMT infrastructure on urban roads can improve mobility for low-income groups. Unlike many other interventions, improvements in this case are possible with cost-effective investment. Adequate and secure NMT linked with public transit networks can lighten the financial and social burden of injury and expense and support the majority of people in developing countries in their usage of their only viable modes for transport.

Access to mobility is far from equally distributed<sup>23</sup> across the world. More specifically, the costs and benefits of transportation continue to be unequally distributed, with a massive gap between developed and developing countries, between rich and poor, between motorized and non-motorized users in terms of access to mobility options. The urban poor in particular pay heavily in time, money, and health as they try to meet their daily basic transport, energy and water needs in both urban and rural settings.



Urban road accidents alone are estimated to cost developing countries USD 65 billion each year. The cost of urban air pollution is estimated to approach USD 1 billion per year and often upwards of 5% of GDP in developing countries in healthcare costs alone. Add to this the already considerable cost of congestion in cities and the combined cost of a lack of road safety, clean transport and accessibility is daunting. The economic cost of congestion alone reached 4.4% of GDP in Korea and 6% in Bangkok.<sup>24</sup>

At the household level, the costs are also high and a road crash can push families into poverty (Box 5). The urban poor in developing countries tend to make fewer trips - but tend to spend more time and a greater share of their disposable income on transport.<sup>25</sup> Between 8 and 16 percent of urban household income is spent on transport, rising to more than 25 percent for the poorest households in very large cities.<sup>26</sup> Women living in a village alongside a main road in Cameroon spend more time producing food to generate income and have twice the income of women who live 1.5 hours from the same road.<sup>27</sup>

A case study from South Africa shows low-income earners spending 25% of income on public transport to and from work; with bicycle purchase, after initial purchase cost, the household cost of transport was reduced to 5% of income after three months.<sup>28</sup>



### Box 5: Road Crashes and Poverty

As a function of the mobility options most affordable to them – NMT and public transport – the urban poor are often the most exposed to risk while also being the least able to afford alternatives and medical treatment. The WHO found that people 15-44 years old, who at their most productive, account for more than half of all road fatalities.

Road crashes are a key determinant to whether a household is pushed into poverty. Research in Bangladesh and Bangalore (India) in 2004 showed many of the poor households identified were not poor before the death or serious injury caused by a road crash. The poor victims had contributed most to their household's earnings (average 62% in urban areas and 42% in rural areas), and the loss of income tipped many households into poverty. Among both poor and non-poor households, the most common road death was a male in prime of life (16-45 years).

In Bangalore 71% (urban) and 53% (rural) of poor households were not poor before the principal wage earner was involved in a fatal crash. In Bangladesh the figures were 33% (urban) and 49% (rural) for bereaved households.<sup>29</sup>

Despite such soaring costs to low and middle income countries, road safety has been almost totally ignored as an issue of sustainable development (Box 6). Road safety does not feature in the UN Millennium Development Goals (MDGs) which aim to eradicate poverty and is largely missing from UN and G8 policies and programmes for sustainable development.

While a necessary ingredient for economic growth, rising mobility need not contribute to rising death tolls and emissions as seen in the business-as-usual scenarios of soaring road fatalities and choked roads and air. Safe and reliable NMT, more fuel efficient personal transport and widely available public transport can help set cities and countries on the path to a low-carbon economy and a more liveable environment.



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More extensive, affordable and safe transport options and infrastructure would reduce the burden of harm and expense on low income groups. It would also serve to reduce the time burden on women and help to improve household incomes through improved access to markets, education and employment, which is particularly important in remote rural areas and for women and girls.

Concerted and long-term efforts to preserve and promote more fuel-efficient, low-carbon modes like NMT are needed in both developed and developing countries. The need for safe NMT infrastructure is more urgent in developing countries due to the lack of facilities and therefore the current high-risk exposure to road crashes. Nonetheless, all countries and cities today face a series of development challenges due to the rate and scale of motorisation, high levels of air pollution, increasing CO<sub>2</sub> emissions from fossil fuel combustion, gridlocks on roads which paralyze economies and a road safety epidemic.





The availability of paved roads had a significant influence in school attendance levels in a community in Morocco. Attendance rate rose from 21% to 48% for girls and from 58% to 76% for boys. In Burkina Faso it was found that communities living more than 10 km from a health centre suffered infant mortality rates that were 33% higher than those of communities living within a ten km radius.<sup>30</sup>



Africa has the least developed road network globally and a road traffic fatality rate of 28.3 per 100,000 people - the world's most dangerous road network with the World Health Organization predicting an 80% increase in road traffic fatalities by 2020. Africa is also urbanizing rapidly, with the urban population set to exceed the rural by 2030. About 300 million additional urban residents are expected over the next 25 years, making urban mobility that is sustainable of critical importance.<sup>31</sup> Currently, the major adverse environmental impact from the transport sector is in poor air quality due to the low quality of fuels, e.g. high sulphur content. While efforts are underway to clean both fuels and vehicles, the rate of motorisation implores long-term planning and investment in green transport options.

The same exponential trends can be seen in Asia as well, with China and India key countries of concern. Throughout Asia, the situation is equally urgent, where about 60% of road accidents occur. The economic costs in ASEAN countries alone are estimated at USD 15 billion a year. The added challenges are again in the rate of population and motor vehicle growth: 44 million people are being added to the urban population every year (equivalent to 120,000 people a day) and the number of motor vehicles is doubling every 5 to 7 years.<sup>32</sup>

Roads may not be a magic bullet for development, but increased mobility enhances economic opportunity. In particular, better facilities and network connectivity for NMT users will catapult efforts for road safety, green economy and poverty reduction. In industrialised countries as well, the needs of NMT and public transport users must be addressed. For example, nearly 30% of European households have no access to a private car and rely on public transport continuing to meet their mobility needs.<sup>33</sup>

A real effort to address mobility issues in developing countries – which inherently include NMT – will support the achievement of the MDGs. There is growing recognition that investment in road infrastructure will be an important factor in achieving the Millennium Development Goals. Between 2005 and 2010 annual investment needs in the roads sector alone total \$90 billion.<sup>34</sup> If, for example, a minimum 10% allocation of such road investment goes to NMT infrastructure, the very conditions for sustainable development will be improved.

North Americans travel an average of 64 km/day mainly by car and plane and emit 6 tonnes of transport related CO<sub>2</sub> a year. Brazilians travel an average of 11 km/day, by a combination of car and bus, and emit 0.7 tonnes of CO<sub>2</sub> a year. Tanzanians travel around 5 km/day, mainly on foot, by bus and bicycle and emit 0.1 tonnes of transport related CO<sub>2</sub> a year.<sup>35</sup>



#### Box 6: Road safety and the MDGs<sup>36</sup>

“Road traffic deaths and injuries impose huge economic costs on developing economies in low and middle income countries. These economic costs are estimated by the World Bank at up to \$100 billion each year. This compares with OECD development assistance of \$119.6 billion in 2009. Developing countries are typically losing on an annualised basis an amount equivalent to 1-3% of GDP. This has adverse implications for poverty reduction since every 1% increase in economic growth is estimated to reduce poverty levels by 0.7%.”

The burden of disease attributed to road safety is comparable with malaria and tuberculosis and is set to increase further. Indeed, the global burden of road traffic injuries is predicted to increase by more than 65% by 2020. Road crashes are now the leading cause of death worldwide for young people aged 10-24. Road traffic injuries are also placing an enormous strain on already overstretched health systems in developing countries. In Kenya, for example, road traffic injury patients represent around 45-60% of all admissions to surgical wards.”



## Share the Road Key Recommendation #2

Better balance the share of NMT investments in road infrastructure projects to meet the full range of people's mobility needs: Roads are meant to facilitate the mobility of people and goods, without preference for some users over others. Sharing the road entails sharing the space and the resources allocated to build, maintain and improve them.







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## 2 Mobilizing Investments

In order to strengthen the urgency of integrated road policy and design for safety, environment and accessibility, the international road finance community, including donors and governments, should make a concerted effort to increase investments in NMT infrastructure through an institutional commitment and investment policy.





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## Catalysing Investments for Shared Roads

Preserving and encouraging NMT modes can help to alleviate rising urban road congestion, rising vehicle ownership, rising two-wheeler traffic and rising road fatalities – particularly in cities. The failure to approach road building from this more inclusive and sustainable viewpoint will serve to calcify energy intensive patterns of development and mobility, impeding low-carbon urbanization and threatening energy security.

Road infrastructure should no longer permit only those who have access to motorized vehicles to reach a wider range of destinations and vital services. Because the poor are unlikely to own motorized vehicles for which most urban roads are designed, they are underrepresented among the beneficiaries of road investment. At the same time, they are over-represented among the victims of the adverse impacts that these road investments frequently cause.<sup>37</sup> In terms of air pollution, pedestrians and cyclists suffer from greater exposure. To include the interests of the whole population in the decisions on road investments, impacts must be assessed not only on the improved performance of the vehicular system, but also on the well being of all people affected by the investment.

The international community must work together to diminish the costs of roads. One critical way to do this is to develop investment policies that will ensure adequate attention and financing is given for NMT, in particular the infrastructure for pedestrians and cyclists. Such investments will benefit all citizens in the form of better and more mobility options, which also affect upon the liveability of the city.

### Share the Road Key Recommendation #3

**Increase the total amount of investments in NMT infrastructure as part of efforts for greening our economies, improving global road safety and achieving the Millennium Development Goals for reducing poverty: Sustainable transport is key to multiple agendas of global importance. Investments to address climate change, promote economic growth, improve road safety and reduce poverty should include components on NMT infrastructure as a matter of course.**

The Netherlands and Denmark are frequently cited as model cases. While the flat terrain did play a role, it is important to point out that the high percentage of trips made by NMT modes in cities is the result of concerted action. In both countries, cycling was in decline in the early 1970s. It was political commitment to cycling as a low-cost mode of transport that subsequently reversed this trend, initially in reaction to economically-damaging high oil prices. The redesigning of the roads to include cycle paths was the first step. Now cycling is a part of everyday life in and between most cities in these countries, despite high average rainfall and long, cold and dark winters in Denmark in particular.

In other words, countries achieve a high modal share of NMT in their cities through investment in NMT infrastructure. Denmark reduced deaths among cyclists by 35% by providing segregated cycling lanes alongside urban roads. Although cycling increased by 50% in the Netherlands between 1980 and 1997 fatalities and injuries decreased significantly. Copenhagen now has more than 350 km in cycling infrastructure which has led to 37% of both residents and commuters cycling to work and school (Box 7).<sup>38</sup> In turn, this translates into more than 90,000 tons of CO<sub>2</sub> emissions reduced per year.<sup>39</sup>



When NMT infrastructure is provided, some of the main deterrents to using NMT are addressed. Concerns for safety are assuaged by providing facilities that protect users from high speed impact. By ensuring NMT facilities are fully integrated in the larger transport infrastructure, i.e. well-connected to other transport modes, public transport in particular, the demand for convenience is met. In terms of the lower social status attached in some places to walking and cycling, investing in NMT infrastructure raises the profile of walking and cycling. Combined with the visible increase of users and the effective promotion and communication of the benefits, NMT can become more widely recognised as an attractive, healthy and environment-friendly mode of travel.



