

Poverty and sustainable transport

How transport affects poor people with policy implications for poverty reduction

A literature review

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October 2014

The views in this paper are those of the authors and they do not necessarily reflect the views of UN-Habitat, the Overseas Development Institute (ODI) or SLoCaT

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Acronyms and abbreviations

ADB	Asian Development Bank	PM _{2.5}	Particulate matter up to 2.5 micrometres in size ('fine')
AFCAP	African Community Access Programme	PMGSY	Pradhan Mantri Gram Sadak Yojan (Indian road programme to connect all villages)
AIDS	Acquired immune deficiency syndrome	RED	Roads Economic Decision (software)
BRT	Bus Rapid Transit	RTS	Rural transport services
CBD	Central Business District	RTSi	Rural transport services indicator
COHRE	Centre on Housing Rights and Evictions	SLoCaT	Partnership on Sustainable Low Carbon Transport
DFID	Department for International Development, UK (UKaid)	SO ₂	Sulphur dioxide
eg	for example	SPARC	Society for Promotion of Area Resource Centres
EPWP	Expanded Public Works Programme, South Africa	SSATP	Sub-Saharan Africa Transport Policy Program, World Bank, USA
FAO	Food and Agriculture Organisation of the United Nations, Rome	STAR	Sustainable Transport Appraisal Rating
GDP	Gross domestic product	TRL	Transport Research Laboratory, UK
GIS	Geographical information systems	Tsh	Tanzanian shilling
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH	UITP	International Association of Public Transport (Union internationale des transports publics)
GRSF	Global Road Safety Facility	UK	United Kingdom (of Great Britain and Northern Ireland)
HDM4	Highway Development and Management Model	UN	United Nations
HIV	Human immunodeficiency virus	UN-Habitat	United Nations Human Settlement Program
h	hour	UNFPA	United Nations Population Fund
ICT	Information and communication technologies	USA	United States of America
ie	that is to say	USD	United States Dollar
IFRTD	International Forum for Rural Transport and Development	VOC	Vehicle operating costs
ILO	International Labour Organisation, Geneva	WHO	World Health Organisation, Geneva
IMT	Intermediate means of transport		
IRAP	Integrated rural accessibility planning		
IT	Intermediate technology (although IT Transport is now a name not an acronym)		
km	kilometre		
LAMATA	Lagos Metropolitan Area Transport Authority		
LGED	Local Government Engineering Department, Bangladesh		
m	million		
MDB	Multilateral development bank		
MDG	Millennium Development Goals		
MUIP	Mumbai Urban Infrastructure Project		
MUTP	Mumbai Urban Transport Project		
NGO	Non-governmental organisation		
NO ₂	Nitrogen dioxide		
OECD	Organisation for Economic Cooperation and Development		
ODI	Overseas Development Institute		
PM ₁₀	Particulate matter up to 10 micrometres in size ('coarse')		

1 Executive summary

1.1 Background

This review of the poverty implications of urban and rural transport was requested by the Partnership on Sustainable, Low Carbon Transport (SLoCaT), contracted by UN-Habitat and implemented by the Overseas Development Institute (ODI) with funding from UK Department of International Development (DFID). The research questions concerned the extent to which the poor can participate in the transport sector, benefit from transport, and be adversely affected by transport externalities. About 360 documents were reviewed, most in English. A significant proportion of the documents were produced by, or in association with, a relatively small number of international and 'northern' development agencies, including multilateral development banks (World Bank and ADB) and DFID-supported research programmes.

1.2 Rural transport and poverty

Importance of connecting rural people to reduce the poverty of isolation

Many of the world's poor people live in rural areas isolated by distance, terrain and poverty from employment and economic opportunities, markets, healthcare and education. Lack of basic infrastructure (paths, trails, bridges and roads) and access to transport services makes it difficult for poor people to access markets and services. There is clear evidence that rural isolation is associated with low agricultural productivity (linked to poor market access and low use of fertilizers and modern agricultural technologies). It is also linked with poor health (for example unnecessarily high peri-natal mortality) and low school enrolment. Rural isolation can imprison the elderly and people with disabilities.

Twenty years ago, little attention was paid to the poverty implications of transport investments: it was assumed that investments in urban and rural roads stimulated economic growth and social development. Recent research has shown that transport investments tend to benefit the 'non-poor' most, and that investments must be consciously designed to avoid further impoverishing poor people. Where transport investments have stimulated economic growth, the poor have often benefitted only marginally – in many cases, they have not had the resources to take advantage of the opportunities afforded by better access. Good transport infrastructure is a necessary condition for economic growth and poverty alleviation, but transport investments alone cannot address the problems of the poorest households.

The main way rural people access markets and services is through roads that connect rural communities to market towns (in some regions waterways are also important). Many people live more than two kilometres from the nearest road, and have to walk for over thirty minutes to reach it. In remote areas, communities may be more than a day's walk from a road. There is much evidence that building roads (and/or trails and footbridges) to connect rural communities to the road network provides numerous benefits and reduces the numbers of people in extreme poverty. Trails and roads enable safer and faster access to markets and services. They also make it more likely that service providers (for example health workers and teachers) are able to reach isolated rural areas.

There is strong evidence that providing basic road connectivity to rural villages can generate significant social and economic benefits. Evidence from Ethiopia, Ghana, Nepal, Uganda and elsewhere shows that upgrading footpaths to basic motorable roads provides much greater benefits than upgrading existing rural roads to all-weather quality. Analyses from China showed that the greatest returns to investments came from the construction of basic (low-volume) rural roads. The investment in such roads had a greater influence on poverty reduction and national GDP than investments in better-quality, higher-volume roads. Investment in rural roads, particularly to provide initial connectivity, leads to greater school enrolment (evidence from many countries including

Bangladesh, Ethiopia, India, Morocco, Pakistan and Vietnam). Investment in rural roads also leads to better staffing at village primary schools (evidence from India, Zambia and elsewhere).

Improved agricultural production and marketing

Most rural communities depend on agriculture (including crops, livestock, fisheries and forestry) for subsistence and income generation. There are numerous research studies and several wide-ranging reviews that demonstrate how improving rural access has led to increased agricultural production, lower costs for farm inputs and lower transport costs for marketed outputs. Studies in Ethiopia, India and Nicaragua showed increased fertiliser use, higher yields, enhanced production, employment, living standards and poverty reduction. The effects of improved rural transport on agriculture and poverty can be complex. Better road access leads to price changes in inputs and outputs and may affect cropping patterns, land prices and land ownership. It also provides various new opportunities for employment, immigration and emigration. How individual poor households are affected depends on local circumstances. People with resources are most able to adapt to changing market conditions and economic opportunities. A study of spatial data in Africa showed that overall agricultural productivity of rural areas was correlated with the travel time to a large town. The travel time included small rural roads and then larger national roads, but the most cost-effective way to reduce this was investment in minor rural roads.

Access to health care

Rural transport infrastructure and means of transport (including transport services) are crucial to overcoming the potentially fatal 'three delays' in health care (particularly peri-natal care) - the decision to seek health care, the travel to reach care and the treatment within the healthcare system (including referrals) all depend on access to transport. Where people are far from roads, their decision to travel is influenced by the problems of travelling by human portage, stretchers, animals, bicycles or motorcycles. Good access to infrastructure and transport services are needed to ensure medical staff and supplies are available in health centres. Evidence from India, Nepal and other countries suggests that constructing and maintaining rural roads, paths and bridges leads to improved health outcomes and healthier rural communities (although there can be complex interactions and externalities that affect poor people).

Involving rural people in road construction and maintenance

Evidence from many countries in Africa, Asia and Latin America shows that involving local people in labour-based road construction and maintenance can provide valuable employment for poor people and can help empower women and disadvantaged groups. For maximum pro-poor benefits, employment opportunities have to be clearly targeted at poorer or disadvantaged individuals, however transport engineers often favour mechanised approaches which are quicker and simpler to contract out, but mean that less of the project expenditure goes to benefit rural people.

Rural transport services and intermediate means of transport (IMTs)

In developing countries, few rural people own cars and mobility mainly involves walking, IMTs and public transport. Rural transport services are often provided by informal sector entrepreneurs using buses, trucks, pickups, 'rural taxis' (minibuses or estate cars), motorcycles, bicycles, tricycles, animal-drawn carts or pack animals. In many countries, IMTs (including motorcycles) provide most of the transport between villages and markets. National transport authorities tend to neglect the importance of non-motorised IMTs for poor people, however bicycles and work animals provide crucial mobility to access markets, healthcare and schools. They also provide employment opportunities, including bicycle taxi operations.

Motorcycles are increasing rapidly in most developing countries, and motorcycle taxi services have often arisen spontaneously. Motorcycle taxis offer employment opportunities for young men. Low-cost daily leasing arrangements allow poor people to become motorcycle operators. Motorcycle taxis offer very flexible services and often travel off the roads and along village paths, so 'extending'

the road to more isolated villages. Motorcycle taxis are often the only form of rural transport readily available. They can account for a high proportion of goods and passenger movements. Although they can be uncomfortable and more expensive per passenger kilometre than conventional transport, motorcycle taxis are highly valued by rural people (including the poor who use them for emergency transport). Motorcycle taxis do increase road accidents, mainly due to risky operator behaviour. While some authorities try to ban them, others try to regulate them positively for improved safety. Motorised three-wheelers, animal drawn carts and two-wheel tractor trailers offer greater safety and carrying capacity, but they are not so fast and timely. The poorest people are unlikely to own such transport, but can benefit from the informal services provided by others.

Those investing in rural roads (road authorities, MDBs, bilateral donors) assume that if roads are built, private sector transport services will develop spontaneously. This is not always the case. Many rural roads have no 'conventional' transport services at all. Research on transport in developing countries has emphasised the need to invest in ensuring there are appropriate transport services for rural people. Lower passenger and small freight fares are associated with larger vehicles, and poor people who travel benefit from passenger trucks and buses that allow the 'mixed' transport of small freight. Studies suggest it is difficult to provide profitable bus or minibus services on small rural roads, which explains their absence or the use of low-cost, old and over-loaded vehicles.

Policy implications

Rural roads can undoubtedly benefit impoverished communities and poor households, but they do not necessarily alter structural poverty. Some researchers suggest improved access to transport raises living standards across social classes. Others have pointed out that the benefits are unequally distributed as the more affluent typically benefit most from the opportunities provided by road investments. Analyses from many countries confirm that roads can reduce overall poverty and provide economic opportunities, but eliminating poverty and increasing equity need to be addressed in parallel with any road investments.

Rural isolation can be mitigated by the provision of appropriate rural road, trail and bridge infrastructure. The greatest benefits of investment often exist at the periphery of the road network, when remote communities are connected (or re-connected) to the national network. Providing rural roads, tracks and bridges benefits rural communities, but people with resources may be in a position to benefit more from improved access to employment markets, healthcare and education. The poorest people may not have the resources to travel to, or afford, the newly accessible markets and services. Rural roads lead to overall poverty reduction but not poverty eradication or socio-economic equity. Rural roads programmes need to be integrated with other measures to increase equity and to minimise the potential for negative socio-economic and cultural effects. Labour-based construction and maintenance systems can transfer funds through rural employment, and can have significant pro-poor benefits (particularly if women and disadvantaged groups are targeted), however labour-based systems still require significant championing by socially-aware national ministries, development agencies and MDBs.

To stimulate economic growth and reduce poverty, national authorities need to ensure resources are allocated for the construction and on-going maintenance of rural roads. Emphasis should be on connecting isolated communities with low-volume, low-cost all-season roads, trails and trail-bridges, suitable for light vehicles including motorcycles and IMTs. These should provide high cost-benefit returns when analysed in ways appropriate for low-volume, rural investments. Although rural access roads may be built and maintained using low-cost standards appropriate to lower traffic volumes, policies should require adequate all-season connectivity. Infrastructure construction and maintenance should be based on participatory planning, involving rural communities (disaggregated appropriately by gender and disadvantage) and key service providers (including health, education, agriculture inputs, water and electricity) to maximise the social and economic benefits and facilitate poverty reduction.

Conventional socio-economic surveys and evaluations may not provide the necessary data required to understand the pro-poor benefits of rural roads. The adequacy of rural transport services must be assessed when measuring the impact of rural roads. Reliable information on rural transport services is seldom available or collected. The Asian Development Bank has developed a Sustainable Transport Appraisal Rating (STAR) multi-dimensional measurement tool that includes economic, poverty and social, environmental and sustainability risk criteria. This is designed for individual projects, but could be adapted as a more wide-ranging planning and evaluation tool. Integrated rural accessibility planning (IRAP) is a key participatory tool to allow local communities to determine their own priorities (although the priorities of the poor may differ from those of the community leaders).

1.3 Urban transport and poverty

Urban expansion and city congestion

More than half the world's population live in urban areas and this proportion is expected to grow. Although megacities attract attention, most of the future growth will be in secondary cities of fewer than 500,000 people. For more than a century there has been a trend of decreasing urban density, as cities accommodate motorised transport and build low density housing on the outskirts. The growth in cities and the reduction in density increases trip distances. This causes more complex journeys and makes the provision of public transport more difficult away from city centres. Despite substantial road building, congestion has been getting worse and average traffic speeds have been declining. Congestion affects all road users, and poor people frequently have to walk or to travel in slow-moving, overcrowded buses. Solutions to congestion, including high capacity urban road construction, can be extremely expensive. While rural road building can directly benefit poor communities, urban transport interventions (new roads, metros, bus rapid transit) are often designed to reduce urban congestion due to increasing car use, and can disproportionately benefit wealthier sections of the population unless properly designed.

Problems for low-cost transport: walking and cycling

In developing countries a high proportion of the poor walk or use non-motorised transport, particularly for journeys less than 5-8 km. For many cities there are few sidewalks and pedestrians have to share the crowded roads with traffic. In the parts of the city where the poor live, roads are often unpaved and poorly drained and maintained. In town centres, the few pedestrian sidewalks that exist are often blocked by parked vehicles, traders and building materials. Although cycling may be relatively inexpensive it is often difficult and potentially dangerous, with few cycleways or cycle lanes.