**Box 7: Continued investments in NMT**

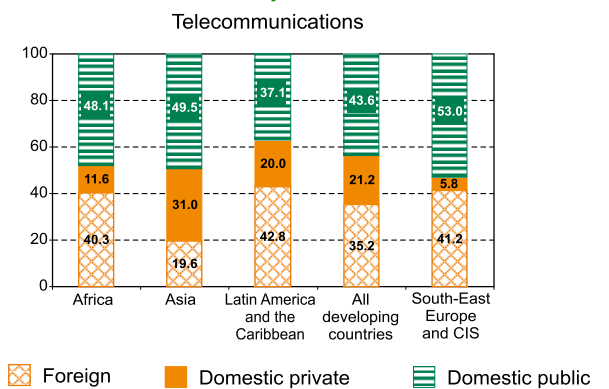
In Copenhagen (Denmark), 37% of residents bike to work and the city plans to invest more than USD 200 million in bike facilities between 2006 and 2024 with the goal of 50% of residents biking to work or school by 2015. In Amsterdam (Netherlands), cycling accounts for 55% of journeys to jobs less than 7.5 km (4.7 miles) from point of origin and the government has pledged USD 160 million from 2006 to 2010 to bicycle paths, parking and safety. In London (UK), a record 111 million pounds (2010) is being invested on improving safety for cyclists, cycling training, more secure parking, 6,000-bike rental scheme, and two cycle superhighways. In Freidburg (Germany), a city with 218,000, the government has dedicated roughly USD 1.3 million annually to cycling since 1976, with 70% of local trips being made by bike, foot or public transit.

Systematically dedicating road investment funds for NMT infrastructure has both symbolic and functional values. It highlights the fundamental importance of considering safety and the environment, and the mobility of all users. It also serves as a benchmark of consideration for safer and more sustainable roads. There are several possible forms for increased investments, including setting aside a certain percentage like 10% of the total funding for NMT infrastructure (Box 8). Of course, flexibility is required in such a policy so as to be applicable on a case by case basis.

Another option suggested by the World Bank’s Sub-Saharan Africa Transport Program is to create a ‘challenge fund,’ i.e. a separate source of money specifically set aside to finance NMT. The precise mechanisms will vary depending on the donor and government. What is common is the institutional recognition that making roads green, safe and accessible to all users will not add to the cost of the project, but rather improve the overall impact and incur massive long-term benefits, e.g. less congestion, reduced energy demand.

Worldwide, massive amounts of funding are put into developing transport infrastructure, in particular roads. The World Bank, for example, has approved USD 9.3 billion USD in new transport commitments in 2010. For the Asian Development Bank (ADB), transport has accounted for 21% of lending since the ADB’s establishment in 1966, and 27% during 2005–2009. For the 2010–2012 period, their projected transport lending is USD 3.4 billion per year. In the African regional context, the African Development Bank (AfDB) invested 40% of its infrastructure funds to transport in 2007 – more than USD 1 billion. In order to achieve the MDGs it has stated the need for a yearly investment of USD 22 billion in infrastructure, again 40% of which should go to transport. The amount of foreign direct investment in transport investment is also significant, ranging from nearly 30% in Africa to 17% in Asia (Figure 4).

**Figure 4: Transport infrastructure investment commitments by source (1996–2006)**



Source: UNCTAD, World Investment Report, 2008

Investments in NMT infrastructure will have differing impacts depending on the time frame. In the short to medium term, safe and continuous NMT facilities connected to other modes will save millions of lives and provide significantly improved mobility for the vast majority in cities, especially the urban poor. It will also prevent further congestion on city roads and degradation of air quality. These positive impacts are fully aligned with development goals such as the MDGs. In the medium to long term, continued public awareness can help promote a significant shift from motorised to non-motorised transportation by addressing behavioural issues. The environmental benefits will become more pronounced with lower demand for fossil fuels, significant reductions of GHG emissions and better utilisation of limited land in cities. Throughout, the regular maintenance of NMT infrastructure will be necessary.





### Box 8: Road Funding Agencies and the minimum 10% difference<sup>40</sup>

As the world's largest source of finance for development, the World Bank's commitment to promote global road safety is immensely important. The Bank is a multi-sectoral institution working in transport, public health, rural and urban development, and good governance; all areas of importance to road safety and sustainable urban transport. More than any other multilateral agency, it has the ability both to encourage senior policy makers in low and middle income countries to start to take early action to reduce the huge social and economic costs of road traffic injuries, while mobilising donors, both public and private, to support them. The Bank's powerful role in the transport and health sectors around the world is especially important. For example, at the end of 2005 the Bank's active transport portfolio amounted to US\$ 20.4 billion, of which nearly 80% was for roads and highway projects.

At present, other than the Asian Development Bank, neither the European Bank for Reconstruction & Development, the Inter-American Development Bank, nor the African Development Bank systematically includes a road safety component in their road sector investments. Given the significant road safety problems affecting some of the banks' partner countries, a strong and unified policy and finance signal is needed to redirect attention to making roads safer and more accessible to all users – including NMT. If the World Bank would take the lead in applying the 10% guideline and a common approach to road projects safety assessments, this could serve to generate significant multiplier effects for traffic injury prevention worldwide.

The combined road sector investments of the multilateral banks in 2005 amounted to over US\$4 billion. If 10% of this portfolio were applied to road safety this would amount to a total of US\$400 million. This catalytic investment would help to increase local technical capacity in low and middle income countries, and to ensure that road safety management becomes self-sustaining over the long term.

## Changing Directions – Road Infrastructure Investment Trends



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Recent research and campaigning has faulted this decline in investment, particularly in the road sector in low income countries - which accounts for 50% of the total infrastructure stock – for limiting progress toward the MDGs. The role of transport infrastructure, including roads, is now better understood in enabling growth through improved mobility of people and goods and access to markets and vital services. However, whereas a few years ago the private sector's share of infrastructure investment remained limited – particularly in Sub-Saharan Africa and in South Asia – recent developments in international forums signal a change in these trends following a general move away from support for transport infrastructure in international development efforts.

Investment choices in the roads sector, both at the national and international levels, provide visible markers of where priorities lie in terms of how shared road space is utilized and allocated. Worldwide, 210 billion Euros in economic stimulus funds have been allocated to road building.<sup>41</sup> A look at past road investment trends in developed countries show varied results for the inclusion of NMT facilities in road building finance. However, there seems to be a

growth of interest in increasing the inclusion of NMT infrastructure needs at the local level –as part of road refurbishment, urban planning and climate investments.

A resurgence in road financing as part of stimulus packages is mirrored by a renewed interest in financing for 'infrastructure' by bilateral and multilateral donor and lending agencies active in developing and transitional countries (List 1). The Commission for Global Road Safety asserts that "bilateral and multilateral donors must now ensure that progress towards the Millennium Development Goals is not undermined by an acceleration of road traffic fatalities and injuries, particularly for vulnerable road users such as pedestrians and cyclists."<sup>42</sup>



**List 1: Major road infrastructure development donors and institutions**

African Development Bank  
 Asian Development Bank  
 Agence Française de Développement  
 Caribbean Development Bank  
 Central American Bank for Economic Integration  
 Chinese Government  
 Corporacion Andina de Fomento  
 East African Development Bank  
 EU-Africa Infrastructure Trust Fund  
 European Bank for Reconstruction & Development  
 European Commission  
 European Investment Bank  
 Infrastructure Consortium for Africa  
 Inter-American Development Bank  
 International Fund for Agricultural Development  
 International Monetary Fund  
 International Road Federation  
 Islamic Development Bank  
 Japanese International Cooperation Agency  
 Nordic Development Fund  
 Nordic Investment Bank  
 OPEC Fund for International Development  
 West African Development Bank



The Gleneagles G8 Summit agreed to create the Infrastructure Consortium for Africa (ICA), based at the African Development Bank (AfDB), to help reinvigorate infrastructure investment in Africa. According to ICA, roads carry 80% to 90% of the region's passenger and freight transport and provide the only form of market and services access for most rural communities. Road transport costs can comprise as much as 77% of the value of African exports for some of the continent's poorest countries.

The ICA works on a Short Term Action Plan to improve investment in infrastructure in Africa. The Action Plan includes a Short-Term Programme for Roads at a total estimated cost of \$1.2-1.5 billion, providing a boost for road infrastructure investment on the continent. The ICA acknowledges that urban transport in Africa is often characterised by declining standards of public transport, high growth in the use of private vehicles, inadequate and deteriorating infrastructure, and poor facilities for pedestrians and cyclists. According to its data, the UN Economic Commission for Africa and the AfDB estimate that the total funding requirement for the completion of key missing transport links is around \$4.3bn.<sup>43</sup>

At the same time, New Partnership for Africa's Development (NEPAD) programme estimates the yearly economic cost to African countries accruing from road crashes in the range of 2% of GNP or \$6.2 billion. Yet as of 2006, the Short-Term Programme for Roads includes a road safety component estimated only at \$20 million to

address these mounting challenges. If, as an example, a minimum 10% guideline were applied to this programme, at least \$120 million would be allocated to road safety, inclusive of NMT infrastructure.

The situation in 2008 looked bleak. Only a third of the \$30 million Action Plan money had been provided and the donor and recipient country knowledge deficit hampered the targeting of investment toward NMT infrastructure. The ICA 2007 annual report calls for modern legislative and planning frameworks to encourage investment in broad terms, and goes on to say that infrastructure projects should be prioritised based on economic and social criteria, fully considering the plight of the urban poor. However, a firm commitment to either road safety prioritisation is lacking. Instead, "African governments and ICA members should consider adopting the recommendation [...] to allocate minimum 10% of road construction budgets to safety".<sup>44</sup> In its User Guide to Project Preparation, the ICA identified environmental impact considerations in the feasibility assessment stage of infrastructure investment projects, but lacks any further guidance on this aspect, while at the same time neglecting road safety considerations in the social, economic and financial modelling studies of the same stage.<sup>45</sup>

**Advocating for NMT investment policies such as a minimum 10% of road investments is a way to bring about a new paradigm where the safe and sustainable mobility of all users, including pedestrians and cyclists, is considered the ultimate aim of roads as a matter of course.**



However, there is an ongoing effort to increase the share of road safety investment in transport projects, translating into a higher percentage allocated to safety in recent years. Table 2 shows the proportion of the cost being allocated to road infrastructure safety improvements in a sample of World Bank financed transport projects. This excludes the allocation to capacity building, education, and enforcement and safety awareness campaigns. The option of a minimum 10% policy is not currently adopted by the World Bank, but the figure is increasing and in some recent projects, more than 10% of the project cost is allocated to road infrastructure safety improvements. The sheer range of these figures illustrates the variation in the priority afforded to safety, although to a lesser extent it may also be indicative of a lack of consistency in defining what constitutes "safe infrastructure."



Of particular note is the Bangladesh Clean Air and Sustainable Environment project for Dhaka with the twin objectives of improving air quality and safe mobility. 52% of the total project cost is dedicated to road infrastructure safety improvement. The transport component will support capacity building through technical assistance, with a particular focus on providing safer walking facilities and public transport. Also significantly, it aims to “mainstream environmental considerations into urban transport related decision making”.<sup>46</sup>

According to the Delhi-based Centre for Science and Environment (CSE), road safety audits are carried out for World Bank funded highway projects, but are neglected when building urban roads. The CSE argues that the World Bank’s policy of requiring road safety audits on highways should be applied at the national level for all types of urban roads.

**Table 2: World Bank Figures on % Finance for Road Infrastructure Safety Improvements as Part of Road Investment Projects**

Project (Approval Year)	% Finance Allocated for Infrastructure Safety	Total Project Cost
China-Wuhan Second Urban Transport Project (2009)	4	USD 608 million
China-Liaoning Medium Cities Infrastructure Project (2006)	4	USD 524 million
China-Anhui Medium Cities Urban Transport Project (2009)	9	USD 304 million
Peru- Safe and Sustainable Transport Project (expected in 2010)	6	USD 1080
Vietnam Road Safety Project (2005)	11	USD 32 million
Argentina- Road Safety Project ( expected in 2010)	25	USD 54 million
Bangladesh- Clean Air and Sustainable Environment Project (2009)	52	USD 71

Source: World Bank, Global Road Safety Facility



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Another positive development is the joint statement issued by 7 multilateral development banks (MDBs) at the First Global Ministerial Conference on Road Safety, held in Moscow in 2009. The African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, European Investment Bank, Inter-American Development Bank, Islamic Development Bank and World Bank outlined a broad package of measures each would implement to reduce the anticipated number of fatalities and injuries in developing countries. This joint statement calls for a ‘shared approach’ in which it is necessary to “develop specific approaches to address the safety requirements of vulnerable road users (pedestrians, cyclists and motorcyclists), including a special focus on urban areas where a high proportion of trauma occurs.”<sup>47</sup>

From the angle of investments for mitigating and adapting to climate change, there is also better recognition of the role of transport, modal shift and NMT infrastructure. Various stakeholders are advocating for a stronger utilisation of the GHG mitigation potential of the transport sector in the post-2012 (post-Kyoto Protocol) agreement on climate change. The demand from countries to include transport is exemplified by the submissions made thus far to the Secretariat of the UN Framework Convention on Climate Change (UNFCCC) of Nationally Appropriate Mitigation Actions (NAMAs) under the Copenhagen Accord, which shows 28 out of 43 submissions by September 2010 have a component on transport.<sup>48</sup> The Clean Technology Fund (CTF) of the Climate Investment Fund – governed by a multi-stakeholder structure including MDBs, UN agencies, development agencies, national governments, NGOs and private sector – is another example. The CTF focuses in three areas, one of which is the transport sector, with a focus on efficiency and modal shifts.

The Asian Development Bank (ADB) is an example of the initiatives being taken by a regional development bank in both road safety and climate change issues (Box 9). The ADB has accorded greater priority to road safety since 1999, including explicit safety initiatives in 50 projects in the last decade, in comparison with only 30 in the previous three decades.<sup>49</sup> Road deaths cost the Asia-Pacific region USD 80 billion, or 2% of GDP annually, a clear indicator of the sheer scale of the problem. Trends suggest that 25% of national health budgets will need to be allocated to road accident victims by 2020. The ADB has





produced a technical note on the routine incorporation of safety into transport and urban planning and maintains a dedicated road safety and sustainable transport website.<sup>50</sup> This promotes capacity building and provides technical assistance and policy guidance, including resources on travel demand management and road user charging, vital to 'lock in' the benefits of new capacity and provide additional revenue funding for NMT infrastructure and ongoing education campaigns.



#### Box 9: ADB Evaluation Study on Reducing Carbon Emissions from Transport Projects

The ADB's Independent Evaluation Department completed a study in 2010 that looks into how to reduce the carbon footprint of the bank's transport portfolio which amounted to 792 million tons for projects approved between 2000 and 2009. It is the first effort by an MDB to measure how much their transport projects reduce or contribute to climate change and presents tools to better quantify and consider the costs and benefits of investments. Expressway projects, three-fourths of investments, were found to increase CO<sub>2</sub> emissions due to induced travel. Also, integrated investments that look at both climate change and air quality yielded greater co-benefits. In light of the findings, one of the key recommendations is to encourage modal shift in investments to reduce emissions.<sup>51</sup>

From the national governments' side, there is a wide array of proactive NMT investments and commitments outside of Europe, especially from the Asia and Latin America regions. Hangzhou and Mexico City are examples of cities which have established public bicycle renting schemes and Amman and Buenos Aires are examples of cities which have significantly invested in NMT infrastructure. Such policies are increasingly linked with investments in bus rapid transit (BRT) systems, e.g. in Delhi, Guangzhou, Jakarta and Dar es Salaam, placing NMT infrastructure as important feeder networks for BRT ridership. In North America as well, the historically car-dependent model is noticeably shifting to a multi-modal approach as exemplified by ambitious programmes by metropolises such as New York and Toronto. At the sub-regional level, there have been concrete agreements made in Africa through the Better Air Quality (BAQ) workshops under the Global Atmospheric Pollution Forum (GAP Forum) that include clauses on increasing investments in NMT infrastructure (Box 10).



#### Box 10: African Sub-Regional Agreements on NMT Investments

Government ministers at the 4 Sub-Regional Workshops on Better Air Quality in Africa (Southern, East, West and Central, and North) in 2008 and 2009 each produced framework agreements recognising the huge environmental, social and economic costs associated with air pollution, including the issue of transport infrastructure and urban planning. The need to raise investments in NMT infrastructure is outlined as a key component to an integrated approach in transport for the continent.

As an example, the following is the agreed article in the Eastern Africa Regional Framework Agreement on Air Pollution, endorsing the idea of a 10% investment policy:

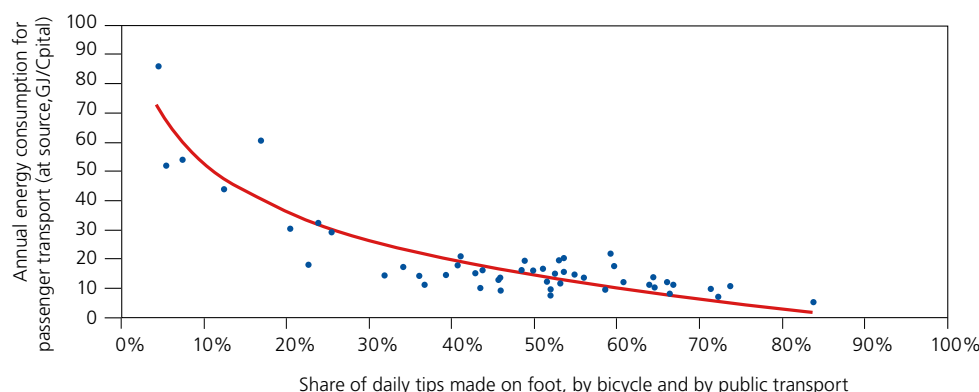
"Encourage the use of non motorized transport systems that have many advantages and are used by an overwhelming majority, but are constantly overlooked. At a minimum 10% of infrastructure costs should be dedicated to this majority and the focus should be on safety. Particular emphasis should be given to high-demand, mixed-use roads in urban and peri-urban areas."<sup>52</sup>

## Investment Costs and Benefits of NMT Infrastructure

Low-carbon and environmentally friendly mobility options, such as cycling and walking are highly energy efficient. According to the IEA, along with land-use planning, improving NMT infrastructure and accessibility through integrated urban transport systems can help to create cities and towns that are conducive to walking and cycling, and in the process significantly cut motorized vehicle travel and associated emissions.<sup>53</sup> Cities with high shares of NMT and public transport usage tend to have much lower transport energy use per capita than cities that are more car-dependent (Figure 5).



Figure 5: Energy Consumption for passenger transport versus modal share



Note: Points represent cities in the SYSTRA data base from around the world.

Source: IEA, Energy Technology Perspectives, 2008

The provision of NMT infrastructure such as cycling paths and cycling lanes, bike parking, specific traffic signals, and adequate walking lanes, coupled with NMT-friendly policies and the development of a safe road culture, would serve to increase NMT usage while also lowering road casualties. Table 3 illustrates the possibilities by providing a comparison of government spending on developing and maintaining cycling infrastructure with associated cycling mode

shares. However, it should be noted that such investment requires time to mature. Dedicated investment of around USD 5 to USD 10 per capita could realistically yield a modal share of 5 - 10%.<sup>54</sup> With a long enough investment horizon, net NMT infrastructure costs may even be negative. A city with more cycling and walking and less road space for motorists would be cheaper to build and maintain than one dominated by personal cars. According to the IEA's assessment, "the provision of walking and cycling infrastructure is amongst the least expensive elements in changing land use and transport patterns."<sup>55</sup>

Table 3: Correlation between cycling infrastructure funding and cycling overall mode share

	Annual Funding (USD per resident)	Cycling Mode share
USA	1.5	1%
Portland (City in Western US)	3.5	4%
Berlin	6	10%
Copenhagen	13	20%
Amsterdam	39	35%

Source: IEA, Transport, Energy and CO<sub>2</sub>, 2009

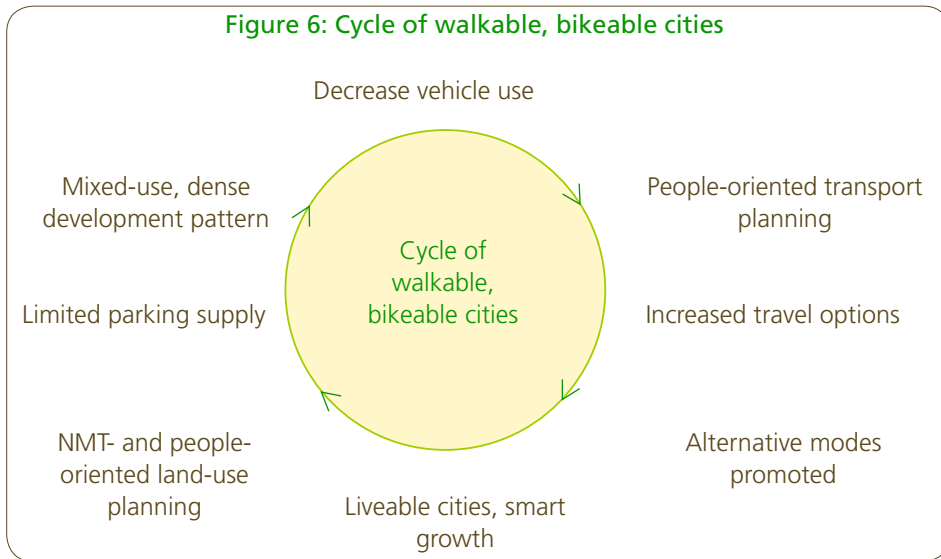
Sustainable roads are cost-efficient. Cost-benefit analyses (CBAs) of walking and cycling track networks in Norwegian cities, taking account health benefits, reduced air-pollution and noise from road traffic, and reduced parking costs that results when travel shifts from automobile to cycling and walking, estimated that benefits are at least 4-5 times greater than costs.<sup>56</sup> Another study found that, compared to the cost of building a metro (or subway) system, the efficiency of building sidewalks and cycling paths was 12 to 14 times higher.<sup>57</sup> A further comparison of investments showed that instead of building a single highway flyover at a cost of USD 10 million, this same amount could provide 150,000 good quality bicycles, or if the price is cut in half, 300,000 bicycles. This could also provide 100,000 modernised cycle rickshaws, creating 100,000 jobs in a non-motorised passenger transport service.<sup>58</sup>

While more data needs to be collected to further quantify and qualify the many co-benefits of investments in NMT infrastructure, the staggering loss of human life and health due to poor road safety is impetus enough to develop strong investment policies that will better the lives of millions around the world. For example, the top two countermeasures for improving safety in Nairobi recommended by the International Road Assessment Programme (iRAP) are pedestrian crossings and sidewalks, which have a benefit cost ratio of 32 and 51 respectively. Also, the many benefits of a walkable and bikeable city are vast and can be propelled by investments in NMT infrastructure (Figure 6).

Furthermore, the merits of such investments are recognised in the Green Economy Initiative led by UNEP, which supports governments in moving towards an economy that increases wealth, provides employment, tackles inequities and poverty, as well as reduces ecological scarcities and climate risks (Box 11).



Figure 6: Cycle of walkable, bikeable cities



**Box 11: Non-Motorised Transport in a Green Economy**



Non-motorised transport (NMT) is the most clean, efficient and healthy way to travel for the individual and the environment. Cities with higher percentages of NMT trips have lower per capita energy use, which translates into less dependence on fossil fuels (a huge burden on the developing countries that import oil), less pressure on other scarce resources such as land, and less emissions of air pollutants and greenhouse gases (GHG).