Employment related to transport

New urban road, pavement and transit infrastructure construction can provide short- and long-term employment for men and women. Evidence suggests that even more jobs can be created (per million dollars spent) by investing in public transport or road maintenance. A World Bank analysis suggested for every USD billion spent on infrastructure, 110,000 related jobs would be created. However, skilled workers gain most as unskilled workers (often poor people) only account for 6-10% of the total expenditure.

Urban public transport provides a range of employment opportunities for the poorer sections of the population but the jobs are almost exclusively for men. Formal public transport operations are estimated to employ 7.3 million worldwide. IMT (including non-motorised transport) is also an important source of employment for the poor, with an estimated 12 million rickshaw drivers in South Asia. In Africa, Uganda alone is reported to have 200,000 bicycle and 90,000 motorcycle taxi drivers.

Travel patterns, expenditure and time budgets

Access to basic facilities (water, schools, markets, clinics) varies substantially between locations, with poor areas generally at a disadvantage. A study of 18 African cities found that people devoted 8-15% of their total household expenditure to transport. The proportion of expenditure on transport increased with income. The poor spent 4-10% of income on transport, perhaps because they walked to avoid transport costs. The patterns were complex and localised, and in some cities middle income groups spent most on transport.

Travel times to and from work vary greatly from city to city, averaging about one hour per day. In many cities a substantial proportion of the poor live in suburban areas (partly because of involuntary resettlement and informal settlements). They face long and expensive journeys to work, often over 20 km and sometimes taking 3-4 hours per day travelling. Women tend to work closer to home than men. With shorter journeys they are more likely to walk. However women have more complex journey patterns, such as taking children to school, going shopping, visiting clinics and travelling to and from work. They are at a particular disadvantage when living in peripheral urban areas because of the poor frequency of public transport. People with disabilities suffer a wide range of issues when travelling, including obstructed and dangerous sidewalks. They may suffer abuse and difficulties when travelling on public transport. Transport operators may refuse concessionary fares (a problem also experienced by students).

Accidents, air pollution and displacement

About 1.3 million people die each year from road injuries and 78 million require medical care. Evidence from large household surveys in Bangladesh and India compared the mortality and serious injuries of the urban and rural poor and non-poor. The urban poor suffered similar rates of road deaths as the urban non-poor. Travelling as a pedestrian was the most important risk factor for the poor. The non-poor made more use of motorcycles, so increasing their risk of death and injury. Transport-induced air pollution is estimated to cause 184,000 deaths each year, through its effects on heart disease, strokes, respiratory infections and lung cancer. While the different risk factors that affect the poor are not always clear, the poor appear to be at more risk from all forms of air pollution.

Involuntary evictions for transport investment are common. There is evidence that many poor communities, particularly those in 'illegal' squatter settlements, are at high risk. Over 4.3 million people worldwide were affected by forced evictions in 2007-2008, with transport responsible for a substantial percentage. A World Bank study found that 16% of evictions related to its projects were due to transport investments. While many donors and development banks have strict guidelines on compensating people affected and providing rehousing, many governments do not follow such rules when undertaking nationally-funded transport projects.

2 Introduction

2.1 Background

A recent report of the High Level Panel on the Post-2015 Development Agenda in its vision statement made an explicit link between the end of extreme poverty and putting in place building blocks of sustained prosperity for all (UN-HLP, 2013). The Partnership on Sustainable, Low Carbon Transport (SLoCaT) considers sustainable transport to be one of the most important of such building blocks. The integration of sustainable transport in global discussions and policy making on sustainable development is a key objective for SLoCaT and SLoCaT has developed a Results Framework for Sustainable Transport (Sayeg, Starkey and Huizenga, 2014). SLoCaT understands that it is essential that its recommendations on sustainable transport and sustainable development fully acknowledge and reflect the linkages between sustainable transport and poverty reduction.

As a contribution to the goal of integrating poverty reduction into transport-related inputs for the post-2015 policy framework, the UK Department of International Development (DFID) commissioned a review of existing research on the relationship between transport and poverty reduction. The objective is to direct and inform future actions by SLoCaT and its members on the subject. This will focus primarily on land transport in developing countries.

2.2 Research methodology

An initial list of relevant publications for inclusion was identified by ODI using a truncated version of the evidence-focused literature review methodology outlined in Hagen-Zanker and Mallett (2013).

This review methodology involves:

- Protocol development (Stage 1) including the identification of research questions (and sub-questions), the selection of inclusion and exclusion criteria, the development of search strings, the identification of databases, journals and websites to be searched and the adoption of a uniform framework for data recording and presentation.
- Retrieval (Stage 2) consists of a three-stage process, including an initial academic literature search, snowballing (forward and reverse) from key publications identified in consultation with selected thematic experts, and the collation of grey and unpublished literature.
- Screening (Stage 3) consists of a two-stage process to assess the relevance of the literature collected, including an initial phase of screening on the basis of document titles and abstracts, and a second phase based on the full text of the remaining documents.
- Analysis (Stage 4) consists of a synthesis of the literature collected, and a description and summary of key findings in relation to each of the identified research questions.

As part of protocol development, alongside journal database searches, the following publications were selected for specific searches:

- Agricultural Economics
- Development Policy Review
- International Journal of Sustainable Transportation
- Journal of African Economies
- Journal of Development Economics
- Journal of Development Studies
- Journal of Rural Studies
- Journal of Transport Geography
- Journal of World Transport Policy and Practice
- Progress in Development Studies
- Research in Transportation Economics

- Society and Space
- Society and Space
- Transport Policy
- Transport Reviews
- World Development

Searches were also undertaken on the websites and research portals of the following organisations:

- African Development Bank (AfDB)
- Asian Development Bank (ADB)
- Corporación Andina de Fomento (CAF)
- Department for International Development (DFID)
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
- Embarq/World Resources Institute (WRI)
- European Bank for Reconstruction and Development (EBRD)
- Institute for Transportation and Development Policy (ITDP)
- Inter-American Development Bank (IADB)
- UN Habitat
- United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)
- United Nations Environment Programme (UNEP)
- World Bank.

Following completion of the initial source list, the transport sector leads in key SLoCaT member organisations were then contacted (in consultation with SLoCaT) and asked to identify any additional relevant published and unpublished research produced or commissioned by their organisations.

Transport specialists from the following organisations were contacted:

- Asian Development Bank (ADB)
- Corporación Andina de Fomento (CAF)
- Department for International Development (DFID)
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
- European Bank for Reconstruction and Development (EBRD)
- EMBARQ
- Inter-American Development Bank (IADB)
- Institute for Transportation and Development Policy (ITDP)
- United Nations Environment Programme (UNEP)
- United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP)
- World Bank.

The results of the academic literature search were combined with additional resources generated from source snowballing and expert engagement to generate an initial selection of around 300 documents. These were provided to the authors as pdf files. During the subsequent review work, the authors added further documents which they came across during their reading, analysis and on-line searches. The final bibliography list contains about 360 references, representing over 15,000 pages of text.

Following engagement with the various project stakeholders, the following priority research questions were identified for the study.

2.2 Research questions

2.2.1 Supply-side

- 1 (a) How and to what extent can the poor directly participate in the transport sector through:
 - infrastructure construction and maintenance?
 - the provision of transport services?
- 1 (b) What information exists on the current level of direct participation (ie. participation in infrastructure construction / maintenance and service provision) by the poor in the transport sector, and what tools have been developed to measure this?

2.2.2 Demand-side

- 2 (a) How and to what extent does transport (including both infrastructure and services, and the means to access them) affect the ability of the poor to access:
 - goods and services?
 - economic opportunities (including employment and trade)?
- 2 (b) What information exists on the current level of access of the poor to formal and informal transport, and what tools have been developed to measure this?

2.2.3 Externalities

- 3 (a) What is the evidence base on the impact of the following externalities generated by motorised transport activities on the poor (in both absolute and relative terms):
 - air pollution?
 - road accidents?
 - congestion?
 - displacement?
- 3 (b) What tools have been developed to measure the impact of externalities generated by motorised transport activities on the poor?

3 Literature review: sources and issues

3.1 Poverty and transport focus

Historically, building roads has been associated with controlling populations, accessing resources and developing profitable markets, with little attention to poverty issues (deGrassi, 2005). As recently as the 1990s, the poverty implications of transport were largely ignored as the transport sector was dominated by political, economic and engineering considerations, with little understanding within transport ministries of poverty-reduction criteria, gender and social issues or participatory approaches (deGrassi, 2005). In an important study for the World Bank, Gannon and Liu (1997) noted that there were no guiding principles for, or systematic approaches to, poverty issues in the Bank's transport sector operations, as transport was considered to have only an *indirect* relationship to poverty. However, through case studies and other research a significant body of knowledge has been developed on the transport burden of poor people in both urban and rural contexts. The Makete Integrated Rural Transport Programme in Tanzania (1985-1996) proved particularly important in recording and publicising links between rural poverty and transport, and influencing national and international policies (Lema, 2007). Studies highlighting the transport-related problems of urban poor people included those of Deaton (1987) and Kranton (1991). Studies focusing on poverty and rural transport included Barwell, Edmonds, Howe and de Veen (1985), Dawson and Barwell (1993) and Malmberg Calvo (1994). These all advocated the need for pro-poor transport policies.

More recently, there have been several attempts funded by bilateral donors and multilateral development banks (MDBs) to review the evidence relating to transport and poverty, and in some cases provide policy and implementation guidance. These have included Booth, Hanmer and Lovell (2000) for the World Bank and DFID; Setboonsargn (2005), Cook et al (2005) and Duncan (2007) for ADB; Transport Resource Centre (2002) and Norman (2013) for DFID and Faiz (2012) for the Transportation Research Board. Some have been developed as ways of presenting the policies and achievements of the agencies (ADB, 2012, for ADB; Netzhammer, Schmid and Breiholz, 2013, for GIZ). These reviews have contributed valuable ideas and sources to this study.

3.2 Poverty and economic growth

It is widely believed that mobility is a key driver of development, with positive economic and social benefits from investment in transport (World Bank, 2009; Kopp, Block and Iimi, 2013). As highlighted by the Transport Resource Centre (2002), appropriate transport is required for achieving the Millennium Development Goals (MDGs). It can be argued that a very significant part of the poverty reduction achievements of the MDGs (eliminating hunger, improving education, reducing child mortality, improving maternal health, etc) have been due to the improved mobility of the target populations, supporting services and goods, however the relationships between transport and poverty are complex.

Many of the macro-economic studies focus on economic growth, and phrases such as 'poverty reduction' may be included in abstracts and key words on the basis that poverty reduction is an inevitable consequence of economic growth. While there are clearly linkages between economic growth and poverty reduction in the long term, in the short term the poor may benefit very little from economic growth. The poorest sectors of society may not be able to benefit from improved transport and they may actually be marginalised by the externalities related to that growth (eg, Hettige, 2006; Gachassin, Najman and Raballand, 2010; Khandker and Koolwal, 2011; Mu and van de Walle, 2011). The more important pro-poor studies disaggregate the benefits of economic growth for different groups, clarifying whether poor people are benefiting from the investment interventions and/or the resulting economic growth.

From an impact analysis of rural road projects and integrated rural projects in Asia (one of each type in Sri Lanka, Indonesia and the Philippines) Hettige (2006) concluded while communities and the poor benefitted, there was little evidence that the 'very poor' benefited from the roads. Better rural roads are a necessary, but not sufficient, condition for graduating from poverty. The integrated projects (with roads components) had a greater impact on overall poverty reduction, but this was not always clear (Hettige, 2006). In another ADB review of the poverty impacts of transport investments in Asia (notably China), Duncan (2007) also concluded that good transport infrastructure was essential for economic growth and overall poverty reduction, but transport investments alone were not sufficient to address the problems of the poorest households.

3.3 A caveat: the origins of reviewed literature and authors

Over 300 documents were selected for review and an additional sixty or so were added by the authors. Most of the literature was derived from bibliographical searches using English keywords. Such searches naturally favour English language publications and formally-published documents (or ones for which English bibliographical entries have been prepared). There has not been any systematic analysis of the origin and authorship of the documents, however several basic observations can be made about the literature selected for review.

Many documents have derived (directly or indirectly) from work of bilateral donor agencies (notably DFID and GIZ) and the MDBs (notably World Bank and ADB) and three UN agencies (ILO, UN-Habitat and WHO). Two UK consultancy organisations (IT Transport and TRL) have been involved in a range of studies. Relatively few documents originate from the regional UN agencies, the Africa Development Bank or other development banks. The majority of documents have been produced by international (mainly 'western') organisations or publications. The majority of authors would be considered 'western' or 'northern': most of the 'southern' authors have been working for international organisations. While most, or all, of the studies carried out in 'southern' countries were undertaken in collaboration with national ministries or other local organisations, their publication has generally been through international channels and generally with 'northern' or 'international organisation's authors or co-authors.

4 Rural roads

4.1 Poverty, access and isolation

A great deal of the transport time of rural people, particularly rural women, is spent on paths close to the village that are used to access water, fuel wood, fields, pastures and village amenities (Assefa Mehretu and Mutambirwa, 1992; Bryceson and Howe, 1993; Fernando and Porter, 2002; Lema, 2007). Footpaths are also the main way in which most rural people start their journeys to connect to the road network, transport services and towns. The problems and the isolation of rural people can be exacerbated by poor footpath condition and/or the lack of bridges that would allow the safe crossing of rivers (Starkey et al, 2009).

Using census data and spreadsheet modelling, Gibson and Rozelle (2003) calculated that the incidence of poverty for people living over 60 minutes' walk from a road in Papua New Guinea was double that of people closer to the road. In the modelling, increasing access through road construction, reduced poverty and increased enrolment in education and literacy. Bringing people to within two hours walk of a road, reduced poverty by 5.7 percentage points and reduced severe poverty by 10.9 percentage points (Gibson and Rozelle, 2003).