Share the Road is recognised under the UNEP Green Economy Initiative as an important campaign to direct investments towards green transport. Advocating increased investments in NMT infrastructure is a key component to assisting governments in taking a low-carbon mobility path. Improving the transport sector through the recommended avoid-shift-clean strategy is essential to achieving sustainable economic development and poverty reduction, given current limitations and risks in our natural resources, ecosystem capacities and climate.

**Share the Road Key Recommendation #4**

Collaborate across a wide range of sectors and countries to make investments in NMT infrastructure a matter of policy in donor agencies and government budgets: The argument is clear, increased investments in NMT infrastructure are necessary for multiple, urgent reasons. Partners must work together to promote this low-cost, high-benefit component to sustainable mobility and institutionalise systematic financing of NMT.







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# 3

## The Road Ahead

In charting forth on a sustainable mobility path, many steps will need to be taken. In addition to increased investments in NMT road infrastructure, a variety of coordinated and sustained efforts are called for at all levels of decision-making, implementation and public involvement.





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Share the Road strongly recommends that, in conjunction with capacity building, an international benchmark must be established in the form of a systematic investment policy for NMT infrastructure in every road building or improvement project. Insufficient funding and capacity for road safety that is inclusive of vulnerable users and NMT modes has been identified by the Commission for Global Road Safety, GTZ<sup>59</sup> and others to be one of the major reasons for poor safety records and low or decreasing modal shares of NMT, especially in the developing world. NMT needs to be strongly promoted through infrastructure investments in order to dampen the rate of motorisation making the transport sector the fastest growing source of CO<sub>2</sub> emissions.

International donor institutions, both multilateral and bilateral, are charged with the task of making loans that balance the twin objectives of ensuring a financial return and helping to achieve sustainable development and the MDGs to eradicate poverty. A successful road should be redefined in terms of infrastructure that creates a multi-modal, safe, environmentally friendly, low-carbon and accessible transport system for all users. After all, sustainable roads are cost-effective and resource-efficient.

Both investments for improving existing roads and for new roads should allocate resources specifically for NMT infrastructure. A pledge of minimum 10% funding, for example, by both international donor institutions and national government bodies for sustainable roads will send a strong message of commitment needed on the part of both funders and funding recipients. It is a critical step towards bringing about a new paradigm where the safe and sustainable mobility of all users, including pedestrians and cyclists, is considered the ultimate aim of roads as a matter of course.

In addition to the 10 key recommendations stated throughout the report, below are more specific recommendations organised into categories of stakeholders. Some overlaps exist, further emphasizing the need to work across various sectors and groups when it comes to addressing the issues involved (Box 12).

### Box 12: Share the Road's first pilot city: Nairobi, Kenya



Nairobi, Kenya was selected as the first pilot city for the Share the Road campaign. Many of the common problems in today's cities such as heavy congestion, rapid population growth and motorisation, lack of long-term urban planning, poor air quality and growing inequity can be found in Nairobi. A case study of NMT in Nairobi was conducted in 2009<sup>60</sup> and cooperation is being developed with multilateral development banks, bilateral development agencies and government agencies on policies and projects to improve safety, the environment and accessibility for all users.

## International Donors (Bilateral and Multilateral)

- Develop and adopt investment policies that systematically allocate funding for NMT infrastructure in roads and transport infrastructure projects.
- Liaise among international and regional funders to ensure broad harmonisation of basic safety, emissions and design data, and associated funding criteria, helping to maintain a 'common market' for development finance (Box 13).
- Integrate aspects of safety, environment, climate change and accessibility throughout the process of developing, approving, implementing, monitoring and evaluating a project for roads and transport infrastructure.





### Box 13: UN Decade of Action for Road Safety, 2011-2020

In November 2009, for the first time, heads of state gathered to discuss road safety at the UN Global Ministerial Conference on Road Safety in Moscow. In March 2010, the UN General Assembly approved a Decade of Action for Road Safety between 2011 and 2020. Both have been achieved with the instrumental work of the FIA Foundation's Make Roads Safe campaign.

This UN Decade provides an unprecedented opportunity to catalyse efforts worldwide in a coordinated manner. International donors, national agencies and other civil society members will work together in countries worst affected, with the goal of saving 5 million lives and preventing 50 million serious injuries by 2020.

The UN Resolution is also a significant step forward in its formal recognition of the connections between road safety and the MDGs: it describes the toll of road crashes as "a major public health problem ... which, if unaddressed, may affect the sustainable development of countries and hinder progress towards the Millennium Development Goals."

## Governments (National and Local/City)

- Take leadership in policies on the allocation of budgets and management of projects in roads and transport infrastructure that highlight low-cost, high-benefit investments in NMT infrastructure.
- Identify a clear leading agency to lead policy development and a reform process, where necessary, to include, inter alia, making a coherent legal framework, including NMT in road design manuals and codes, and institutionalising the monitoring and regular maintenance of NMT infrastructure.
- Establish internal capacity in all relevant government bodies so that the concepts of external costs, sustainable mobility networks and safe systems for all users are incorporated into decision-making procedures.
- Overcome the paucity of statistical data and rectify the problem of underreporting through dedicated departments collecting information with respect to, inter alia, safety, air quality, vehicle emissions and modal shares.

"I walk to work every day, rather than take the presidential limousine. It's better for the environment and I can stop and chat to people on the way."

Mohamed Nasheed,  
President of the Maldives<sup>61</sup>

## Private Sector

- Support research, programmes, and policies that recognise the importance of NMT infrastructure and its benefits for road safety, decongestion, low-carbon transport and sustainable development.
- Share best practice in research on methodologies for the measurement and calculation of costs and benefits that internalise currently excluded costs such as accidents and CO<sub>2</sub> emissions.
- Build a network of local and national stakeholders who can positively influence government and donor policy.

### Share the Road Key Recommendation #5

Promote further education and training for engineers, designers, planners and funding proposal writers to raise their capacity to design and finance safe, intermodal transport systems: Achieving sustainable transport will be a challenging journey that requires a new way of planning, financing and implementing, especially in cities with rapid urbanisation and motorisation. Effective exchange and cooperation across national and sectoral boundaries are needed to cultivate such expertise.

## Civil Society (Including Professional Associations)

- Foster awareness and capacity at national and regional levels by providing assistance for project developers, transportation planners, engineers and economists.
- Promote awareness among the general public on NMT through communication strategies and coordination with relevant government bodies.
- Build a network of local and national stakeholders who can positively influence government and donor policy.



## UN Agencies

- Support other stakeholders, in particular national governments, in taking a sustainable mobility path by providing policy guidance and technical and financial assistance.
- Coordinate among UN Agencies working in the areas of road safety, green economy and transport (e.g. UNEP, UNDP, WHO) to ensure a coherent and integrated package of assistance.
- Inspire action towards sustainable development and poverty reduction, including achieving the MDGs, by acting as a catalyst and helping to connect partners around the world.

“Every city can improve their quality of life in less than three years. No matter the scale of the city, no matter the financial conditions.”

Jaime Lerner, Architect and former Mayor of Curitiba, Brazil<sup>62</sup>



### Box 14: Curitiba and Jamie Lerner’s Creative Leadership as Mayor<sup>63</sup>

“Lerner thought that people would love a pedestrian mall if they had a chance to see it. He planned carefully with the department of public works and on a weekend in the winter of 1971, they started on Friday evening to build the pedestrian walk. An army of strange-looking silhouettes surrounded access to the main street downtown. They jackhammered the pavement, put down cobblestones, erected streetlights and kiosks, and planted thousands of flowers. They completed this on Sunday and expected a major opposition from store owners on Monday. Instead of resistance, the storeowners who had been threatening legal action were petitioning the mayor to extend the mall.”

### Share the Road Key Recommendation #6

Have creativity and courage in charting a sustainable mobility path: When faced with particular challenges, a healthy dose of thinking outside the box is necessary (Box 14). Cities that are now leading examples had to overcome their own difficulties; their champions continue to promote safe, clean, more equitable transport.







## Annex 1

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# Design Principles to Protect and Integrate all Users

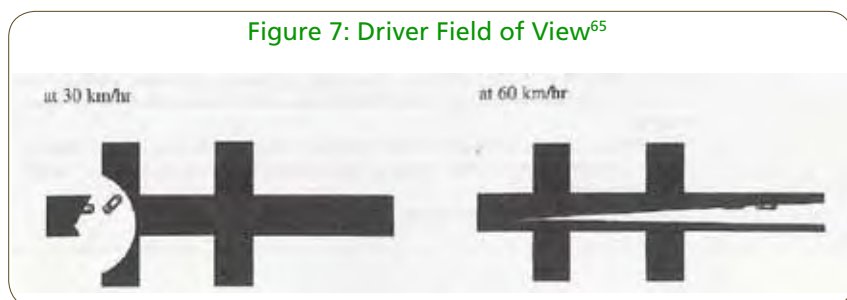
Safe road infrastructure that is designed and built for all users enables sustainable mobility. A combination of protection and integration is key – separation between different modes of transport to protect the more vulnerable from impacts of high speeds and integration of all transport modes into a cohesive system. By accommodating NMT as a transport mode in its own right cities can better provide multiple options which optimize travel time, reduce the environmental footprint and improve accessibility.



## Protection of vulnerable users from high speed impact

The terms vulnerable road users and NMT users are often used interchangeably because NMT users are particularly vulnerable to the impacts of fast-moving vehicles (Box 15). For one, pedestrians and cyclists, who travel alongside car lanes, are hidden from the driver's field of view at higher speeds (Figure 7). Moreover, the International Road Assessment Programme (iRAP) studies show that the human body cannot survive an uncushioned impact above 40 kilometres per hour (kph). Another study by the European Transport and Safety Council gives the following values: a pedestrian hit at a speed of 30 kph has a 5% chance of being killed, at 50 kph this is 45%, and at 65 kph 85% will be killed. In general, 30 kph is seen as the threshold speed for critical injury and death and many western European towns and cities have or are considering the adoption of speed limit of 30 kph in certain zones, for the direct safety benefits and the traffic calming effect that encourages greater walking and cycling. For example, crashes have fallen by 56% and fatal and serious accidents by 90% in the British city of Hull since 32 kmph limits were widely implemented and 32kmph zones in London have reduced casualties by 45% and fatal and serious casualties by 57%.<sup>64</sup> (In all cases the previous limit was 48 kph or 64 kph for certain distributor roads.)

Figure 7: Driver Field of View<sup>65</sup>



### Box 15: Vulnerable road users



All road users are vulnerable to some extent to road crashes and health complications from roadside emissions, but some users are more at risk than others. Pedestrians and cyclists lack the protective shell of the automobile and are more exposed to the risks of high-speed impact: death or severe injuries. In road safety terms, exposure is usually taken to refer to the amount of travel undertaken, defined as the number of trips, the distance travelled, or time in the road environment. The urban poor are particularly at risk due to greater exposure as a function of transport modes used, place of residence, and the inability to afford alternatives and treatment for injuries. Congestion, a lack of adequate and affordable public transport and increased urban sprawl mean that their journeys are getting longer, more expensive, and more dangerous.

The inherent comparative disadvantage of vulnerable users in a potential collision is exacerbated by the general lack of safe road infrastructure. As traffic becomes more intense and vehicles continue to dominate roads, in particular in cities, the lack of separate and sheltered road space for vulnerable users means that slow moving and non motorized modes are more exposed to fast moving vehicles. The absence of footpaths and cycle tracks, or traffic calming measures to reduce speed where pedestrians and cyclists mix with motorised traffic, increases the risk of a crash occurring and its severity. Modern road systems designed largely for the motor vehicle leads to greater conflict and risk for all road users, including drivers.

Speed management of motor vehicles is not only necessary for road safety but also contributes to the environmental footprint of road transport. Road features for speed management encourage “a driving pattern that reduces vehicle emissions and fuel consumption... [which] has implications for traffic planning where regard should be taken to traffic safety as well as environmental concerns.”<sup>66</sup> That is, speed management can help to achieve multiple objectives, including road safety targets and CO<sub>2</sub> reductions through eco-driving.

While speed management (e.g. speed humps, enforcement of speed limits) is necessary to reduce all types of road crashes, serious bodily injury is also possible at lower speeds. Essentially, there are three possibilities that can be used in combination: (1) where separation is undesirable or unfeasible, speed reduction by physical measures is necessary whenever different traffic modes share the same infrastructure, (2) where speeds and/or volumes of motorized traffic cannot or should not be reduced, separation of transport modes by means of paths, underpasses and overpasses should be applied, and (3) where traffic modes inevitably meet each other, use simplifying manoeuvres including speed reduction to make it easier to deal with conditions and reduce the severity of conflicts and collisions.<sup>67</sup>



Lack of safety and security concerns of NMT road users (both current and potential NMT users) are key barriers to increased usage of NMT modes by road users. Investments in NMT infrastructure help preserve the existing modal share of NMT. Additionally, when road design reallocates the total space available for roads more proportionately between motorists and non-motorists, a proportion of road users may be encouraged to shift from using vehicles to walking or cycling, especially for shorter trips. A modal shift in favour of NMT tends to result in less congestion, smoother traffic flow, and therefore, better accessibility for all.

### Share the Road Key Recommendation #7

Design roads so that vulnerable road users such as pedestrians and cyclists are protected from high speed impact: NMT facilities that protect users from high speed impact can drastically cut the number of serious injuries and fatalities. Giving NMT users their own space makes these modes of travel more enjoyable and attractive, while also improving traffic flow for motorists.

## Integration of NMT into the larger transport network



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In addition to safety and security concerns, travel time and convenience are key factors that concern current and potential NMT users. In order to minimise travel time and maximise convenience, as well as design the most sustainable roads, the integration of the NMT infrastructure into the larger transport network must be a key consideration. There are four practical and inter-related reasons.

**First**, inter-modality is essential because most non-motorized trips are short distance. Walking is the most common mode of transport worldwide for distances less than 3km. In general, cycling is the most energy efficient way for a person to travel a relatively short distance, e.g. 0.5 to 5km at speeds of 10 to 30kph. For example, a study conducted in developed countries showed that most walking trips are less than 1.5km and most cycling trips are less than 8km, although recreational trips are often much longer.<sup>68</sup> The distances travelled tend to be significantly longer in urban centres of developing countries (not to mention rural areas where destinations are even farther apart) where people have less choice in which mode to take given their limited income and the limited provision of public transport. However, non-motorized travel, and

walking in particular, is often used to access motorized transport as part of a longer multi-modal journey. This means that NMT infrastructure needs to connect to other transport modes, most notably public transport. For effective inter-modality, models such as 'New Mobility hubs' are needed to provide a safe and seamless door to door trip combining the right modes for the purpose.

**Second**, it is imperative that safe and sustainable road infrastructure is designed with present and potential users in mind. For example, the Centre for Science and Environment estimates that public transport users are also pedestrians at least four times a day based on their research in Delhi. The provision of NMT facilities, especially pedestrian sidewalks, facilitate safer and better usage of public transport and vice versa. Bus rapid transit (BRT) plans in many cities, including Delhi and Dar es Salaam, Tanzania, have recognised the benefits from links to NMT infrastructure as feeder networks. Roads should be planned with more holding areas (so as to prevent pedestrian overflow onto motor vehicle lanes) with bicycle parking facilities and "the pedestrian infrastructure should be planned to cater to the present and future demand for walking that will be generated from the higher usage of public transport."<sup>69</sup> Accessibility must be assured for all users, upholding the principle of universal design. This means the roads leading to terminals and bus stops should be equipped with ramps and sloping inclines for vulnerable users of the system (cyclists, disabled, parents of young children, travellers with baggage, etc.).

**Third**, the co-benefits of designing safety features such as bicycle facilities, shoulder sealing and pedestrian crossings can be maximised by integrating NMT into a multi-pronged approach to sustainable transport systems. In most cities, health discomforts and ailments due to heavy air pollution plague NMT users, fuelling the prejudice that only those who cannot afford to travel in better conditions walk or cycle. Where NMT facilities with good ambient air quality exist, not only will the health of current users be protected but also more travel by NMT will occur due to better conditions. In order to have such NMT facilities, however, measures to clean up the fuels, as well as the vehicles themselves, are necessary. It is important to remember that a sustainable urban transport system will depend on a multi-pronged approach of promoting the shift to low-



carbon transport modes (e.g. NMT, electric vehicles) and the development of cleaner, more fuel-efficient cars. An improved environment will increase the number of NMT users and when a critical mass of NMT users is reached, accident and pollution levels further decrease. The integration of NMT into a wider sustainable transport plan also raises the status of walking and cycling and increases social acceptance of NMT as a viable mode of travel.

**Fourth**, designing sustainable cities means designing the kind of safe and sustainable road infrastructure that promotes all three aspects of safety, environment and accessibility. The underlying goal of all road design is to make roads safe and attractive and to balance the competing interests of all road users. When appropriate planning and funds are invested in attractive infrastructure for pedestrians and cyclists, policy-makers demonstrate their commitment to creating liveable and sustainable cities. Most, if not all, leading concepts and paradigms in sustainable city design and sustainable transport systems (e.g. smart growth, car free development, complete streets, and transit oriented development) highlight the role of promoting NMT. Key questions faced include those like 'what will happen in the future as cheap motoring becomes available to a greater proportion of the population' and 'what would be the economic impact of peak oil on a transport system based on cheap oil imports.' The implications mean urban planning and transport planning aim to optimise land use and existing infrastructure to create higher-density, mixed-use neighbourhoods and cities. Such a vision means less motorised mobility and more journeys on foot or bike.

### Share the Road Key Recommendation #8

**Integrate NMT networks with other modes, especially public transport, in order to maximise usage and impact: Walking and cycling are best suited for shorter distances, 3 km to 15 km respectively. Connecting sidewalks and cycling paths to bus stations and other motorised transport expands the possible range of resource-efficient travel and also increase ridership of public transport.**

## Forgiving Roads for All Users

Intuitive road design essentially means that the architecture of a road is used to send a signal to road users on how they should behave. Specific intuitive design principles are provided in more detail below. Ideally, a transport system should be easy to understand, and safe and simple to use.

Forgiving roads are roads that take the safety systems approach. Since the 1970s, high-income countries have made progress in road safety by moving away from 'blaming the victim.' The paradigm shift towards the safety systems approach supports the thinking that the road user, the vehicle, and the road infrastructure form a dynamic system. Rather than focusing on behaviour alone, it recognises good road and vehicle design and traffic management as integral elements in road safety planning, complementing actions to reduce hazardous behaviour. This does not mean diminished responsibility for the road user to obey the law and avoid risky behaviour. The key idea is that a driver who respects the law should be protected as far as possible from severe injury should a crash occur. "Crucially, the safety systems approach acknowledges that a degree of road user error is inevitable and should be 'tolerated' by making the system as a whole more 'forgiving'." <sup>70</sup>

Although pedestrians and cyclists sometimes share the same space, from a design perspective it is important to consider their similarities and differences.

The similarities include:

1. Both pedestrian and cyclists tend to be slower than motor vehicle traffic, except in few occasions of traffic congestion, whereas cyclists have predominantly vehicular characteristics that need to be catered for in the infrastructural design such as 'braking distance and a turning radius dependent on the speed.
2. Both travel near the edge of the road in conflict with other demands such as drainage, driveways, utility poles, and signs, and
3. Both are vulnerable to traffic speeds, traffic volumes and weather.

The differences include:

1. Pedestrians are generally slower than cyclists, can change directions quickly, and frequently stop,
2. Where convenient, cyclists can ride on the roadway and follow vehicle traffic rules and thus move even faster, and
3. Pedestrians can cross the road anywhere where they feel safe to do so while cyclists cannot because once they ride on the road they are expected to follow similar rules as vehicular traffic.



Also, it is important to acknowledge the fact that people use a variety of modes depending on such factors as the reason for the journey. For example, a person can walk to take the bus to work but use their car on weekends for shopping and leisure travel. Taking these factors into account when designing sustainable roads helps to prevent the under-estimation of demand for NMT infrastructure.

As discussed, there are several key considerations in the design of NMT infrastructure that is common to pedestrians and cyclists. For instance, the continuity of sidewalks and cycling lanes so that an actual network is created is key in making NMT a viable mobility option for users. Cycling networks connected with public transport stations, all with pedestrian access will yield the most significant shift from motorised to non-motorised transport and thus the most benefit in terms of environment and decongestion. Below are some additional considerations, specific to the mode, as a general suggestion of the minimum considerations necessary – more detailed information are to be found in the relevant design manuals and codes.

### Design considerations for pedestrians

Sidewalks (alternatively called ‘footways’) and crossings should be a requirement on all roads except some sections of highways where there is no pedestrian traffic. The space for sidewalks can be obtained by reducing the number and/or width of carriageway lanes, serving as a traffic calming instrument. Footway width should be appropriate for expected demand – the table below presents some guidelines.

**Table 4: Example of guidelines for sidewalks**

Capacity in persons in one hour		Required width of footpath in meters
All in one direction	In both directions	
1220	800	1.5
2400	1600	2.0
3600	2400	2.5
4800	3200	3.0
6000	4000	4.0

Source: CSE, Footfalls: Obstacle Course to Livable Cities, 2009

The opportunity could be taken to fill wider spaces with public art, cafe seating and other non-essential facilities that make walking a pleasant experience: the ‘design’ element in Cervero’s “3 Ds” – density, diversity, and design.<sup>71</sup> Higher residential densities provide the market for more economically viable high frequency public transport and local services such as shops and educational facilities. Diversity refers to a mixture of land uses rather than single use zoning of residential areas, retail parks, business quarters and so on. Neighbourhoods with a mixture of homes, jobs and services reduce trip distances and increase walkability, reducing the need to use the private car.

Crosswalks should be located at regular intervals and close to popular trip destinations and origins along urban arterials. A minimum standard is a pedestrian refuge island in the middle of the carriageway, but pedestrian-activated traffic signals and ‘zebra crossings’ are preferable, provided they are clearly visible and accompanied by traffic calming measures. All three make it obvious to the pedestrian where they should cross a road. The latter should allow young children, the elderly and disabled to cross the road (preferably all lanes) comfortably on the green phase: ‘smart crossings’ can be programmed to prolong the pedestrian green phase for as long as is necessary. A general rule-of-thumb is that nobody should have to run if they begin crossing on a green signal. These facilities send the message that NMT users are important and their time is valued as highly as that of motorists, and may serve as effective traffic calming instruments in their own right. Subways and footbridges are expensive to build and maintain, extend travel times and require more physical effort. Pedestrians will continue to risk their lives crossing roads where no such provision has been made at ground-level even if a subway or footbridge exists unless the latter options are more economical in terms of time and convenience.

In London, the rephasing of the traffic signals to allow greater pedestrian crossing time contributed to a 35% reduction in pedestrian road deaths and serious injuries.<sup>72</sup>

Concrete is the preferred **sidewalk surface**, providing the longest service life and requiring the least amount of maintenance. Asphalt is also an acceptable walkway surface, especially in rural areas and in park settings.



**Kerb ramps** provide access between the sidewalk and roadway for people using wheelchairs, strollers, walkers, crutches and also for pedestrians with mobility impairments. They should be provided at bus stops for new and retrofitted roads and at all intersection crossings and pedestrian refuge islands for ease of access by wheelchairs, strollers, the elderly and those with any form of physical impairment.