In addition to some long-standing, traditional designs for paths and bridges, various new designs of trail bridges, cable systems and footpath construction have been developed and tested for use by community organisations, NGOs and government departments (ILO/ASIST 2000; Lebo and Schelling, 2001; IT Transport, 2002; SKAT, 2002; IT Transport, 2004). Engineered paths and trail bridges reduce travel time, improve safety and increase rural people's access to markets and services. Some countries, including Lesotho and Nepal, have specific units responsible for installing and maintaining rural footbridges. A labour-based rural transport project in Peru rehabilitated and maintained 7000 km of trails, primarily used by women and children (McSweeney and Remy, 2008). A study on trail bridges in Nepal illustrated not only the life-saving implications for people travelling to medical services, but also the impact of medical outreach. Vaccination and medical outreach teams were much more likely to travel to villages if there were good trails and footbridges (Trail Bridge Support Unit, 2008).

Poor rural people often cite the need for better transport (roads and transport services) as key investments that would improve their lives (Cook et al, 2005; Lema, 2006; Riley and Bathiche, 2006; Odoki et al, 2008). Investment in rural roads can involve connecting villages that are not on the road network and/or improving the maintenance and quality of existing rural roads. Both types of investment bring significant benefits to rural communities and to poor people, but there is evidence that the greatest benefits often come from providing motorable access to people that are currently far from any road.

From a study in Ghana by Hine and Riverson (1982), the benefits of upgrading footpaths to roads could be a hundred times greater than improving existing roads. This was because of the greatly reduced transport costs when trucks or other motorised transport replaced human portage. Similarly, studies from Nepal have shown very high benefit to cost ratios for new rural roads that allow human portage (or pack animals) to be replaced by light trucks (Shrestha and Starkey, 2013). A study of public investments in rural Uganda suggested that the most basic 'feeder' roads had a benefit-cost ratio of 7.2, with 34 people taken out of poverty for each million shillings invested (Fan, Zhang and Rao, 2004). In contrast, the benefit-cost ratios of gravel or tarmac roads were not significant. The impact of small feeder roads on poverty reduction was three times greater than gravel or tarmac roads, per unit of investment (Fan et al, 2004). Fan and Chan-Kang (2005), in an important study of the investments in roads in China, concluded that while China's huge investments in expressways was economically beneficial for China, the greatest returns to investments came from the construction of low-volume rural roads. The investment in such roads also had a greater

influence on poverty reduction than investments in better-quality, high-volume roads. The benefit-cost ratios of 'low quality' (rural) roads were four times greater for national GDP than investments in 'high-quality' roads (Fan and Chan-Kang, 2005). Banjo, Gordon and Riverson (2012) in their World Bank review of rural transport, emphasised the need to focus rural transport investments on the lower end of the rural road network—community roads, paths and trails—in order to meet the rural access and mobility needs of smallholder farmers.

Modelling longitudinal household data from 15 villages in Ethiopia, it was found that improved access (all-season, motorable rural roads compared to paths and trails) reduced poverty by 6.9 percentage points and increased consumption growth by 16.3 percentage points (Dercon and Hoddinott, 2005; Dercon et al, 2009). In Pakistan, poverty and poor rural connectivity were correlated, with the lowest income quintile having, on average, poorer access (Essakali, 2005). Twenty percent of villages in Pakistan were not connected by all-season roads and this lack of connectivity was correlated with lower school attendance (particularly for girls), less immunisation and poorer maternal health statistics (Essakali, 2005). Impact evaluations have demonstrated comparable impacts of feeder roads that have been correlated with greater educational enrolment, literacy, market access, non-agricultural work and economic diversification in Vietnam (Mu and van de Walle, 2011), Morocco (Levy, 2004) and Bangladesh (Khandker, Bakht and Koolwal, 2009).

4.2 Agricultural production

Most rural communities depend on agriculture (including crops, livestock, fisheries and forestry) for subsistence and income generation. Improving agricultural production can provide economic justification for new investments in the construction and maintenance of rural roads, and should lead to increasing rural incomes. Knox, Daccache and Hess (2013) reviewed in some detail 27 published documents linking road access to agriculture and their study summarised briefly many analyses of how the construction of rural roads had led to increased agricultural production. Examples included new roads correlated with lower input prices and freight costs in India (Lebo and Schelling, 2001), increasing crop outputs in Ethiopia (Dercon et al, 2009) and increasing cultivated farm areas in Nicaragua (Orbicon and Goss Gilroy, 2010). Escobal and Ponce (2002) also reviewed 25 documents relating to various countries in Latin America and elsewhere that reinforced the benefits of small rural roads in terms of enhanced agricultural production, employment, living standards and poverty reduction.

The agricultural benefits of rural roads have been clearly identified in many countries. The lack of rural roads and the poor quality of road infrastructure has been cited as a major constraint to agricultural production in East Africa (Salami, Kamara and Brixiova, 2010). However, the link between greater agricultural production and poverty elimination can be complicated by issues of land ownership and costs, employment and migration. In an influential study, Binswanger, Khandker and Rosenzweig (1993) analysed large survey databases in India with many variables and concluded that, excluding weather, irrigation and other issues, roads contributed directly to agricultural production (by 7%) and increased fertiliser use (also 7%). However, there were complex interactions, with the location of credit facilities and markets being very significant (and influenced by road provision and other factors). In a more recent study in India, Bell and van Dillen (2012) re-surveyed villages in Orissa recently connected to the road network by the huge PMGSY investment in rural roads. They were able to quantify increases in 'farm gate' prices of rice (5%) with greater benefits for vegetables and other crops and lower costs for fertilisers and chemicals (Bell and van Dillen, 2012). Aggarwal (2014), analysing other Indian PMGSY datasets, concluded that connecting villages with all-weather roads increased the use of fertilisers and 'improved' crop varieties.

Stifel and Minten (2008) used national survey data to show how isolation (distance from roads) in Madagascar was associated with low agricultural yields (a correlation independent of soil fertility). This was attributed to transport costs (for agrochemicals and harvested produce), extensive rather

than intensive practices, price fluctuations and insecurity. Jacoby and Minten (2008) also studied isolation in Madagascar with an emphasis on the higher transport costs associated with inadequate rural roads. They created a model that suggested a new rural road would reduce transport costs and improve incomes of the remotest households (the main beneficiaries) by about 50%, mainly from non-farm earnings. They also speculated on the implications of road-related migration, both to the towns and to the rural areas for people wanting low-cost land with the benefits of transport access (Jacoby and Minten, 2008).

In a spatial analysis that correlated travel times (road connectivity), crop yields and agro-ecological potential in sub-Saharan Africa, Dorosh, Wang, You and Schmidt (2010) concluded that investment in rural roads directly affected agricultural production. They suggested that agricultural production in areas more than eight hours travel time from a town of 100,000 people was only at 5% of its potential, compared with 45% of its potential in areas less than four hours travel time from a large town. Using data from Mozambique, they argued that investing in small rural roads would be the most cost-effective way to improve overall road connectivity. Like many authors, they concluded that while the benefits to agricultural production from better rural road connectivity should be clear, the implications for rural people would be complex, with changes in agricultural prices and practices and migration to cities (Dorosh et al, 2010). An analysis of options for transport investments for increasing agricultural production in South Sudan also concluded that emphasis should be on low-cost roads linking villages to markets (World Bank, 2012).

While it is clear that rural roads can promote enhanced agriculture production, the impact on communities is not always straightforward. A study in Peru looked at the impact of rehabilitating trails (non-motorised roads) and engineered, earth feeder roads by comparing household surveys before and after rehabilitation (Escobal and Ponce, 2002). The rehabilitated infrastructure was associated with greater incomes from non-agricultural sources. Incomes and opportunities were greatest on the rehabilitated feeder roads, but the rural residents invested their extra income in livestock. This was interpreted to be due to their assumption that the transport benefits would be temporary as the roads would probably fall into dis-repair again (Escobal and Ponce, 2002). Impact evaluations on agricultural feeder roads in Zambia also showed complex patterns: agricultural production and cotton sales increased and many communities considered improved access was responsible for a better quality of life: but some communities did not consider their lives had improved because of the road project (Kingombe, 2011).

4.3 Access to health care

Medical literature on maternal mortality tends to underplay the key role of transport (Gil-González, Carrasco-Portiño and Ruiz, 2006). However, transport infrastructure and means of transport (including transport services) are both crucial to overcome the potentially fatal 'three delays' in peri-natal care - making the decision to seek care, travelling to reach healthcare and then the treatment within healthcare system (including referrals to other locations) (Thaddeus and Maine, 1994). Babinard and Roberts (2006) reviewed many studies from around the world to highlight how poor access was a major cause of peri-natal mortality, with an estimated 75% of mortality resulting from inadequate transport to access basic health facilities and/or transport for referrals to hospitals. Transaid (2013) also reviewed case studies from many countries to illustrate the importance of distance, transport infrastructure and means of transport from outlying villages to health centres, and from health centres to hospitals. Human portage, stretchers, animals, bicycles and motorcycles were often required for the initial transport leg. Poor roads and lack of ambulances (or other transport) affected referral journeys. Shrestha and Workman (2008) identified transport problems as a major cause of peri-natal mortality in the hills of Nepal (where most journeys were on foot) and with worst outcomes among the most disadvantaged ethnic groups (thought to be associated with insufficient money and lack of awareness). Appropriate access infrastructure and

transport are also needed to ensure medical staff and supplies (including blood products) are available in health posts (Babinard and Roberts, 2006; Transaid, 2013).

The corollary of the problem analyses is that constructing and maintaining rural roads, paths and bridges leads to improved maternal health outcomes and healthier rural communities. There is much anecdotal and survey evidence to support this, although, unlike the case for road safety, there do not seem to be any clear aggregated statistics showing how better rural roads, bridges and trails would improve public health. As part of a wider review of transport and poverty, Brennen and Kerf (2002) reviewed eight studies from around the world and concluded that reducing the cost and time to reach health centres through improved transport frequently leads to an increase in timely access of the poor to health care. Molesworth (2006) has pointed out that although the health benefits arising from rural road provision can be huge, there are complex interactions and externalities that have to be taken into account. Providing road access can increase the prevalence of sexually transmitted diseases (including HIV/AIDS) and subsequent migration and employment changes can adversely affect the income, status and health of certain groups, notably disadvantaged women (Molesworth, 2006). Downing and Sethi (2001) pointed out that while rural roads would certainly improve access to health care, poorer members of the communities might not benefit due to transport fares and the constraints of medical fees, opportunity costs and distrust of formal health care.

Bell and van Dillen (2012) examined the health benefits of connecting villages by all-season roads in Orissa, as part of the PMGSY rural road project. The survey data sets and short time span were not able to identify statistically significant effects relating to disease morbidity and mortality, but they clearly demonstrated that sick people were increasingly taken to distant hospitals rather than being treated in village health centres. From qualitative surveys, the local people were convinced that their well-being was better, lives had been saved and the death rate was lower (Bell and van Dillen, 2012).

It is not just living people who need to travel: in many societies people who die away from their home villages need to be transported back for burial. If villages are not connected to the road network, this may involve carrying corpses or coffins for long distances. As Starkey et al (2009) reported from Lesotho, this is a particular problem for poor people who may not have the contacts or resources to arrange what is often a labour-intensive, difficult and perhaps unpleasant transport operation involving several hours walk from the nearest road.

4.4 Access to education

Rural roads can greatly influence where schools are built, how many rural boys and girls go to primary and secondary schools and how adequately the schools are staffed. In most countries, rural primary schools are within walking distances of their catchment communities, but secondary schools are more spaced out, requiring much longer average journeys (and perhaps boarding arrangements). China has recently closed most village-based schools and concentrated primary and secondary education in small towns. This policy necessitates the provision of good village-to-town transport infrastructure and transport services (Starkey, 2013). In Nepal, the construction of a new rural road led directly to the construction of a new secondary school funded by a private foundation (Starkey et al, 2013b). A programme of maintaining rural pathways and feeder-roads in Peru, increased primary school enrolment for girls by 7% and secondary school attendance for boys by 10% (McSweeney and Remy, 2008). Mukherjee (2012), in an analysis of the databases associated with the large Indian PMGSY rural road project, suggested school attendance increased by 22% as a result of the new village access roads. Enrolment from disadvantaged groups ('backward castes') increased significantly, but so did enrolment from other groups (Mukherjee, 2012). Aggarwal (2014) analysed other Indian PMGSY datasets and concluded that there was a 5% improvement in primary educational enrolment for 5-14 year old children, without significant gender differences. However, Aggarwal (2014) also identified a drop in enrolment for 14-20 year olds, which was thought to be

related to greater employment opportunities for young people associated with improved road access.

In the Luapula Province of Zambia, education provision suffered from poor rural transport services. The transport problems caused absences from work for several days each month as teachers travelled long distances by bicycle to collect their salaries. The lack of transport services made it difficult to keep rural teachers at their posts (Starkey, 2007b). Similarly, in rural Morocco, rural road building improved the quality of rural education as it was easier to recruit and retain teachers (Levy, 2004). Bell and van Dillen (2012) were able to quantify the effect of road access on teachers' attendance using follow-up surveys in Orissa, India. Several of the new PMGSY roads connected villages that already had primary schools. Village primary school attendance was therefore largely unaffected by the new roads but days lost due to teacher absence decreased fourfold (a statistically significant difference). A similar effect on improved secondary teacher attendance was seen in a surveyed village with a secondary school that was recently connected by an all-season road; overall secondary school attendance and retention was deemed to benefit from the new roads (Bell and van Dillen, 2012).

4.5 Non-equal benefits

While rural roads undoubtedly benefit impoverished communities and poor individuals, it is not surprising that the greatest benefits of rural roads will go to those with the resources to invest in the new opportunities available. Gannon and Liu (1997) stressed that better transport reduces absolute poverty through lowering costs and increasing opportunities, but it had no claim as a policy instrument for the redistribution of welfare for the poor. Windle and Cramb (1997) studied the impact of rural roads in Sarawak, Malaysia and concluded that while all people connected by a road could benefit from it, the greatest gains in terms of improved prices and economic opportunities were for those rural people who were closer to the larger towns. Jacoby (2000) modelled data from household surveys in Nepal, with particular attention to land values, wages, distance to a road and agricultural production and marketing. He concluded that the poor do benefit greatly from investments in rural roads (particularly longer rural roads) although the benefits are not sufficient to reduce inequalities. He likened the benefits to a rising tide that lifts all sizes of boats (Jacoby, 2000).

Khandker and Koolwal (2011), drawing on survey data from road-building projects in Bangladesh, demonstrated the benefits to households in the 25-50% percentile of per capita food expenditure (in this respect, the poorer percentiles benefited most from the investment). However, the authors concluded that 'the very poorest households may not be as able to capture the cost and productivity benefits of the road project'. This point was also illustrated in a study of the benefits of six projects to construct rural roads in Nepal. The survey analysis showed 25% increases in average incomes and food security along the new road corridors. The incomes of 'disadvantaged' ethnic groups had increased by 15%, but the incomes of 'non-disadvantaged' groups had increased by 37% (Starkey et al, 2013b). The roads benefited poor people, but rural people with greater access to capital and resources could respond better to the new economic opportunities. This study also noted a decline in traditional markets where the roads improved access to urban markets (Starkey et al, 2013b). This accorded with an analysis in Vietnam where economic diversification was greatest in rural communes close to towns, and where greatest beneficial impacts of rural roads on poverty reduction were associated with the remoter, poorer communes with little existing market development (Mu and van de Walle, 2011).

Gachassin, Najman and Raballand (2010) studied the poverty impact of roads in Cameroon. They observed that it was not rural roads per se that reduced poverty but the opportunities they bring (notably non-agricultural employment). They concluded that that uniform road building would not have the best impact on poverty reduction, but that road programmes need to be targeted to the real needs of the communities and road users (Gachassin, Najman and Raballand, 2010).

Socio-economic surveys following rural road improvement in Kenya showed that most of the new movements along the rehabilitated roads were associated with work and business opportunities and health-related visits for 'non-poor' people, including many women (Ahmed, 2010). Poor people along the improved roads did not use the roads so much, particularly for health and educational purposes. However poor people living close to the improved road did travel more for all purposes than poor people living by the non-improved, 'control' roads (Ahmed, 2010). The implication again is that road investments do increase economic activity and they do reduce poverty, but people with resources (the non-poor) tend to benefit most. This was also a conclusion of impact evaluations in rural-road related investments in Indonesia, the Philippines and Sri Lanka (Hettige, 2006).

Cook et al (2005) looked at the impact of transport and energy investments supported by the ADB and the World Bank in China, Thailand and India. They concluded that the poor do appear to benefit proportionally from rural infrastructure investments and reduction in travel times in the medium term, although some could be marginalised. In a related study, the issue of non-equal benefits was summarised well by Duncan (2007) in a review concentrating on Chinese experiences. He concluded that rural poverty should be considered a household phenomenon, and not a village one. Villages are not homogenous, and building roads to connect villages will allow the more well-off households to benefit most. Poorer households will benefit significantly, but they may not have the resources to make full use of new opportunities. Transport interventions are unlikely to resolve the chronic problems of the poorest people, who may even be further marginalised by the changing economic circumstances (Duncan, 2007). Roads reduce poverty and provide economic opportunities, but poverty elimination needs to be addressed in parallel with any with road investments.

4.6 Long-term benefits and negative consequences

A review of transport infrastructure projects funded by ADB, cited examples from Indonesia, China, Lao, India and Thailand as evidence of clear, positive, long-term macro-economic and micro-level impacts (Setboonsarn, 2005). This was reinforced by a more recent overview of infrastructure investment and poverty reduction (ADB, 2012). While the economic benefits of rural roads can be clear, there are some questions relating to the durability of the pro-poor benefits and to the possible rise of negative externalities. Several authors have noted that benefits relating to farm-gate prices, labour rates and land values tend to equilibrate over time and positive and negative migration effects may increase (Jacoby, 2000; Stifel and Minten, 2008; Dorosh et al, 2010; Gachassin et al, 2010; Khandker and Koolwal, 2011). Molesworth (2006) highlighted the negative effects of HIV/AIDS and rural migration associated with building rural roads. Bell (2012a) questioned the huge road maintenance implications of the massive PMGSY road-building programme that will connect all Indian villages to the road network. He also pointed to the externalities (accidents, congestion, pollution) associated with extra traffic travelling from the feeder roads to nearby towns.

4.7 Policy implications

The government of India has made a policy decision to connect all villages with more than 500 inhabitants (or 250 inhabitants in the remoter areas) to an all-season road. China also aims to connect all 'administrative villages' with all-weather roads. However, some people have questioned whether it makes economic sense to try to connect all villages with motorable roads. Raballand, Macchi and Petracco (2010) suggested that the ambition of bringing all people to within two kilometres of an all-season road was unrealistic in Sub-Saharan Africa. They considered that ensuring all rural communities were within five kilometres of an all-season road was a more realistic development goal. The 'first mile' (or first five kilometres) can be paths or tracks suitable for walking or intermediate means of transport (IMTs) including motorcycles.

Many small rural roads have few, if any, transport services, and so most people use such roads to travel by walking or IMTs (IT Transport, 2003; Raballand et al, 2010; Raballand et al, 2011, Starkey et al, 2013a). Raballand et al (2010) argued that infrastructure that connects villages to the road network need not be designed to a standard (and cost) suitable for trucks. This is a resource-allocation argument, which could influence poverty-reduction strategies negatively if interpreted as a 'laissez-faire' option. Much evidence has been cited here that investment in low-cost, low-volume roads (including tracks, paths and trails suitable for pedestrians and IMTs) to connect villages appears cost-effective and highly beneficial (Hine and Riverson, 1982; Fan et al, 2004; Mu and van de Walle, 2011).

Even if low-volume rural roads do not immediately lead to daily conventional public transport services, they can still be beneficial for emergency transport, market-day transport and attracting service provision (teachers, extension workers, immunisation teams and development projects). On a new rural road surveyed in Nepal, it was reported that not only did the road provide invaluable access for ambulances for emergencies, but that the road alignment and gradients also made the road preferable (safer, more comfortable and more secure) to local paths for carrying poorer people (including women in labour) to hospital on stretchers (Starkey et al, 2013b). Cook et al (2005), based on impact evaluations in Asia, suggested that improved access and mobility for service providers (including teachers and medical staff) was of particular benefit for the poor, as they were less able to travel to more distant services.

4.8 Measurability of pro-poor benefits and investment priorities

Almost all the papers reviewed that have tried to quantify the benefits of rural roads have been based on analysing two or more time-separated household surveys. The analyses involved statistical correlations with the proximity to roads and/or to changes to roads and the results have generally been interpreted as cause and effect relationships. Anomalous correlations have generally been ignored (though some authors have attempted to explain them).

Research based on large databases (eg, national household census information) may identify correlations, but knowledge of local factors may be needed to understand the importance of the various findings. Studies based on individual roads (or catchment areas) appear to be more accurate as the authors generally have a good idea of road context and can explain the implications of correlations. One of the issues of the correlation approach is that road building and population distribution are not random. Road locations may have been decided by the presence of natural resources and influential populations. Poor populations and areas may have characteristics that can reduce the beneficial impact of rural roads (Mu and van de Walle, 2011). Furthermore, proximity to roads is not the same as access to markets and services: poor people need appropriate transport services and statistical parameters concerning rural transport services are seldom available in national databases (Starkey et al, 2013a).

Conventional cost-benefit analyses based on road appraisal models such as HDM4 and RED for low volume roads often fail to justify investment costs, as the traffic levels are too low to show a net discounted benefit from vehicle operating cost savings (van de Walle, 2000). Wider economic and social benefits are generally ignored and insufficient attention is paid to the value of time for different rural people. In a study on the value of rural time, ways of quantifying the time benefits of rural transport have been proposed (IT Transport, 2005).

Two related studies have proposed ways in which the social costs and benefits of rural roads can be measured and built into road appraisal programs (TRL, 2004; Odoki, Ahmed, Taylor and Okello, 2008). These studies have not yet led to mainstreaming pro-poor social measurements into conventional rural road assessments. This is partly because of the problems of identifying and accurately measuring consistent and robust statistics, and the considerable differences in

perceptions and weightings given by local communities and by district and national authorities (Odoki et al, 2008).

It is widely agreed that social benefits do need to be quantified appropriately to justify and prioritise rural road investments. Measurements of social benefits of roads tend to emphasise the benefits accruing to the better off rural people and omit benefits that favour the poor (van de Walle, 2000 and 2002). Modelling techniques to reduce bias when correlating road access and poverty have been discussed by Khandker, Bakht and Koolwal (2009), Gachassin, Najman and Raballand (2010) and Mu and van de Walle (2011). Bell (2012b) has proposed a model for estimating the social benefits of roads in terms of goods, health and education. The Asian Development Bank has been developing a project-based Sustainable Transport Appraisal Rating (STAR) multi-dimensional measurement tool that includes economic, poverty and social, environmental and sustainability risk criteria (Véron-Okamoto and Sakamoto, 2014). This tool should be useful for appraisal, monitoring and evaluations and may assist in standardising approaches to measuring the impacts of transport on poverty. Researchers working with the International Forum for Rural Transport and Development (IFRTD) have been investigating ways of measuring rural transport services, with the aim of developing standard indicators that assess the access provided by transport services from the points of view of the users, the operators, the regulator and development personnel (Starkey et al, 2013a).

Measuring the impact of roads on poverty is clearly a retrospective exercise, albeit one that can be used to predict future impacts of investment decisions. As there is some discussion on the desirability of connecting all villages (Raballand et al, 2010), localised, participatory planning may allow local communities to determine their own priorities. Integrated rural accessibility planning (IRAP) has been developed as a tool for this (Dingen, 2000; Lema, 2007). It is likely that most rural communities would like to be connected to the national road network by a 'black-top', all-weather road. However, given limited investment resources, villagers may have other priorities. The poorest people may be more concerned about within-village tasks, such as collecting water and fuel. Investments in health and education facilities, electricity and agricultural irrigation may be of higher immediate concern than roads (although the influence of rural roads in achieving these benefits has been demonstrated in the literature). The more influential and vocal villagers may well be those who would benefit most from rural roads (eg, village leaders, storekeepers, teachers, health workers and agribusinesses). An example of gender-sensitive, participatory approach in Timor Leste was described by Gajewski, Ihara and Tornieri (2007).

4.9 Involving rural people in road construction and maintenance

There is much evidence that involving local people in labour-based road construction and maintenance can provide valuable employment for poor people and help empower women and disadvantaged groups (Devereux and Solomon, 2006). Instead of construction and maintenance funds going towards the use of heavy equipment, imported fuel oils and urban-based contractors, the money is spent on employment within rural areas. The money 'transferred' in this way can reduce poverty and improve livelihoods, particularly for people for whom there are many days of work over a long time (Devereux and Solomon, 2006). Labour-based maintenance systems, organised by community-based organisations or small contractors can be highly appropriate, providing paid employment and ensuring there are people 'on-site' to keep roads in motorable condition (IT Transport, 2013). The transport requirement of road maintenance can justify investments in small-scale transport (including animal-drawn carts) that have further benefits for year-round transport and also agricultural production (Fischer, 1994; Dercon et al, 2009).

To be 'pro-poor', labour-based employment in rural areas may need to be targeted. For example, just over half of the people employed in a Botswana labour-based rural roads programme were 'non-poor' (Teklu and Asefa, 1997), although the programme did provide valuable employment for many 'poor' people. In a labour-based road programme in South Africa, the pro-poor benefits of

employment were reported to be short-lived, albeit important in the short-term for those employed people (Musekene, 2013).

Labour-based road schemes can bring social benefits to women, in addition to short-term incomes. The employment of women for road construction and maintenance within community-based organisations and small-scale contractors may improve their social standing and offer entrepreneurial opportunities (ILO, 2010). Concrete examples of this have been provided from Peru (Gutierrez, 2009), China (ADB, 2011) and Nepal (Starkey et al, 2013b). Using participatory methods and involving men and women in road maintenance enterprises in Peru led to community benefits beyond the infrastructure and promoted transparency in local government level and empowered women to participate in meetings and form micro-enterprises (Gutierrez, 2009; McSweeney and Remy, 2008; ILO, 2010).

Howe (2001) suggested that the good track record of the many pilot projects and some long-term programmes should justify labour-based construction as the default option for rural roads. As there are great potential benefits from involving poor people in road construction, the labour-based agenda has often been driven by pro-poor development agencies. The transport sector itself tends to be dominated by engineers who favour modern machinery; transport ministries and the transport contracting industry have tended not to be proactive in mainstreaming labour-based methods except where external funding agencies have promoted this. For example, a review was undertaken of a 13-year Swiss-supported labour-based road construction programme in Nepal. This had successfully provided five million persons days of work of which half was for 'disadvantaged groups', including women and marginalised castes (Starkey et al, 2013b). However, this exemplary programme had not won the hearts and minds of the transport sector in Nepal. Government transport officials still preferred machine-based operations that were quicker, easier to organise and gave more scope for corrupt receipts. In other rural road-building programmes in Nepal, commercial contractors generally avoided the complications of using local men and women workers. They sometimes accepted contract penalties for using non-labour-based methods and sometimes they used teams of migrant men who were more easily supervised and were cheaper for the contractors than locally-sourced labour (Starkey et al, 2013b). The transport sector seldom sees its role in terms of poverty alleviation, and so road-funding organisations (donors, MDBs and government agencies) will need to have very clear, pro-poor policies and conditions if the rural poor are to gain significantly from the potential employment benefits of rural road construction and maintenance.

Guidelines to help planners and engineers adopt labour-based approaches have been prepared by IT Transport (2003), Kafle (2006) and ADB (2011). ILO has prepared guidelines for adapting tools so that people with disabilities can be included in labour-based programmes (Dilli, 1997).

4.10 Concluding observations on rural roads

Most of the world's poor people live in rural areas isolated by distance, terrain and poverty from employment and economic opportunities, markets, healthcare and education. Lack of good infrastructure (paths, trails, bridges and roads) and access to transport services makes it difficult for poor people to overcome the obstacles to economic freedom, healthy families, education and participation in national development. There is clear evidence that rural isolation is associated with relatively low agricultural production (linked to poor market access and low use of fertilizers and modern agricultural technologies). It is also associated poor health (with unnecessarily high perinatal mortality) and low school enrolment. Rural isolation can imprison the elderly and people with disabilities.