Inadequate **street lighting** is one of the reasons pedestrians and cyclists refrain from moving after dark in many urban areas in developing countries. Good street lighting improves the visibility, comfort, and security of all users – motorists and NMT users. It is important to light at least the intersections and other pedestrian crossing areas. Lighting is also recommended in areas where there is a high concentration of night-time pedestrian activity, such as shops, downtown areas, and public transport pickup/drop points, places of worship, schools, and community centres.

Other design considerations include erection of concrete bollards or trees to limit encroachment by motor vehicles, and the placement of drainage grates and manhole covers outside the travel paths of pedestrians and cyclists.

### Design considerations for cyclists<sup>73</sup>



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Cycling friendly infrastructure should meet 5 internationally agreed main requirements: safety, directness, coherence, comfort and attractiveness. These requirements can be met by good design at two levels: the design at the level of the network (make sure that good cyclable routes are available between all relevant origins and destinations), and the design at the level of the facility (i.e. cycling friendly road sections and intersections). The key challenge in designing cycling-friendly infrastructure is negotiating the different traffic flows at intersections.

**On-road cycling** lanes separated from motorised traffic offer cyclists protection from physical contact with motorised transport. The volumes of flow and the speed of motorised traffic will determine the need for and extent of separation – whether physical (bollards or raised kerbs) or only visual with painted markings). Where lack of enforcement and education exists, visual measures alone are insufficient, as this can be worse than no separation at all, in terms of the distances that drivers allow between their vehicle and cyclists. Bicycle users may still feel intimidated by the proximity of passing traffic if the on-road model is adopted.

**Separated cycling paths** (also called cycling tracks) are preferable in most of the heavily congested cities in Africa and Asia where there is lack of enforcement to regulate the usage of road space. These paths should be of sufficient width to allow cyclists to overtake, typically 3 meters.

It is important to provide safe and secure **bicycle parking** facilities where the journey ends and where cyclists can leave their bicycles to connect to another mode of transport. Many would-be cyclists are put off cycling by this deficiency. Ideally bicycle storage should offer secure steel hoops to which bicycles may be locked, preferably covered and in areas with good surveillance.

Designers should ensure that cyclists are **visible** to other road users, especially at places (such as junctions) where there is potential conflict amongst road users. Cyclists use muscle strength, hence the design should aim to reduce energy loss by minimizing steep ascents and designing direct routes as much as possible without compromising safety.

Cyclists themselves may pose a threat to pedestrians on shared paths: this highlights the importance of education for all road users. It may be necessary to provide 'traffic calming' measures such as chicanes on sections with particularly heavy pedestrian flows or blind corners (where these cannot be designed out).

Also, especially from the perspective of the existing high demand for and employment in rickshaws and pedicabs in the developing world, the width of cycling lanes and paths should preferably be wide enough to fit these forms of NMT as well.



## Design principles for users of motor vehicles

A proper network design with due differentiation according to mode of transport can make a big difference. For the user of motorised transport, it is essential to have clear signage advising motorists of speed restrictions, of the presence of vulnerable road users (e.g. outside schools, hospitals and rest homes), and of the location of popular destinations and parking facilities. The latter is essential to avoid traffic scouting for parking spaces. "Cruising" for parking is economically inefficient (results in lost time), environmentally damaging and increases accident rates since every additional vehicle kilometre travelled has an accident risk associated with it.<sup>74</sup>

Ideally, a road should be designed so that motorists intuitively drive at an appropriate speed, reinforced with clear signage. For example, a road that is wider than necessary gives motorists the subconscious message to speed up, even if the legal speed limit is low. Drivers can be sent an intuitive message to slow down through the use of narrower roads and road furniture such as pedestrian refuge islands, chicanes, flower beds or benches. A motorist should be given plenty of advance notice for pedestrian or bicycle crossings.

When designing roads where there is a high share of motorised two-wheelers, it is important that planners specifically address the special safety needs of motorcyclists due to their relative lack of protection and the threat they pose to non-motorised users. To reduce serious injury rates, soft measures – use of helmets, speed enforcement, and driver education – are of particular importance. Also, in principle, separation of motorcyclists and NMT users should be practiced due to the higher speeds of motorcyclists (Box 16).



### Box 16: The motorised two-wheeler phenomenon

NMT users do not comprise the entirety of the group referred to as 'vulnerable road users'. Users of motorised two-wheelers (i.e. motorbikes) and public transport passengers are also vulnerable to the impact of high speeds. In Vietnam, for example, users of motorised two-wheelers accounted for the majority of road fatalities (approximately 1,000 a month).

Safe road infrastructure should be designed with a long-term vision that takes into account the rapid development of technology and accompanying future changes in the modal mix. For example, motorised two-wheelers are heavily polluting but electric bikes are in development and some are currently available on the market.

Another development is in pedalecs, which are bicycles fitted with an electric motor that is turned on when pedalling and turned off after a set higher speed. Given that two-wheelers are more space-efficient and affordable than automobiles, if safety and environmental standards are upheld, electric two-wheelers and pedalecs can very well be a major component of urban sustainable transport systems and the protection of users of motorised two-wheelers should be improved. It is important to distinguish between pedalecs and other electric two wheelers as their road behaviour characteristics are quite different: pedalecs can safely be mixed with ordinary bicycles on dedicated cycling facilities. For other electric two wheelers, this could be problematic due to the higher speed differences.

It is also important to recognise the following two phenomena: traffic evaporation and latent NMT demand. Safe and sustainable road infrastructure including NMT facilities can mean limitations on motorists in terms of speed and travel time. However, data taken from nearly 100 locations showed traffic chaos to be limited to a 'settling in period' after the implementation of measures to reduce congestion (comparable in the sense that restrictions are placed). In fact, there was a 25 % average overall reduction in traffic and a 14 % median reduction in traffic (i.e. 'traffic evaporation'). The point to take home is that "contrary to widespread assumptions car drivers adapt to changes in road conditions in highly complex ways which computer models cannot accurately predict: initial cramming of roads was followed by searching for alternative routes and times to travel in the short term, more varied and flexible trip-planning, changing mode of transport, reviewing the need to travel, and trip combining in the medium term, and switching locations of activities or even home or workplace in the long term."<sup>75</sup>

While the opportunity to design and construct shared roads can be readily seized for new road developments, existing road networks are in dire need of re-design in many cities, especially in developing countries where the rate of population growth has far exceeded the capacity of governments to plan and build accordingly. For politicians and government authorities in general, the decision to take capacity away from the dominant road user (in terms of space not people) comes about with correct understanding that congestion will not be solved by providing more space for cars alone. It is imperative to recognise



that all users, including motorists, will adjust their travel behaviour depending on the mobility options made available to them. As the European Commission says in its report on reclaiming city streets for people, "in such circumstances new ideas, such as the concept of 'traffic evaporation' (which challenges the assumption that traffic congestion will necessarily worsen if road capacity is reduced), can lend valuable support as to the technical feasibility of creative traffic management solutions."<sup>76</sup>

"The capacity of individual car users to change their travel behaviour in a range of creative ways, when faced with the problem of severe traffic congestion, presents real opportunities for urban planners who seek to optimise the use of space and quality of life in the city"

European Commission<sup>77</sup>



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## Annex 2

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# Metrics for Sustainable Roads

In order to be able to assess the impact of an investment in new roads or retrofitting, the effect on road safety, environment and accessibility has to be anticipated by the investor, the authority and the decision-maker. The set of indicators presented in this chapter aims to offer preliminary steps in directing road investment and design towards a people-oriented approach that incorporates the mobility needs of all road users.



## Indicators that integrate impacts in safety, environment and accessibility

Traditional approaches to road planning and building often neglect NMT needs in their assessments of engineering and costs because they usually measure the benefits of improving transport and road infrastructure in terms of access and use by motor vehicles, like improved connection, travel time, speeds and fuel savings.<sup>78</sup> The costs of improvements in transport infrastructure are classically defined as construction costs, ongoing operations and maintenance costs. This provides only a limited picture on the real impacts. In particular, performance criteria for the measurement of mobility must properly include all modes of transport and support the overall vision of secure access to sustainable mobility. A socio-economic impact assessment methodology should be an integral part of any cost benefit analysis.

The indicators proposed in this chapter are meant to evaluate the impacts of road investments in a more comprehensive way, thus allowing decision makers to make a balanced judgement on the costs and benefits of the road project being analyzed. Ideally, the impact of the project on all road users in the area is weighed in the decision making process. Done properly, such an inclusive assessment would even negate the need for a formal allocation such as a '10% minimum' to address the three aspects of Share the Road - safety, environment and accessibility.

The World Business Council for Sustainable Development (WBCSD) has developed a set of indicators for their Sustainable Mobility Project which includes accessibility, safety, greenhouse gas emissions and impact on the environment public well-being.

**Table 5: WBCSD indicators for the Sustainable Mobility Project**

Indicators	Personal mobility	Movement of goods
ACCESSIBILITY	Do households have access to motorized personal vehicles or reliable public transport? Do households have access to ICT services?	Can goods be delivered and received where and when they are needed?
FINANCIAL OUTLAY REQUIRED	Is personal travel affordable within household budgets? What proportion of the population can afford some form of ICT services	Are logistics costs economic to enable goods to be transported?
TRAVEL TIME	Is transportation taking too much time?	Is transportation and logistics holding up trade?
RELIABILITY	Are people confident they will reach their destination in the expected timeframe? Are the ICT services reliable?	Can businesses make effective plans and efficient choices with confidence in logistics and transportation?
SAFETY	Can individuals reasonably expect to travel without threat of death or serious injury?	Can goods be transported without damage or loss?
SECURITY	Can individuals feel safe to travel without fear of harassment, robbery, or assault.	Can goods be transported with confidence that they won't be stolen or deliberately damaged
GREENHOUSE GAS EMISSIONS (GHGs)	Are transport related greenhouse gas emissions on a sustainable path	
IMPACT ON THE ENVIRONMENT AND PUBLIC WELL-BEING	Are mobility-related "conventional" emissions, noise and impact on ecosystems at an acceptable level?	
RESOURCE USE	Is mobility-related energy, land and materials use sustainable in the context of overall supply and alternative demands for these resources?	
EQUITY IMPLICATIONS	How equitably are the positive and negative impacts of mobility distributed across different societal groupings (income, age, ethnicity, gender etc)?	
IMPACT ON PUBLIC REVENUES AND EXPENDITURES	What proportion of public spending (including revenue offsets) is allocated to infrastructure and mobility services? Is there sufficient to close the mobility divide within a reasonable planning period?	
PROSPECTIVE RATE OF RETURN TO PRIVATE BUSINESS	Is the prospective rate of return for mobility related goods and services sufficient to attract investment?	

Source: WBCSD, Mobility for Development, 2009



Several indicators, or systems of measurement designed to interpret observations, already exist for road transport, urban transport systems in general, and a few specifically NMT, but few take into consideration the multiple aspects of safety, environment and accessibility together to form an integrated assessment of current and future conditions. For example, Krambeck and the World Bank developed the Walkability Index. In it, 10 physical characteristics for a walking pathway are: modal conflict, i.e. the presence of other modes such as bicycles, motorbikes; security from crime; crossing safety; motorist behavior; amenities such as benches, street lighting; disability infrastructure and sidewalk width; maintenance and cleanliness; obstructions, such as from hawkers; availability of street crossings; volume of use.

### Share the Road Key Recommendation #9

**Develop indicators that can monitor and evaluate roads for their contribution to sustainable development in terms of environment, safety and accessibility: The traditional method of expressing transport improvements in km paved or the average speed of motor vehicles is outdated. Modern and inclusive ways to measure progress in roads and transport infrastructure must be developed to make investments more successful.**

## New infrastructure and impacts on travel behaviour



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The set of indicators proposed by Share the Road is meant to help decision-makers to choose between alternative options for improving mobility, including investments in NMT infrastructure. Taken together, they provide a methodology for assessing the impact of roads (e.g. in safety figures, emissions avoided, etc) that work to integrate safety, environment and accessibility.