Rural isolation can be mitigated by provision of appropriate rural roads, trails and bridges. Greatest benefits come at the periphery of the road network, when remote communities are connected (or re-connected) to the national network. Providing rural roads, tracks and bridges benefits rural

communities, but people with resources will benefit more from the better access to employment markets, healthcare and education. The poorest people may not have the resources to travel to, or afford, the newly accessible markets and services. Rural roads lead to overall poverty reduction but not poverty eradication and socio-economic equity. Rural roads programmes need to be integrated with other measures to increase equity and minimise the potential for negative socio-economic and cultural effects of opening roads on some rural women, men and children. Labour-based construction and maintenance systems can 'transfer' funds through rural employment, and can have significant pro-poor benefits if women and disadvantaged groups are targeted. However, the transport sector generally favours machine-based systems and labour-based systems still require significantly championing by socially-aware ministries, development agencies and MDBs.

National authorities need to ensure resources are allocated for the construction and on-going maintenance of rural roads. Emphasis should be on connecting isolated communities with low-volume, low-cost all-season roads, trails and trail-bridges, suitable for light vehicles including motorcycles and IMTs. These should give high cost-benefit returns when analysed in ways appropriate for low-volume, rural investments. Although the rural access feeder roads may be built and maintained using the low-cost standards appropriate for low traffic volumes, policies require pro-active implementation programmes to ensure adequate all-season connectivity. Infrastructure construction and maintenance should be based on participatory planning, involving rural communities (disaggregated appropriately by gender and disadvantage) and key service providers (health, education, agriculture, water, electricity) to maximise the social and economic benefits and help eradicate poverty.

Although the literature provides evidence of the huge benefits to agricultural production, public health, education and poverty alleviation that can come from improving rural access, there appear to be no agglomerated statistics that highlight the potential national, regional and global benefits. In contrast, the World Health Organisation (WHO) and other agencies have produced documents that spell out clearly the cost of road accidents and the predicted costs of inaction (WHO, 2013). Such statistics have been widely quoted throughout the media and are influencing policy debate at national and international levels. National and international policy on improving rural access could be influenced by comparable authoritative statistics and projections, showing the cost on inaction on rural roads, trails and footbridges in terms of public health, peri-natal mortality, school enrolment, lost agricultural production and food wastage. The multilateral development banks and specialised UN agencies (eg, WHO and FAO) could take a valuable lead that could help reduce rural isolation and poverty.

5 Rural transport services and intermediate means of transport (IMTs)

5.1 Access, proximity and mobility

Rural people need access to shops and markets (for buying and selling), to key services (health, education, energy, information, civic functions), to income-earning possibilities and to socio-cultural opportunities (cultural and sporting events, religion, family visits). This access can involve provision of facilities in rural areas (proximity) and/or the mobility to travel to towns or other areas. In developing countries, most people do not own private cars, and the main means for mobility are walking, intermediate means of transport (IMTs) and public transport services. On rural roads, transport services are often provided by informal sector entrepreneurs, and the means of transport may be buses, trucks, pickup, 'rural taxis' (often minibuses, estate cars or pickups), motorcycles, bicycles, tricycles, animal drawn carts or pack animals (Starkey et al, 2002; Starkey, 2007a). In some countries, waterways offer similar mixes of boats, ranging from small, private rafts or canoes to non-motorised and motorised transport services (IFRTD, 2003).

5.2 Intermediate means of transport (IMTs)

Intermediate means of transport (IMTs) range from simple wheelbarrows and hand-carts, to bicycle-based and motorcycle-based technologies and include 2-wheel carts or 4-wheel wagons pulled by oxen, buffaloes, donkeys, mules, horses or camels (Riverson and Carapetis, 1991; Starkey, 2001; Starkey, 2002; Crossley, Chamen and Kienzle, 2009). IMTs provide local transport, carrying people and goods around villages (and towns) and some also provide transport between villages and markets, either for individuals or as informal transport services. On many rural roads, IMTs constitute the majority of the traffic and together they may carry large numbers of people and significant quantities of freight (IT Transport, 2003; Starkey et al, 2013a). In many countries, motorcycles are becoming the most common vehicle on rural roads. For example, a study was carried out on a rural road in Cameroon that had about 200 vehicle movements a day on non-market days (of which 100% were IMTs, mainly motorcycles) and 500 movements on market days (of which 93% were IMTs). It was estimated that motorcycles accounted for 82% of annual passenger kilometres on that road and 74% of the annual small freight transport (Starkey et al, 2013a).

IMTs can be relatively expensive compared to local incomes, and so rural people with resources are most likely to own them. The costs of ownership can be shared through informal tariffs and hire services. As in many transport and poverty situations, the poorest members of communities may not be able to afford either ownership or the informal fares and tariffs. Making credit, or raw materials, more easily available to manufacturers, stockists and potential users can greatly assist the diffusion of IMTs (Starkey, 2001; Porter, 2013). Targeting appropriate credit at users with insufficient resources, for example women or school children, can also improve uptake and improve mobility for disadvantaged people (Malmberg Calvo, 1994). For women, there may be local gender-based constraints that discourage personal mobility or particular types of transport (bicycles, motorcycles, certain animals). Local promotion schemes can help overcome prejudices. Intolerance to women using particular means of transport tends to decrease over time and with greater familiarity (Malmberg Calvo, 1994; Starkey, 2001; Porter, 2013).

National transport authorities have a tendency to neglect the importance of non-motorised intermediate means of transport for poor people. Such IMTs are often considered old-fashioned, inefficient and a temporary stage prior to more universal motorisation. However, their on-going importance in many areas can be very high, as they often provide crucial mobility to access healthcare, schools and markets.

In eastern and central Africa, bicycle taxis (sometimes known as boda-bodas) have provided important transport services, as well as employment opportunities for young men (Malmberg Calvo,

1994; Howe, 2002; Howe, 2003). In Luapula in Zambia, bicycle taxis regularly carried people for distances in excess of 30 km (Starkey, 2007b). Bicycle taxis are increasingly being replaced by motorcycle taxi services, which are more expensive but much quicker (Starkey, 2007b; Porter, 2013; Starkey et al, 2013a).

5.3 Motorcycle taxis and three-wheelers

In many countries in the world, motorcycle taxis are extremely important. Motorcycles, often imported from China or India may be available for a little as USD 500-600, less than half the price prevailing a decade ago (Starkey, 2007b). They provide a modern and attractive employment option for young men, as well as high returns for people who lease them out at low cost on a daily basis (Starkey, 2007b). They also provide vital mobility on rural roads that lack conventional transport services. Men and women users rate them highly (even for transporting goods, access to maternal healthcare and transport for people with disabilities), as do development authorities (Starkey et al, 2013a). Motorcycle taxis are available, timely and will go off the road into villages, so extending the 'reach' and the impact of the road. People might prefer more comfortable vehicles, but in the absence of such alternatives, motorcycle taxis are highly appreciated by rural communities in many countries (Porter et al, 2003; Starkey et al, 2013a);

Motorcycle taxis tend to be anarchic and are frequently overloaded, with accident-prone drivers and insufficient safety features. Some regulatory authorities discourage or ban them, while others try to regulate them for improved safety. In some countries, including Cameroon, Colombia, Myanmar and Rwanda, motorcycle taxi operators have to wear high-visibility tabards (over-vests) with their individual numbers (or that of the motorcycle). In Colombia, some authorities require that the registration numbers of motorcycle are clearly marked on driver and passenger helmets to reduce dangerous behaviour and motorcycle crime. Such regulation is intended improve behaviour as motorcycle drivers realise that they may be easily identified by the police or the public (Starkey, 2011).

Motorcycle taxis provide important mobility for rural people as well as employment opportunities. On some rural roads studied in Tanzania, Kenya and Cameroon, motorcycle taxis have been found to be supplying three-quarters of the entire passenger and freight transport market (Starkey et al, 2013a). However, the relatively high fares charged mean they are mainly used by the more affluent rural people. Poor people, including the sick and people with disability, tend only to use them for urgent travel and emergency transport, in which case they make major efforts to meet the costs.

There is increasing evidence concerning the high accident rate associated with motorcycle taxis with their drivers being at greatest risk of accidents (Guerrero, Bishop, Jinadasa and Witte, 2013). While some authorities simply ban them, this may be counter-productive for the overall welfare of rural people, unless alternative means of transport are available. Sympathetic regulation in consultation with communities appears a more positive way of tackling the problem and ensuring that rural people have appropriate access and mobility (Starkey, 2011).

Motorised three-wheelers are quite common as informal transport services in towns, and they are increasingly rapidly in Africa, Asia and Latin America (but not as fast as motorcycles). They are increasing used around rural (and urban) markets. In Ethiopia, and other countries, they have been replacing horse-pulled taxi carts (FAO, 2011). Compared with motorcycles, three-wheelers have higher goods capacity that benefits the operators and the users. Their greater weight and three wheels make them safer (partly due to reduced possibilities for risky behaviour from their drivers). However they require relatively good infrastructure, and they are less likely to be used along narrow villages paths.

5.4 Animal-drawn carts and two-wheeled tractor-trailers

In all regions of the world, animal power has been extremely important for rural transport. In many countries carts and wagons pulled by oxen, cows, buffaloes, donkeys, mules and horses provide both passenger and freight services between villages and markets (Havard, Vall and Lhoste, 2009; FAO, 2014). Pack animals (notably donkeys, mules and horses) are particularly important in mountainous areas that lack the gradual inclines required for cart use. Although animal power is sometimes incorrectly associated with poverty, transport animals can be expensive to own and maintain and the poorest sections of society may not be able to own them. Poorer people may benefit from employment opportunities and the provision of informal animal transport services by neighbours or transport entrepreneurs (Starkey, 2010).

In China and South Asia, animal-drawn carts have increasingly been replaced by two-wheel tractor trailers that provide hugely important transport services that benefit the rural economies and a wide range of rural people (Faiz, 2013). As two-wheel tractors increase, those still using transport animals may be among the poorer members of society, who may be marginalised by the changes to motorised power, including the banning of animal-drawn vehicles from roads and market areas (Starkey, 2010). However, the poorest people will own neither animals nor two-wheeled tractors.

5.5 Rural bus services, taxis, minibuses and passenger trucks

While IMTs can be used for long distances, they are mainly used for journeys less than 10-20 km. Larger-scale rural transport services (notably pickups, minibuses, midi-buses and multipurpose trucks) are very important for linking villages to agricultural markets and services in towns. In most developing country, rural transport services are operated by the informal private sector, with minimal regulation (generally only for vehicle safety and over-loading on the approaches to towns).

It has widely been assumed that if there are good roads, market forces will lead to transport demand being met by private transport operators. Howe (2001) pointed out that there was a real danger in making 'transport' synonymous with 'roads'. In many ministries, conferences and development agencies 'investments in transport' only means investments in 'roads'. Tsumagari (2007) analysed fifteen years of World Bank investments in rural transport, and concluded that 98% of the 'transport' investment was simply investments in roads and not 'transport'. However, it is now widely agreed that 'roads are not enough' (Dawson and Barwell, 1993): rural people also need public transport services to access markets, services and socio-economic opportunities.

Most countries have adopted 'laissez-faire' attitudes to rural transport services, with little or no public-sector planning and little or no evaluation of the quality or quantity of the services that are provided. Starkey et al (2013a) have argued that this has been partly due to the lack of recognised ways of assessing or measuring the appropriateness of rural transport services. These authors have proposed ways of 'measuring' the effectiveness and appropriateness of transport services from the perspectives of the users, the transport operators, the regulators and those concerned with development (including agriculture, health and education).

There have been plenty of warnings in the literature that have clearly stated that rural people need transport services and that existing services are inadequate (eg, Dawson and Barwell, 1993; Ellis, 1997; Howe, 1997; Ellis and Hine, 1998; Lebo and Schelling, 2001).

Despite the warnings of inadequate rural transport services, there appear to be few studies that have tried to document and to understand the reasons for this 'market failure', and how it affects poor people. IT Transport (2003) looked at IMTs and transport services in five African countries. On most of the roads studied, the main means of transport were walking and IMTs (bicycles and animal carts). A detailed study on transport services was undertaken in Malawi. This 'measured' the use of transport services in relation to the catchment population. It was found that 0.5 to 2% of the

catchment population used transport services each day on some roads (IT Transport, 2003). Without further studies to provide additional comparative data on rural transport services supply and demand, it was difficult to interpret the implications of these findings.

Starkey (2007a, 2007b) reported surveys of rural transport services in Burkina Faso, Cameroon, Tanzania and Zambia with several examples of motorable roads with no transport services other than IMTs. Further studies of transport services in Tanzania and Cameroon suggested that conventional transport services only operated daily on 'regional' and 'national' roads, with the smaller roads ('district' roads) served only by IMTs except on market days (Starkey et al, 2013a).

Raballand et al (2011) reported a trial carried out in Malawi in which five villages were provided with a subsidised minibus service for six months. Village residents were allocated 'tickets' of differing prices in a randomised way. Men and women with tickets that cost little used the service more than those that had been allocated more expensive tickets. However, in none of the scenarios (ranging from high fares and few passengers to low fares with many passengers) was the operator able to make a profit using conventional economic criteria. This is in accordance with the studies of IT Transport (2003), Starkey (2007b) and Starkey et al (2013) where operator margins are very low on roads in poor condition and where there is low transport demand. Operators respond by charging higher prices per passenger-kilometre, using very old vehicles, providing irregular services (waiting for a full load) and/or overloading vehicles. This encourages a downward spiral of transport provision as rural people, particularly rural women, are less likely to plan to travel when services are expensive and unpredictable (Starkey, 2007b).

Anti-competitive practices by transport operators (through cartels or associations) can constraint service standards in some countries including Nepal and India (Maunder et al, 1999). However, transport associations can also help to improve standards through self-regulation (Starkey et al, 2002; Molomo, Venter and Mashiri, 2013; Transaid, 2014). The problems of cartels affect all rural residents in that area, but the poor may be most affected, as these people are the least able to make use of alternative means of transport (including personal vehicles). Nevertheless, the poor have been shown to benefit greatly from taxi associations in Nigeria that have provided special services for emergency transport (Transaid, 2013). In a scheme developed with the national taxi-drivers association, women in labour can summon a taxi that will take the woman directly to a clinic or hospital, and she will only be charged the actual cost of the fuel. As compensation, that taxi driver is promoted to the front of the waiting queue, with other members of the association accepting their being overtaken in the queue as part of the association's community service role.

People travelling on rural transport services often need to carry heavy or bulky freight. Farmers wish to carry produce to market and shoppers bring back goods from the market towns. While such loads may be large for a passenger vehicle (two or three sacks or baskets) they are small freight amounts and it is generally unrealistic to consolidate or consign such loads into freight vehicles. As a result, most rural transport services are 'mixed', with passengers and small freight, in light trucks, minibuses or buses. Many authorities try to ban or discourage mixed transport (which is illegal in many countries). However mixed passenger-freight transport services are extremely important for poor people. More affluent people may have sufficient loads to use freight vehicles, but the poorer people need to transport their goods using 'mixed' passenger transport (Starkey, 2007b).

In many countries, the rural public transport services are characterised by old vehicles, irregular timetables and severe overloading. Such practices are often related to poor road conditions, low economic transport demand and low profit margins. Transport authorities in China resolved to improve transport services by legislating for higher standards. They prohibited informal services (including transport by two-wheel tractors, three-wheelers and agricultural trucks) and only registered bus companies were allowed to tender for rural routes. Safety measures included a seat for every rural passenger and compulsory scrapping of all buses after seven years. With poor roads

and low envisaged loading levels, the regulated fares proposed were high (up to four times the price of rural fares in neighbouring Myanmar and other countries in the region). Despite the high fares, bus companies have been reluctant to operate on poor roads. Of 33 rural roads studied in the Pu'er Prefecture of Yunnan Province, only four had any bus services, and other transport services were not allowed to operate (Starkey, 2013). In this case it appears that the regulatory standards were too high and the result was that many poor rural people had no access to transport services provision. The outcome for rural people and transport services in Pu'er appeared to be worse than that in neighbouring countries with less regulation: most rural people would prefer overloaded informal transport services to no services at all.

6 Poverty, urban transport, urban growth and employment

6.1 The challenges of urbanisation

Urban areas face very different challenges to rural areas, and necessarily the nature of transport solutions are very different. Transport interventions (principally road building) in the rural areas of developing countries are mainly designed to improve the rural economy and so directly help the rural poor. In contrast urban transport interventions are overwhelmingly designed to address the problems of urban congestion and the rapid increase in urban car populations. In this case the main beneficiaries are not the urban poor but are much more likely to be the rich and middle income sections of the population. The poor may benefit from the changes, although often the reverse is the case, particularly with new road building, severance and resettlement.

In 2008, for the first time in history, more than half the world's population (3.3 billion) lived in urban areas. By 2030 this is expected to rise to 4.9 billion. In comparison the world's rural population is expected to remain fairly constant from 2005 to 2030 (decreasing by just 28 million). The fastest growth in urban populations (at about 2.3% per year) is predicted to occur in the developing countries of Asia and Africa, particularly in the secondary cities. There are 75 urban agglomerations above 5 million people and a further 400 with populations between one and five million. In total there are 875 urban areas above 500,000 people. Currently, 52% of the world's urban population live in settlements of less than 500,000 and the bulk of urban population growth will be in these smaller cities and towns rather than in the largest cities. A key challenge that may influence urban poverty is that many of the smaller cities have markedly less administrative capacity to provide services and deal with growth than the largest cities.

Of the world's 20 mega-cities only Dhaka and Lagos are predicted to grow at more than three per cent per year, while six mega-cities will grow at rates under one per cent per year. Although rural-urban migration attracts the most attention, the natural increase of urban areas (which excludes rural-urban migration and urban reclassification) appears to be more substantial, accounting for 60% of the growth in the median countries (UNFPA, 2007).

Cities have been called the 'locomotives' of development, so it is essential that they remain attractive places to work and invest in (World Bank, 2008). Indeed most new factories and offices are located in or near cities so that they can make most use of the diverse skills and the abundant labour. In most countries, the larger cities have higher income levels. There are important economies of agglomeration at work. Cities provide an opportunity to exploit economies of scale in production, the benefits of specialisation, the development of industry-specific skills in one location, better opportunities for innovation from observing and adapting ideas from others, and the advantage of buying and selling in larger markets. Once industrial techniques are perfected in central locations, production is often pushed out to smaller towns and cities where land rents are cheaper (World Bank, 2009).

Rural migrants make a rational choice when moving to an urban area. It has been calculated that since 1990 the transfer of population from rural to urban areas has, on average, accounted for 10% of the national reduction in poverty. Remittances from urban-based non-farm activities are now a major source of income for rural populations. There are many poor people in urban areas, and they largely work in the informal sector. In Sub-Saharan Africa the informal sector accounts for two thirds of urban employment (UNFPA, 2007).

6.2 Decreasing urban density and its implications

As cities grow their population density declines. This trend has been apparent for more than two centuries. An analysis of 25 cities found that densities declined four-fold from their peak of an average 43,000 people per square km in the late 1700s to around 10,000 per square km in 2000

(UN-Habitat, 2013). The current decline in density occurs as cities accommodate motorised transport (notably cars) and build low density housing (urban sprawl) on their outskirts. From 1990 to 2000 average densities fell from 3545 to 2835 in developed countries compared with a drop from 9860 to 8050 people per square km in developing countries. On current trends urban densities will decline by another 26% by 2040. There are currently wide differences in population densities from spread out cities in the United States like Atlanta with a density of just over 1000 people per square km to a city like Hong Kong with a density of around 30,000 people per square km (UN-Habitat, 2013).

City growth and rising incomes is accompanied by a rise in trip length, and a rise in movements, particularly to the inner core area or Central Business District (CBD). Inevitably this leads to congestion and the need to increase transport capacity, particularly in the CBD and the major corridors. City growth also leads to a rise in more complex journeys as people find work or go to school in other areas of the city outside of the CBD. This has implications for public transport as more people need to travel on different transport routes and various means of transport (eg, buses and trains) to reach their destination.

Low density development takes place in the suburban and outer areas of the city, partly to accommodate the parking and movement of cars. It also provides more living space for wealthier households. The growing proportion of the population making trips by car, together with the low density, makes it increasingly difficult to sustain urban public transport in the suburban areas. This, in turn, leads to more car use and increased difficulties for those without access to a car. Urban sprawl has other undesirable effects: it increases public and private costs of infrastructure per residence while reducing the fiscal capability of the traditional core (Gwilliam, 2002).

City density, size, and shape, together with transport infrastructure affect the nature of passenger movements. There are wide variations between cities in passenger modal composition. In the city of Copenhagen, 35% of commuting trips for work and education are on bicycles that are perceived as safe, healthy and appropriate (Copenhagen, 2012). This city is investing to increase its bicycle modal share to 50%.

For many developing countries, non-motorised transport (principally walking and cycling) account for a high proportion of trips, although people do not necessarily consider this safe, healthy and appropriate. Non-motorised transport accounts for 70% of trips for Dakar and Douala, 50% in Beijing and around 40% in Nairobi, Addis, Lagos and Berlin and about 35% for Barcelona, Tokyo and Madrid. With the exceptions of Beijing and Tokyo, walking is the dominant form of non-motorised transport for these cities. In Nairobi, there is little cycling (about 1% of trips) and much of the non-motorised transport comprises people walking long distances to work from the suburbs, often along roads with no pedestrian sidewalks (Pendakur, 2005). In such cases, walking is more associated with poverty than with healthy living. Such long-distance walkers would benefit from safe cycleways and cycle parking infrastructure and/or cheaper public transport.

Public transport accounts for around 60% of trips in Dar es Salaam, Bogota and Paris, 55% in Tokyo, but only around 10% in Douala and Melbourne. Private motorised transport is high in many cities in Australia (eg, 75% for Melbourne) and North America, with 70% in Toronto (UN-Habitat 2013).

City planners, particularly those in high and middle income countries, have in recent years become more interested in refocusing policy to reduce the adverse effects of motorisation on the quality of life in inner city areas and on the poor. While the trend of declining densities has not been reversed, polices have promoted safe cycling and walking such as new cycle ways, pedestrian only streets and green spaces (Copenhagen, 2013). Other measures have included the integrated planning of public transport and measures to promote more mixed land use so housing, jobs and green spaces are brought closer together (UN-Habitat, 2013).

6.3 Urban traffic congestion

Increasing incomes can lead to major rises in car populations. Currently, in 2014, there are estimated to be about 900 million passenger cars and light duty vehicles. This is expected to increase to nearly 1.6 billion vehicles by 2035. The largest increase in car populations is taking place in developing countries. By 2035, China is projected to have approximately 350 million private cars nearly ten times as many as in 2008. Mexico City's car population is increasing twice as fast as its human population, while India's private vehicle population is increasing three times as fast (UN-Habitat, 2013).

Congestion is the inevitable consequence of a rapid increase in car populations, and it has a major adverse effect on daily journey travel times, vehicle fuel consumption and on air pollution. In China despite a massive road building programme average traffic speeds have continued to decline. In central Beijing, average traffic speeds dropped from 45 km/h in 1994 to 12 km/h in 2003. The average speed of buses in major central cities dropped from 30-35 km/h in the 1950s to 10-15 km/h in the 1990s. In 2003, the average bus speed was 9.2 km/h in Beijing and it was 10 km/h in Shanghai in 2004 (Zhong-Ren Peng, 2005). In many cities in the developing countries, weekday traffic speeds are similarly low; less than 10 km/h for Bangkok, Manila and Mexico City and 15 km/h in Kuala Lumpur and Sao Paulo (Gwilliam, 2002).

It is estimated that the total economic damage of air pollution represents up to 10% GDP in polluted cities such as Bangkok, Kuala Lumpur and Jakarta. Furthermore for six developing-country cities with a total population of over 50 million (Mumbai, Shanghai, Manila, Bangkok, Kraków and Santiago) the costs of particulates and other vehicle emissions (excluding lead) are estimated to be the equivalent of 60% of the import cost of gasoline and over 200 percent of the import cost of diesel (Gwilliam, 2002).

An important factor affecting the capability of cities in developing countries to deal with congestion is the low percentage of land devoted to roads. The roads are reported to account for between 5% and 15% of the land areas of developing country cities, compared with around 20 to 25% for most European Cities and about 35% for cities in USA. Cities with under 10% of their area devoted to roads cannot support the widespread use of motorcars (Gwilliam, 2002). However, some cities with very good metros systems can function with quite low areas assigned to roads, as are the cases of Tokyo, Hong Kong and Paris that have 13%, 12% and 11% of land allocated to roads respectively (Barter, 2001).

The main interventions to deal with urban congestion and help reduce travel times are:

- New road construction
- Transit solutions (metros, light rail, bus rapid transit)
- Public transport promotion
- Supporting non-motorised transport
- Traffic management solutions
- Road and parking pricing
- Integrated transport and land use planning.

A number of cities, such as Guatemala City, Curitiba, Portland and Toronto have come to adopt a 'Transit Orientated Development' (TOD) approach to urban development. Here mixed use residential and commercial development takes place close to transit stations, with higher density (generally high rise) developments within 400-800 m of transit station and lower densities further out. In this way people can live and work close to transit stations, with short-distance walking, cycling and public transit being the main means of transport. The Institute for Transportation and Development Policy (ITDP) has developed a Transit Orientated Development framework (TOD Standard) for analysing and measuring spatial developments, densities and public transit demand (ITDP, 2014). This

promotes eight measurable planning parameters which can be assessed to bronze, silver or gold attainment standards.

- Walk: develop neighbourhoods that promote walking
- Cycle: prioritise non-motorised transport networks
- Connect: create dense networks of streets and paths
- Transit: locate development near high-quality public transport
- Mix: plan for mixed use
- Density: optimise density and transit capacity
- Compact: create regions with short commutes
- Shift: increase mobility by regulating parking and road use (ITDP, 2014).

Traffic management solutions may involve a wide variety of measures such as junction widening, white and yellow line marking (to channel traffic and to control parking, loading and unloading), traffic lights, road signs and general parking controls. These can have important effects in reducing congestion. However, to implement comprehensive traffic engineering solutions to maximise traffic flows requires skilled expertise and planning that is not always available or employed in developing cities (particularly in the smaller developing cities in Africa).

One of the most effective ways of reducing congestion is via road pricing whereby vehicles are charged a fee (which may vary according to the time of day) for entering the congested inner city area. The fee has the effect of reducing demand and encouraging users to switch modes or stagger their journey times to an inner city area. Some road tolling systems operate on key tunnels and bridges to the inner city area, examples are Sydney, New York and San Francisco. More comprehensive area congestion charging has been adopted in Singapore, Oslo and London. These approaches can involve electronic number plate recognition systems (as in London) with payment via the internet so that vehicles are not held up and stopped to make the payment when entering the charging zone. On the whole developing countries have been largely reluctant to adopt congestion charging schemes although often urban motorways are charged as in Shanghai and in Santiago (Chile). Shanghai also has attempted to restrict car ownership and limit and auction new car registrations.

6.4 Road condition, construction and resettlement issues

Many roads in urban areas of developing countries are unpaved, without drains, and often receive next to no maintenance. Conditions can be particularly poor for both walking and driving on these roads during the wet season. In fact it is commonly observed (and confirmed by personal experience in Dar es Salaam and Nairobi) that during wet periods, traffic congestion on main routes becomes markedly worse. In Dar es Salaam, during the dry season the unmaintained minor roads are used by motor traffic as important connections between major routes. When it rains the road surfaces become slippery with mud and deep potholes fill with water and the small roads become difficult or impassable for conventional passenger cars. Hence improving and maintaining minor roads can have an important effect in both improving the walking environment and in increasing overall system capacity.