First, the impact of new infrastructure on the social and economic development of urban communities is highlighted to include all people in any impact assessment. To better understand the potential benefits of infrastructure facilities for all users we adopt a theoretical framework that is shaped around a fundamental understanding of travel behaviour based on i) travel, ii) transport and iii) traffic markets. Changes in the travel, transport, and travel markets are used to study change as a consequence of interventions, (both demand and supply).

Second, a shift from vehicle based indicators (measuring speed, for example) towards people oriented indicators (measuring safety and accessibility, for example) is advocated to reverse current road casualty and emissions trends. When the impact of investments on travel behaviour and the quality of the journey of people is measured irrespective of their mode of transport, then results of the assessment of these impacts will be less biased to only one category of road users, e.g. motorised transport users. Consequently the benefits and disadvantages for NMT users may be given equal consideration in the decision making process.

In order to derive an indicator framework and indicators to better understand travel behaviour and analyze policy options for optimizing the benefits for people and society, it is possible to distinguish three different levels for interventions: the travel market, the transport market and the traffic market.

### Level 1: The Travel Market (which trips do people want to make?)

The travel market is where demand for participation in activities and the supply of those activities result in travel patterns. The travel market is subject to many socio-economic and cultural factors which are beyond the reach of the instruments of urban and transport planning. Yet government policies can influence this market to a certain extent. Land use planning (e.g. the choice of locations for living areas and industrial areas) can both stimulate the need for motorised travel (e.g. by creating distances between living areas and working areas) or minimise the need for travel by a planning based on the principles of proximity.

Travel demand management is another important instrument to help prevent unnecessary growth in the need to travel. Smart planning can reduce trip distances, allowing those trips to be made on bicycle or by foot. Creating shortcuts for cyclists and pedestrians can reduce the impedance and hence increase the preference for cycling and walking. In many cases large infrastructure projects induce an adverse effect on cycling and walking by creating barriers and detours.





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**Level 2: The Transport Market (the transport system to be used)**

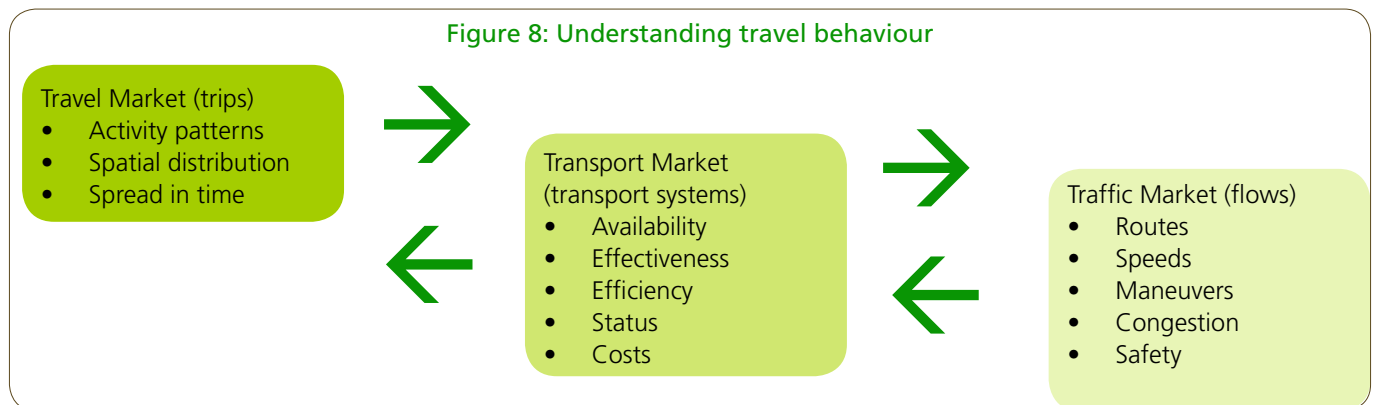
If there is a desired travel pattern, this demand must be met with a supply of transport options. The transport market is focused on the cohesion between travel demand and the availability and affordability of transport modes and services. The demand for travel and the supply of transport possibilities lead towards a certain distribution of transport systems for the travels to be made. Government transport policies can influence this market in order to create a shift in the modal split. Policies should aim at promoting those combinations of transport modes used for travel that offer the highest benefits for society at the lowest costs. Governments can create more attractive networks of user-friendly and safe routes for specific modes of transport, e.g. securing better connections for pedestrians and cyclists to public transport and offering better, cheaper public transport. On the other hand, governments can also launch financial instruments like taxation on vehicles, differentiation in tax cuts on travel costs compensation, road pricing etc. to promote the shift to public transport or to low or zero emission modes of transport.

**Level 3: The Traffic Market (the routes and roads to be used)**

Once the transport user has chosen a certain transport mode, s/he will have to make choices with regards to factual road behaviour. The quality of infrastructure, including traffic management systems, should assimilate the demand for transport. Decision makers can affect this market by the design of road infrastructure like pedestrian crossings, traffic calming, diverting streams of motorized traffic to more suitable routes. Engineering interventions – as discussed in the previous chapter – include protecting vulnerable users while crossing and moving alongside the road, creating parking facilities and offering amenities for people waiting for public transport. Non-infrastructure actions are also essential such as educating road users and enforcing traffic rules.

The reason for introducing these three markets is to show that comprehensive traffic and transport policies go far beyond the traditional road engineering approach. In fact, the traffic and transport system is highly complex with several interacting layers ranging from travel (in terms of the wish of people to access activities), to transport options available and affordable and finally traffic on and along the streets. Each market provides possibilities for actions and interventions to improve the overall performance of the traffic and transport system.

Figure 8: Understanding travel behaviour



**Shift towards a people-oriented approach**

The social and economic value of a trip is not only dependent on the distance travelled, and has to be assessed in terms of the quality of the activity that can be undertaken as a result of a trip. At the same time negative impacts of facilities for different modes of transport on the travel and accessibility possibilities of all people and negative impacts on society have to be taken into account. Traditionally, however, the performance of road projects are measured in terms of the capacity of roads for motorized vehicles (in so called person car units), travel time by motorised vehicles, congestion (for motorized vehicles), etc. thus only measuring a small portion of the choices made in the market, and not paying attention to essential feed back mechanisms on the functioning of these markets overall.



In the three markets described above many decisions are possible at different levels. People decide and make their choices within the dynamics of demand and supply in these markets. The result of their choices is a travel behaviour that enables a certain level of participation in socio-economic activities, in order to meet their aspirations to a larger or lesser extent. Effects of interventions on these markets therefore should in principle be measured in those terms: to which extent do interventions like road investments in NMT infrastructure have an impact on travel behaviour overall and on socio-economic participation.

Governments should take into consideration the needs of and the effects on all people – all current and potential road users – when making policy decisions on safe road infrastructure. The proposed indicators should help to weigh and balance accessibility, safety and environmental footprint.

**Table 4: Example of guidelines for sidewalks**

Indicators	Common	Proposed
Accessibility	<ol style="list-style-type: none"> <li>1. Average speeds: LOS is defined using average speed of motorised vehicles. Private vehicles(cars, motor cycles) are not differentiated from buses. NMTs( bicycles and pedestrians) are completely ignored.</li> <li>2. Average/max flow: Number of vehicles/hour, capacity of a facility is defined using vehicles/hour. Focus is on vehicles rather than moving people.</li> <li>3. Average delay/vehicles, maximum delay/vehicle is used to define LOS for intersection. Focus is on vehicles and not movement of persons.</li> <li>4. Average queue length and maximum queue length is used for intersection LOS. Focu is on motorised vehicles( public and private combined).</li> <li>5. Average delay/person, maximum delay/person is used for pedestrian LOS at intersection.</li> </ol>	<ol style="list-style-type: none"> <li>1. Average number of destinations within reach for persons living in a specific area given the actual access to transport modes, based of travel times of respectively 15 minutes, 30 minutes, 45 minutes and 60 minutes</li> <li>2. Size and number of inhabitants of catchment area of relevant (clusters of) destinations based on travel times of 15, 30, 45 and 60 minutes specified for the various modes of transport.</li> </ol>
Road safety	<ol style="list-style-type: none"> <li>1. User Safety: fatality/injury risk per trip can be used. However, most common indicators are: <ul style="list-style-type: none"> <li>• fatality or injury/1 million passenger km travelled,</li> <li>• fatality or injury/ 100,000 population</li> <li>• fatality or injury /10,000 vehicles</li> </ul> </li> <li>2. Fatality/injury risk per trip can be disaggregated to <ul style="list-style-type: none"> <li>• risk during access trip,</li> <li>• risk as occupant of the vehicle and</li> <li>• risk imposed to other vehicles/users on the road</li> </ul> </li> <li>3. Vehicle Safety indicators: fatality or injury/10,000 vehicles traditionally estimated for motorised vehicles only. Disaggregated risk can be applied to this also.</li> <li>4. Road Safety indicators: Current indicators are: <ul style="list-style-type: none"> <li>• Fatality/injury/km,</li> <li>• fatality or injury/passenger km</li> <li>• fatality or injury/vehicle km</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Number of fatalities and serious injuries per 100,000 population</li> <li>2. Number of fatalities and serious injuries for relevant NMT-groups per 100,000 motor vehicles</li> </ol> <p><b>Additionally:</b></p> <ol style="list-style-type: none"> <li>3. Risk of being involved in an accident with MT.</li> </ol>
Environment	<ol style="list-style-type: none"> <li>1. Pollutants (CO<sub>2</sub>, NOX, SOX, SPM, HC )/veh-km : Focus is on engine efficiency, cleaner alternate fuels. Life cycle emissions are not captured. Rebound effects are ignored.</li> <li>2. Pollutants (CO<sub>2</sub>, NOX, SOX, SPM, HC )/passenger –km: Same as above except higher occupancy vehicles are favoured. Life cycle emissions are ignored.</li> <li>3. CO<sub>2</sub>/person or country: Used at international negotiations.</li> </ol>	<ol style="list-style-type: none"> <li>1. Pollutants caused by travelling/ 100,000 population</li> <li>2. Percentage of trips for which people have the option to (realisticly) choose for a sustainable mode of transport</li> </ol>



The proposed Share the Road approach asks infrastructure and road finance decision makers at every level to consider and calculate the performance of roads within transport systems as a whole, and to include within their calculations the effects on vulnerable road users. That is, to carefully consider which groups in society are likely to benefit from the project and which groups could potentially suffer. When the number and needs of all road users are part of the equation, it is likely that the result is a more equitable and people-oriented approach. The full report is published online at [www.unep.org/transport/NMT\\_roads](http://www.unep.org/transport/NMT_roads). It includes further details, including a conceptual application of the approach in a hypothetical example.

### Share the Road Key Recommendation #10

Communicate among donors and governments both at the project and policy level to identify best practices in monitoring and measuring impacts of road investments: Some donors and governments have already embarked on internal initiatives to improve the effectiveness of investments, as well as to reduce the unintended negative consequences. An open atmosphere of sharing and coordination will help propel a global push for better investments.



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## Glossary

The following are definitions of terms used in the context of this report.

**Crosswalks:** The facilities on a road for non-motorised vehicles, e.g. pedestrians and cyclists, to cross the road.

**Cycling paths:** The facilities on a road for cyclists' mobility, separated from motor vehicles.

**Investment:** The financial resources dedicated by governments, development partners, donor agencies and the private sector into a programme or project with the expectation of financial and/or social returns.

**Mobility:** The ability to move from one place to another; the fundamental objective of transport systems.

**Non-motorised transport:** Modes of transport such as walking and cycling that do not depend on an internal combustion engine, also called active transport or human-powered transport.