New road construction is a major feature of many cities. For example in China the total length of urban roads more than doubled in the 13-year period between 1990 and 2003, during the same period, the total area allocated to roads more than tripled (UN Habitat, 2013). In Africa major road construction projects are being carried out in Addis Ababa, Nairobi and Lagos. Urban high capacity road projects are not cheap, the 45 km Nairobi-Thika road has been estimated to cost USD 360 m while the 10 lane, 50 km Lagos-Badagry road has been estimated at USD 1.5 billion.

New urban transport infrastructure is often scheduled to be located on land and corridors that has been settled, sometimes illegally, by poor squatter communities that have little or no legal rights.

Sometimes the housing may be ‘bulldozed’ away to make room for development, with little consideration for the housing or livelihoods of their occupants. A wide range of difficulties arise with the resettlement process. Inevitably most resettlement takes place on available land on the outskirts of the city making it difficult for residents to access previously-held jobs in the inner city. Because of the lower densities, access to public transport is poor and it can be difficult to find new jobs nearby. Other problems may arise such as a move to ‘temporary accommodation’ with little prospect for more permanent solutions, also it may be difficult for the poor to be able to afford rents for the new accommodation on offer.

Besides the resettlement issue, new high volume roads can create major problems of community severance. They can be extremely difficult, and dangerous, for pedestrians to cross. The Nairobi-Thika highway, with six express lanes and four service lanes, is such an example (KARA and CUSD, 2012). There were planned to be 18 high quality footbridges along its 45 km length, but the highway was in operation before most of these were in place. The lack of convenient crossing led to many accidents and deaths, and major severance problems for the local residents located along the road.

6.5 Public transport

Public transit solutions can be extremely effective in transporting people in cities. Metros have capacity of moving up to 60,000 passengers per hour (in one direction), travelling at 30-40 km/h. In comparison Bus Rapid Transit (with platforms, to speed boarding and exclusive lanes) can move up to 40,000 passengers per hour, travelling at 20-30 km/h. Light rail carries up to 12,000 passengers per hour, travelling at 20 km/h. An ordinary busway can move up to 20,000 per hour travelling at 20 km/h. Once they are built underground or elevated systems are least affected by, and least disruptive to, the road traffic. Where transit systems cross other traffic at the same level then the overall capacities of the roads and the transit system are reduced.

Where a transit system is operating on its own track it can provide a faster travel solution in a congested city than a private car. This will have the effect of encouraging car drivers to switch modes to the transit. If the transit system is sufficiently large, it can help to provide a lower boundary to road traffic speeds. However feeder services (buses, minibuses, intermediate means of transport and/or cycleways) are likely to be needed in suburban areas to take passengers to and from the transit stations and their final destinations.

There are 204 (existing and under construction) metro systems listed in Wikipedia, of which 36 are in China, 11 in India and 8 in Brazil. In addition there are 401 light rail or tram systems listed. In comparison there are 180 cities with Bus Rapid Transit Systems, with 59 cities in Latin America and 36 cities in Asia (Embarq, 2014). A high proportion of the largest cities already have some kind of mass transit system, although cities in Sub-Saharan Africa have been relatively slow to develop these. There is likely to be growth of mass transit systems in the large number of medium size cities (with over 500,000 people).

A wide range of costs have been quoted for different transit solutions. Typically metros cost in the range of USD 50 m to USD 150 m per km. Underground metros are 4 to 6 times more expensive than those above ground. Costs increase with the income level of the country. For an upper middle income country (USD 13,000 per capita) the full infrastructure and rolling stock costs of a urban transit system are calculated to be in the order of USD 54 m per km for a metro, USD 16 m per km for light rail and USD 7 m per km for a bus rapid transit system (UN-Habitat, 2013).

A high proportion of urban transit operations are heavily subsidised. Of the 65 systems where data was available (for developed countries in North America, Europe and Asia) only six systems – principally in Japan, Taiwan, Singapore and Hong Kong did the fare-box revenue cover the direct operating costs. For most European cities fare-box recovery ratios are in the 30-50% range. Of the

65 systems listed, 16 had fare-box recovery rates that were under 30% of the direct operating costs (Wikipedia, 2014).

Formal public transport by conventional buses where routes, frequency and pricing are controlled forms a major part of transport provision in most towns and cities of the world. These operations are promoted by governments through fare controls and by giving concessionary fares to children, students, the elderly and the disabled. Subsidies are common. In the 1950s, a high proportion of urban public transport was owned by governments. Increasingly private operators have taken over and they may be selected through processes of bidding for the rights (or subsidies) to operate on specified routes. Bus priority traffic measures, through for example, 'bus lanes' may also be implemented.

Unfortunately in many developing countries, over the past few decades, formal public transport has deteriorated, as governments held down fare levels without increasing subsidies. Consequently, the frequency and quality of services have declined. As a result informal public transport has increased in importance. In many countries in Africa, informal transport now dominates service provision. The informal sector is characterised by individual entrepreneurs operating minibuses, midi buses, shared taxis and, in some countries, motorcycle taxis. The routes are often partially fixed but the stopping points are unregulated. The 'matatu' minibuses and midi-buses in Nairobi are reported to have the highest per capita use of informal transport in the world with 662 trips per inhabitant per year, three quarters of public transport trips and 36% of traffic volumes (UN-Habitat, 2013).

A number of governments have tried to regulate and 'formalise' the informal urban transport sector. The 'matatu' minibuses in Nairobi used to be notoriously overcrowded, but the Kenyan authorities resolved to improve the situation. It was decided to actively enforce regulations that said that all public service vehicles must be licenced and roadworthy, all seats must have a seat belt, and drivers and conductors must have certificates to say that they are fit and proper to hold a licence. Operators had also to apply for a specific route licence (with the presumption that licenses would be granted to resolve the problems of shortage of supply and overloading). Fares were not controlled, and so varied with the level of demand, with reductions in off-peak times being normal (Adam Smith International, 2005). After a short operators strike, the matatu operators largely complied and fitted passenger seatbelts and started to reduce overloading (at least on the main roads). However, the reduction of the effective fleet capacity (fewer places due to reduced overloading) led to more poor people walking. Public transport standards had improved for those that could afford transport, but the regulation had led to rising prices that directly affected poor people. The busy and vibrant matatu industry is continuing to evolve and recent research work has included mapping the various matatu routes (using mobile phones) to better understand the situation and regulatory options to improve services (Graeff, 2013; Klopp et al, 2013).

At the turn of the century, the informal '*car rapide*' fleet of 3000 minibuses in Dakar were very old and in poor condition. Although fares were low the service was of poor quality and disorganised. To deal with the problem (and also to reduce air pollution), the authorities in Senegal brought in a programme to start to renew the fleet and formalise operations with route allocation and an official fare structure. The operators formed themselves into economic interest groups to purchase the new vehicles at subsidised rates and then lease them to the individual operators. To participate in the scheme the operators had to scrap a legally licensed high-polluting existing vehicle for which they would receive compensation. They also entered into concession agreements that specified the routes to be followed and the fares to be charged. They also had to stop at official bus stops, abandon practises of 'short tripping' and to issue tickets to all customers. Training was provided to operators on financial management and to staff on how to deal with the public. By 2009, about five hundred new buses (less than 20% of the operating fleet) had been delivered to participants of the scheme (but many older vehicles remained on the roads). It is generally agreed that the scheme has

improved public transport in the city. The main improvements have come from the formalisation of operations, rather than from the new buses. Journeys are faster (because they only stop at specified stops) and more reliable. The fares are predictable (not being based on the decisions of the driver and conductor). The revenues of the owners have increased, partly because before the scheme 20% of revenues had been lost through unofficial payments. However the new buses are operating in competition with the remaining informal *car-rapide* vehicles. The informal operators do not adhere to the same safety standards; they flout traffic rules and payoff the traffic police. This partly undermines the basic framework of the concession agreement, and there are some suggestions that some operators of the new buses are returning to some of the outlawed practices. With two systems still in parallel, the full implications for poor passengers (and for poor operators and operators' assistants) have yet to be assessed (Kumar and Diou, 2010).

Non-motorised transport, particularly walking and cycling, remains an important part of urban transport. For many years cities in India and China have had a high proportion of trips made by bicycles. Commercial cycle rickshaw services have also been common. In recent years, particularly in Europe, there have been a range of measures to promote the use of bicycles, with bicycle lanes, bicycle sharing schemes and traffic management measures. 'Transport for London' has been particularly active in this area. However, despite the demand, there has not been the same support for non-motorised transport in many cities in Africa and Asia. Cycle routes are largely non-existent and there is a huge lack of pavement space for the walking public. In many inner city areas what little pavement there is occupied by parked cars, traders, building materials and other obstructions and, as result, pedestrians end up walking in the road. In outer areas, roads may have no pedestrian pavements at all.

A major constraint to the development of better urban transport in developing countries is the political will and administrative capacity of urban areas to deal with the issues. Too often a range of different institutions are responsible for dealing with different aspects of urban transport, that include the local roads, trunk roads, land use planning, bus services and rapid transit services. In some cities several different local authorities may be responsible for various parts of the same city (as is the case with Dar es Salaam). Coordination is inevitably a major issue in urban transport. To help overcome these difficulties unitary authorities have been established. Examples of city transport organisations that cover a wide range of responsibilities include 'Transport for London' and the Lagos Metropolitan Area Transport Authority (LAMATA).

'Transport for London' is an example of a local government organisation that has responsibility for a very wide range of transport services in London including, the underground, over-ground railways, buses, river services, strategic through roads (excluding motorways), the licencing of taxis, the congestion charge and the provision of cycleways. LAMATA has the overall responsibility for transport planning, coordination and regulation in the Lagos metropolitan area with the primary mandate to play a lead role in carrying out transport planning, assist in transport policy formulation, coordination of major operational and investment decisions and implementation. LAMATA has the power to levy and collect user charges, tariffs, fees and road taxes in connection with the provision of its services.

Lagos Metropolitan Area Transport Authority (LAMATA) and its BRT

The Lagos Urban Transport Project (LUTP) was set up in 2002, with assistance from the World Bank, to improve public transport and establish the regulatory authority, LAMATA. The LUTP activities included institutional reform, road network development and the establishment of a regulatory framework for bus services. A Bus Rapid Transit (BRT) system was launched in 2008, having been planned and implemented in record time. LAMATA concentrated on rapid and effective implementation of 'BRT-lite' rather than 'gold standard' infrastructure. The results include:

- Over 200,000 commuters use the BRT system (exceeding expected usage by 100 percent)
- Commuters enjoyed a 40% reduction in journey time and a 35% reduction in waiting time
- Bus waiting time at terminal reduced from 20 minutes in 2003 to 10 minutes by 2009
- BRT passengers enjoyed a 30% reduction in average fare costs (from 140 Naira to 100 Naira) despite the 100 percent rise in fuel costs since commencement
- Money spent by poor households on travel reduced from Naira 150 (2003) to Naira 100 (2009)
- Income spent by poor households on public transport reduced from 17% (2003) to 11% (2009)
- Time spent by poor households on travel reduced from 90 minutes (2003) to 23 minutes (2009)
- Greater security (less robbery) on BRT than older public transport.
- Increase in average bus speed (from less than 15 km/h to 25 km/h) by route franchising (and operational discipline) and creating an enabling environment (investing in infrastructure needs)
- Bus operations (both capital and operating costs) fully financed by the bus operators at a fare which is almost 30% lower than fares on the traditional yellow buses (molues) and minibuses (danfos).

An evaluation has declared the BRT system a success, defining the critical success factors as significant and consistent political commitment, the presence of a competent strategic public transport authority in LAMATA, scheme definition that concentrated on essential user needs and deliverability within a budget and program, and a community engagement program that has ensured that BRT-Lite is seen as a community project created, owned and used by the people of Lagos. (World Bank, 2013).

6.6 Employment and opportunities for the poor in urban transport construction

The extent to which the poor can participate in urban transport construction projects depends upon their capabilities, strength, skills, gender, location and other commitments. For the most part, the poor will be at a disadvantage because of their lower skill levels. Unskilled women tend to be particularly disadvantaged because of male prejudices and their possible other responsibilities and commitments (such as looking after families). Nevertheless nearly all transport construction provides some opportunities for unskilled workers.

Labour-intensive road construction programmes have been carried out in many developing countries, but these have been mostly confined to rural roads. However a few projects have also had an urban roads dimension in which the objective was to provide employment for the poor. Examples include the South African Expanded Public Works Programme (EPWP) and the Bangladesh Local Government Engineering Department (LGED). Van Esch and Franssen (1997) described several small urban community-based employment programmes in Africa. These included storm water drainage and footpaths in Kampala and Dar es Salaam (Hanna Nassif area), roads and drains in Lusaka, bicycle lanes in Kisumu (Kenya) and road rehabilitation in Kawangware (Nairobi, Kenya).

With regard to larger scale initiatives, there appears to be very little information, or research, on direct employment opportunities in urban transport construction or maintenance. The construction industry is a major employer in virtually all countries, and major urban investment should provide significant opportunities. Data from UK and USA show the total construction industry for these countries accounts for around 5 to 6.5% of total employment and a similar contribution to GDP. Inland transport infrastructure accounts for around 0.8% of GDP for the OECD. For transition and developing countries the percentage appears to be higher, so that for the Central and Eastern

European Countries the figure was 1.7% of GDP in 2010 (OECD, 2012). Few statistics are available on the proportion of urban transport construction of infrastructure spending or of GDP. Most transport infrastructure expenditure is spent on interurban road and rail links. For developing countries, urban transport construction expenditure might be up to one third of the total for transport infrastructure (but sometimes being much less than this). Urban transport construction expenditure component therefore may range from 0.1% to 0.6% of total GDP.

An analysis of transport investment in Middle East and North Africa by the World Bank suggested that in oil-importing countries for every USD billion spent around 110,000 infrastructure-related jobs were created. The opportunities for non-qualified workers were much less for rail transport accounting for just 1% of expenditure, in comparison with road and port investment expenditure on non-qualified labour accounted for 6-10% of the total expenditure (Ianchovichina et al, 2012).