**Road infrastructure:** The physical facilities and designed network that provide the means to travel.

**Share the Road:** The initiative led by UNEP to advance investment in walking and cycling infrastructure as part of the move towards a green economy.

**Sidewalks:** The facilities on a road for pedestrians' mobility, also called footpaths or footways.

**Sustainable transport:** The type of transport that minimises adverse impacts on the environment, society and economy.

**Vulnerable road users:** The group of roads users particularly vulnerable to high speed impact, such as pedestrians, cyclists and motorcyclists who lack the protective shell of the automobile.

**Walking and cycling road infrastructure:** The facilities for non-motorised transport, connected to the wider transport network, especially public transport.



## References

1. International Energy Agency (2008), *Energy Technology Perspectives 2008 – Scenarios and Strategies to 2050*, OECD Publishing, Paris.
2. Ibid.
3. Litman, T. (2007), *TDM Encyclopedia*, Victoria Transport Policy Institute, [www.vtpi.org/tdm/tdm12.htm](http://www.vtpi.org/tdm/tdm12.htm).
4. Essen H., F. Brouwer, M. Otten, and A. Schrotten (2008), “Minder emissies door investeren in infrastructuur”, CE Delft, Netherlands.
5. UITP (International Association of Public Transport) (2006), *Mobility in Cities Database*.
6. C40 Cities, Climate Leadership Group (2010) *Best practices: Transport in Bogota, Colombia – Cycling System*, [www.c40cities.org/bestpractices/transport/bogota\\_cycling.jsp](http://www.c40cities.org/bestpractices/transport/bogota_cycling.jsp).
7. International Energy Agency (2009), *Transport, Energy and CO<sub>2</sub> – Moving Towards Sustainability*, OECD Publishing, Paris.
8. World Health Organisation (2008), *World Health Statistics*, [www.who.int/whosis/whostat/2008/en/index.html](http://www.who.int/whosis/whostat/2008/en/index.html).
9. World Health Organisation (2009), *Global Status Report on Road Safety: Time for Action*, WHO Press, Geneva.
10. Commission for Global Road Safety (2006), *Make Roads Safe: A New Priority for Sustainable Development*, Commission for Global Road Safety, London.
11. Commission for Global Road Safety (2009), *Make Roads Safe: A Decade of Action for Road Safety*, Commission for Global Road Safety, London.
12. UN Environment Programme (2009), *Our Planet: Sustainable Transport*.
13. Government of Kenya (2009), Ministry of Transport, *Police statistics, 2000-2008*.
14. Mohan D. (2002), “Traffic safety and health in Indian cities”, *Journal of Transport and Infrastructure*.
15. Adapted from Commission for Global Road Safety (2006), *Make Roads Safe: A New Priority for Sustainable Development*, Commission for Global Road Safety, London.
16. International Road Assessment Programme (2009), *iRAP Kenya Results 2009: Final Report*.
17. World Bank (2009), *World Development Report 2010: Development and Climate Change*.
18. International Energy Agency (2009), *Transport, Energy and CO<sub>2</sub> – Moving Towards Sustainability*, OECD Publishing, Paris.
19. World Business Council for Sustainable Development (2004), *Mobility 2030: Meeting the Challenges to Sustainability*.
20. Hook, W. (2006), “Urban Transportation and the Millennium Development Goals”, *Global Urban Development*, Volume 2 Issue 1 March 2006
21. World Bank (2002), *Cities on the Move: A World Bank Urban Transport Strategy Review*.
22. GTZ (2003), “Preserving and Expanding the Role of Non-motorised Transport”, *Module 3d of Sustainable Transport: A Sourcebook for Policy-makers in Developing Cities*, GTZ, Eschborn.
23. World Business Council for Sustainable Development (2004) *Mobility 2030: Meeting the Challenges to Sustainability*.
24. World Bank (2002), *Cities on the Move: A World Bank Urban Transport Strategy Review*.
25. Hook, W. (2006), “Urban Transportation and the Millennium Development Goals”, *Global Urban Development*, Volume 2 Issue 1 March 2006
26. UN Environment Programme (2008) *Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World*.
27. World Business Council for Sustainable Development (2009), *Mobility for Development: Facts and Trends*.
28. Bicycle Empowerment Network (2004), *Internal survey findings*.
29. Aeron-Thomas et al. (2004), “The involvement and impact of road crashes on the poor” (Conducted by Transport Research Laboratory (TRL) on behalf of the Global Road Safety Partnership), available at [www.grsroadsafety.org](http://www.grsroadsafety.org).
30. African Union and the UN Economic Commission for Africa (2005), *Transport and the Millennium Development Goals in Africa*.
31. World Bank (2009), *World Development Report 2010: Development and Climate Change*.
32. Asian Development Bank (2010), *ADB and the Transport Sector*, [www.adb.org/Transport](http://www.adb.org/Transport).
33. European Commission (2009), *Reclaiming City Streets for People: Chaos or Quality of Life?*
34. Commission for Global Road Safety (2006), *Make Roads Safe: A New Priority for Sustainable Development*, Commission for Global Road Safety, London.
35. World Business Council for Sustainable Development (2009), *Mobility for Development: Facts and Trends*.
36. Watkins, K. (2010), *Road Traffic Injuries: The Hidden Development Crisis*, Commission for Global Road Safety, London.
37. Hook, W. (2006), “Urban Transportation and the Millennium Development Goals”, *Global Urban Development*, Volume 2 Issue 1 March 2006
38. City of Copenhagen (2010), *Office website*, [www.kk.dk](http://www.kk.dk)
39. C40 Cities, Climate Leadership Group (2010b) *Best practices: Transport in Copenhagen, Denmark – Bicycles*, [www.c40cities.org/bestpractices/transport/copenhagen\\_bicycles.jsp](http://www.c40cities.org/bestpractices/transport/copenhagen_bicycles.jsp).





40. Commission for Global Road Safety (2006), *Make Roads Safe: A New Priority for Sustainable Development*, Commission for Global Road Safety, London.
41. Heinrich Boll Foundation (2009), *Toward a Transatlantic Green New Deal: Tackling the Climate and Economic Crises*.
42. Commission for Global Road Safety (2006), *Make Roads Safe: A New Priority for Sustainable Development*, Commission for Global Road Safety, London.
43. Infrastructure Consortium for Africa (2008), Office website, [www.icafrica.org](http://www.icafrica.org).
44. Infrastructure Consortium for Africa (2007), *Annual Report*.
45. Infrastructure Consortium for Africa (2006), *User Guide to Project Preparation*.
46. World Bank (2009) Projects Database: Clean Air and Sustainable Environment Project, [web.worldbank.org/external/projects](http://web.worldbank.org/external/projects).
47. Asian Development Bank (2009), *Safety on the Roads: Joining Forces to Save Lives*, News Release No. 2009/number/SDN.
48. *Bridging the Gap* (2010) Copenhagen Accord NAMA Submissions: Implications for the Transport Sector, [www.transport2012.org](http://www.transport2012.org).
49. Asian Development Bank (2006), *Mainstreaming Road Safety*, ADB, Manila.
50. Asian Development Bank (2007), *Promoting Road Safety and Sustainable Transport*. [www.adb.org/Projects/PRCRoadSafety/default.asp](http://www.adb.org/Projects/PRCRoadSafety/default.asp).
51. Asian Development Bank (2010), *Reducing Carbon Emissions from Transport Projects*, [www.adb.org/Documents/Evaluation/Knowledge-Briefs/REG/EKB-REG-2010-16/default.asp](http://www.adb.org/Documents/Evaluation/Knowledge-Briefs/REG/EKB-REG-2010-16/default.asp).
52. The full text of the agreement can be viewed at [www.unep.org/urban\\_environment/PDFs/EABAQ2008-AirPollutionAgreement.pdf](http://www.unep.org/urban_environment/PDFs/EABAQ2008-AirPollutionAgreement.pdf).
53. International Energy Agency (2009), *Transport, Energy and CO<sub>2</sub> – Moving Towards Sustainability*, OECD Publishing, Paris.
54. Ibid.
55. Ibid.
56. Kjartan Sælensminde (2002), *Walking and Cycling Track Networks in Norwegian Cities: Cost-Benefit Analysis Including Health Effects and External Costs of Road Traffic*, Institute of Transport Economics, [www.toi.no/getfile.php/Publikasjoner/T%D81%20rapporter/2002/567-2002/sum-567-02.pdf](http://www.toi.no/getfile.php/Publikasjoner/T%D81%20rapporter/2002/567-2002/sum-567-02.pdf).
57. Gota, S. (2009), *Transport Infrastructure Efficiency, Air Quality, Climate Change and Transport*, [cai-asia.blogspot.com/2010/03/transport-infrastructure-efficiency.html](http://cai-asia.blogspot.com/2010/03/transport-infrastructure-efficiency.html)
58. Hook, W. (2006), "Urban Transportation and the Millennium Development Goals", *Global Urban Development*, Volume 2 Issue 1 March 2006
59. GTZ (2006), *The Road Safety Cent: Management and Financing of Road Safety in Low-Income Countries*, GTZ, Eschborn.
60. The study by Climate Excellence Africa can be found online at [www.unep.org/transport/NMT\\_roads](http://www.unep.org/transport/NMT_roads)
61. TIME (2009), *Heroes of the Environment*
62. CNN World (2010), *Transit guru: My life in the bus lane*, [articles.cnn.com](http://articles.cnn.com)
63. Khayesi M., Monheim, H. and Nebe, J. M. (2010) "Negotiating 'Streets for All' in Urban Transport Planning: The Case for Pedestrians, Cyclists and Street Vendors in Nairobi, Kenya", *Antipode* Vol. 42 No. 1, p. 119,
64. London Road Safety Unit (2003), "Review of 20mph zones in London Boroughs", *Safety Research Report No.2*.
65. De Langen M., and R. Tembele (2001), *Productive and Liveable cities: Guidelines for pedestrian and bicycle traffic in African cities*, Swets & Zeitlinger, Lisse.
66. Rosquist, L.S. (2000), *Vehicular emissions and fuel consumption for street characteristics in residential areas*, Lund University, Sweden.
67. Interface for Cycling Expertise (2009), *Cycling-Inclusive Policy Development: A Handbook*,
68. Iacono, M., K. Krizek, K., and A. El-Geneidy (2008), *Access to Destinations: How Close is Close Enough? Estimating Accurate Distance Decay Functions for Multiple Modes and Different Purposes*, Report 2008-11, University of Minnesota.
69. Centre for Science and Environment (2009) *Footfalls: Obstacle Course to Livable Cities*, CSE, Delhi.
70. Commission for Global Road Safety (2006), *Make Roads Safe: A New Priority for Sustainable Development*, Commission for Global Road Safety, London.
71. Cervero, R. and K. Kockelman (1997), "Travel Demand and the 3 Ds: Density, Diversity and Design", *Transportation Research Part D* 2(3): 199–219.
72. Greater London Authority (2008), *Information London*, p. 31
73. More details and exmples can be found in Interface for Cycling Expertise (2009), *Cycling-Inclusive Policy Development: A Handbook*.
74. Shoup (2006), "Cruising for Parking", *Transportation Policy* (13), 479-486.



75. Cairns, S., C. Hass-Klau, and P. B. Goodwin (1998), Traffic Impact of Highway Capacity Reductions: Assessment of the Evidence, Landor Publishing, London.
76. European Commission (2009), Reclaiming City Streets for People: Chaos or Quality of Life?
77. Ibid.
78. Arora, A. and G. Tiwari (2007), A Handbook for Socio-economic Impact Assessment (SEIA) of Future Urban Transport (FUT) Projects, Transportation Research and Injury Prevention Program (TRIPP), Indian Institute of Technology, New Delhi.