An analysis relating to the USA suggested that, per dollar spent, investment in public transport generated 31% more jobs than new construction of roads or bridges. Similarly maintenance and repair of roads and bridges generated 16% more jobs than new construction per dollar spent. It was also found that putting or keeping public transport in communities with high unemployment produced up to 2.5 times more new jobs than that of putting public transport into communities with low unemployment (Smart Growth America, 2011). As an example of urban transport investments and potential benefits, there are reported plans to construct 1000 km of Bus Rapid Transit corridors in 20 cities across India in the coming 6-12 years, at a cost of USD 3-4 billion. Over the next 20 years this should save more than 27,000 lives and create 128,000 jobs, as well as reduce greenhouse gas emissions by 42 million tons (WN, 2014).

6.7 Direct employment opportunities in providing urban transport services

In some countries, particularly in Asia, informal transport services can provide a great deal of employment to the urban poor, but almost exclusively for men. For example it has been estimated that there are 10 million rickshaw drivers in India, as part of the 400-million informal sector labour force. There were also estimated to be 2 million rickshaw drivers in Bangladesh, with 280,000-400,000 operating in Dhaka. Uganda was reported to have 200,000 bicycle and 90,000 motorcycle 'boda-boda' drivers operating for hire. Formal urban public transport is estimated to employ 7.3 million worldwide. The Asia Pacific region employs 2.8 million, Eurasia 1.2 million, Latin America 1.2 million, Middle East/North Africa 200,000 and Sub-Saharan Africa just 70,000 (UITP, 2011). Informal motorised public transport can also be an important employer. For example there are various estimates of between 5000 and 6500 matatu minibuses in Nairobi, employing in the region of 15,000 to 20,000 people for an urban population of about 4.4 million.

Recent research has found that rickshaw rental rates are higher closer to metro stations in Delhi. It has been found that the daily rental rates rise by 1% as distance to the nearest metro station is reduced by 1 km. It is suggested that metros have therefore had an effect of helping to increase demand for rickshaw services. Presumably the density of metro stations is such that users find the trip distances to the metro are neither too close (in which case customers would walk) or too far (in which case customers would use motorised transport). As rickshaw drivers are overwhelmingly from poorer villages outside of Delhi it is suggested that building the metro has had a 'pro poor' effect. Although metros may increase demand, if rental rates are higher, clearly a significant benefit is also going to those that hire out the rickshaws and not just to the rickshaw drivers (Kurosaki, 2012).

6.8 Participation in urban transport planning to address poverty issues

There is a strong perception that urban transport planning has in the past been largely designed to help improve the mobility of the richer sections of the population, particularly those with cars. Less

thought has been given to the needs of the poor. Furthermore, traditional urban transport modelling and planning, that helps drive solutions, has also focused on the time savings of vehicle occupants and motorised vehicle operating cost savings. There is usually little or no modelling or analysis of pedestrian or cyclist movements or how development will affect the livelihoods of those involved. Many authors complain about the lack of consultation and consideration given to the poor when major redevelopments, particularly of slum areas, are taking place. The following examples from Kenya and Malaysia illustrate these concerns.

“For example, one of the current highway mega-projects in Kenya—the Thika Highway Improvement Project—failed to alter its design to accommodate or plan for the traders of Githurai market, one of the largest regional markets in the Nairobi area. This is the case even though the designs are being constantly updated (although not made easily available for the public). The road construction went ahead, destroying the market without a proper plan to relocate the businesses. Women traders, who had relied on the urban space for survival, continued to try and sell wares alongside the roadside; cars eventually hit and killed some of them, starkly revealing how the uneven struggle for urban space is intertwined with transportation decisions made at a distant bureaucratic level. (Klopp, 2012). In parliament the local MP for the Githurai area asked whether the Minister of Roads was, “aware that the expansion of the Nairobi-Thika road will encroach on the entire Githurai market, thus putting at stake the livelihoods of more than 3,000 small-scale business people with attendant costs that will impact on their families?” The Assistant Minister responded that his “Ministry is not responsible for securing alternative land for use by the traders” (Hansard, Tuesday 24th November 2009). This is emblematic of the way that the interests and concerns of small businesses and the livelihoods of the many poor they employ and the farmers they support are secondary objectives to roads that serve other interests.” (Klopp, 2012).

“Urban transport planning in this region tends to follow a “predict and build” approach, attempting to build enough infrastructure to cope with the demand, with hardly any effort so far to manage demand for transport. Transport planning and decision making ...tend to be conducted as a technocratic process with little or no public participation. In many cases, minimal information is released to the public until shortly before construction begins.” (Barter, 2012).

The urban transport ‘technocratic’ planning process involves undertaking surveys and collecting data on travel patterns. To this extent, data are collected from different groups in society, including poor people. There may be some attempt to understand the main characteristics of the travel patterns of different groups. However, as seen in the Nairobi example, what is often lacking is a comprehensive dialogue with different groups on the key urban transport choices, and their implications. A recent study for the development of an urban transport master plan for Dar es Salaam provided an example of stakeholder consultations. Here three stakeholder meetings were held, but on each occasion the meetings (lasting around 3 hours each with 17-35 stakeholders present) largely comprised officials from different organisations and consultants with only a handful of representatives from the local government and local communities (Dar es Salaam, 2008).

However an example from Mumbai shows that how the poor can engage with the planning and resettlement process.

“Since the 1980s, organisations such as Society for Promotion of Area Resource Centres (SPARC) have been working towards ensuring some security of tenure and the importance of recognising the urban poor as partners in tenure and making shelter improvements at global, regional, national and local levels . . . This initiative saw some success in 1997-98, when organised groups of slum dwellers were able with SPARC to reach an agreement with the Railroad Transport Authority and municipal authorities to relocate and resettle several thousand households living in slum settlements located alongside railway tracks in Mumbai (as part of the Mumbai Urban Transport Project). SPARC and the National Slum Dwellers Federation helped slum dwellers to organise and form cooperative housing societies. Both the MUTP and Mumbai Urban Infrastructure Project (MUIP) together accounted for the resettlement of 50,000 to 60,000 slum families. ... The key lesson that emerged was the importance for low-income households and their communities of being organised and of the necessity of their

being able to engage in every step of the resettlement process from formulating relocation plans and determining the actual logistics of the move. The railway resettlement programme set several benchmarks – community organisations were ceded some of the powers traditionally enjoyed by government agencies in resettlement schemes, including the power to determine the eligibility of families and second, allocation of housing units in the resettlement area. It also stressed the importance of women-centred ('Mahila Milan' or women together) community participation, not merely on grounds of gender equity but also "on the demonstration of their skills as household and community managers" (Kumar, 2005).

Inclusive frameworks for collecting data and engaging in participatory planning have been developed by Fouracre, Sohail and Cavill (2006) and by Sohail, Mitlin and Maunder (2003) to enhance urban transport planning and improve the access and quality of public transport services.

Compared with the traditional urban transport planning approaches it is suggested that more information should be collected on:

- Transport patterns (trip rates and purposes, distances, the roles of public transport for social and recreational purposes, and the correlation between fares, transport expenditures and household income)
- Travel needs and problems; service availability, affordability, quality of services etc.
- Livelihood opportunities; how do the poor respond to the changing conditions of livelihood and how does the transport market adjust?
- Who are the urban poor? The heterogeneity of low-income groups, participatory poverty analysis, poverty impact indicators to measure poverty reduction, travel time and costs.
- Level of services in communities; do other interventions such as health and schools, precipitate the generation of new travel routes?
- Activities of the urban poor; livelihoods activities, productive, personal investment activities, ie, health care/education, investment in social networks and leisure activities.

The methods of enquiry should start with a stakeholder analysis including the community in general but also the poor, disabled, women and other disadvantaged groups, operators (including drivers, owners, etc), and regulators and administrators of roads and public transport. This would be followed by:

- Key informant interviews
- Participatory work involving focus groups
- Transport surveys
- Household surveys
- Detailed activity analysis at the household level to help understand what the transport system constraints are on household activities and how these constraints affect livelihoods.

7 Poverty and urban access

7.1 Access to transport services, employment and other urban facilities

Access by the urban poor to employment, schools and other facilities depends on a range of factors:

- the location of their housing
- the distance and location of work opportunities and other facilities
- the location of local transport infrastructure, including roads and transit facilities
- the service density of public transport
- public transport fare levels and available income for transport
- the gender, age and any disabilities of those concerned.

Poor people in inner city areas generally have better access to employment and facilities than those living further out. For all income groups, there is a 'trade-off' between housing costs, living space and transport costs. Inner city areas generally have higher rents (even for 'illegal' squatter settlements), less living space but lower transport costs to work. For those in the suburbs (including informal settlements) there are generally lower rents and more living space but higher transport costs to work. Poor people in inner cities may have low transport budgets and little time spent travelling, but poorer living conditions mean they do not feel 'better off' than those further out.

7.2 Access to basic facilities

Urban poor people tend to have better physical access to facilities such as water, schools and health care than the rural poor. However, there are different constraints within the urban environment. A study of in East Africa found some poor urban residents took as long as 92 minutes a day to collect water: the problem not being the distance to the supply (a constraint in rural areas) but the time spent waiting, competing with the large numbers of others who also need to use the same resource (UNFPA, 2007). The use of public toilets is also likely to be constrained by waiting times.

Access to basic facilities varies considerably from town to town and settlement to settlement. In Dar es Salaam, a comparative, representative survey of 1128 households, drawn from the 1993 Human Resources Development Survey, was carried out. In this study a comparison was made between 'Unplanned settlements', 'Planned settlements' and 'Affluent settlements'. Unplanned settlements had the lowest income while affluent settlements the highest. Data on income levels and access to key facilities are given in Table 1. This study shows that although the poor (in unplanned settlements) had an advantage for food shopping and were little different in terms of access to public transport they were nevertheless at a distinct disadvantage in terms of access to paved roads, water, schools, dispensaries and hospitals compared with the richer sections of the population (Diaz Olvera, Plat and Pochet, 2003).

Table 1: Access data to key facilities for unplanned and affluent settlements in Dar es Salaam

<i>Settlement type:</i>	<i>Unplanned</i>	<i>Planned</i>	<i>Affluent</i>
Household expenditure	Tsh 800,000	Tsh 1,060,000	Tsh 1,550,000
Homes with running water	12%	36%	76%
Mean distance to water (for homes without)	280 metres	120 metres	20 metres
Mean time to collect water (for homes without)	59 mins	34 mins	20 mins
Mean distance to place of food purchase	450 metres	630 metres	660 metres
Mean time to place of food purchase	8 mins	11 mins	10 mins
Distance to public primary school	1.1 km	0.8 km	0.8 km
Distance to public secondary school	5.7 km	4.5 km	3.4 km
Distance to public dispensary	2.3 km	2.6 km	1.7 km
Distance to public hospital	4.7 km	3.2 km	2.9 km
Access to paved roads (% of settlement)	46%	55%	60%
Access to public transport (% of settlement)	62%	77%	64%

Source: Diaz Olvera, Plat and Pochet, 2003

For comparison, some results of a study of six low-income settlements in Colombo, Sri Lanka, are presented in Table 2. The statistics recorded are not identical but they give an idea of some access issues for poor urban communities.

Table 2: Access data to key facilities in Colombo for six low income settlements.

	<i>Kardirana Watta</i>	<i>Poorwarama</i>	<i>259 Watta</i>	<i>121 Watta</i>	<i>43 Watta</i>	<i>Badowita</i>
Distance from city centre	4 km	8 km	3km	3 km	5 km	8 km
Community type	Relocated	Relocated	Shanty	Slum	Slum	Relocated
Access road (tarred/gravel)	Tarred	Mixed	Tarred	Tarred	Gravel	Tarred
Distance to public transport	0.5 km	0.5 km	0.5 km	0.25 km	0.5 km	2–3 km
Distance to work for majority	6 km	5–6 km	5 km	3–4 km	3–4 km	4 km
Distance to school	3 km	0.5 km	1.5 km	0.25 km	1 km	3 km
Distance to market	4 km	3 km	2 km	0.25 km	1 km	4 km
Distance to hospital	8 km	4 km	6 km	4 km	1 km	6 km
Distance to Post Office	0.5 km	0.5 km	0.5 km	200 m	1 km	0.5 km

Source: Sevanatha, 2003.

7.3 Walking and cycling

The constraints faced by poor people in their journeys to work or school depend upon distances, costs and the ease and availability of different forms of transport. The poor often try to minimise their cash expenditures by walking or cycling. It has been suggested that walking is used by at least half the urban population and accounts for 80% to 90% of all trips among the poor (Cook et al, 2005). Data from Tanzania showed that walking accounted for the majority of trips up to 5 km, for Temeke in Dar es Salaam and for trips up to 8 km in Morogoro (Howe and Bryceson, 2000). Public transport (buses and minibuses) becomes the predominant mode above these distances. In Temeke about half the journeys were over 5 km and about 30% over 8 km. In Morogoro, 36% of journeys were over 5 km and 12% were over 8 km. Walking accounted for 47% of all trips in Temeke and 67% of all trips in Morogoro (Howe and Bryceson, 2000). Pendakur (2005) suggested that Morogoro had a high proportion of bicycle journeys (23%) compared to other cities in the region.

Urban transport infrastructure often makes insufficient accommodation for safe pedestrian movements, whether alongside main roads or smaller urban and suburban roads. While this is a problem for all income groups, people with resources are more likely to find alternatives to walking where it is difficult. Poor people may have no choice. Some common issues that walkers face are described below.

“Perhaps the most fundamental problem confronting the pedestrian is that many roads are only designed for motor vehicles. Sidewalks for pedestrians are non-existent or comprise the bare earth. If they do exist their condition is normally unsatisfactory due to lack of maintenance. Open manholes and trenches, resulting from vandalism and the incomplete activities of various public utilities – water, electricity, telecommunications, sanitation, etc - are recurrent complaints. Conditions are particularly bad during the rainy seasons when pools of water present a major problem to pedestrians. Walking is especially difficult during rush hours when many people have to compete for the restricted space. Most are forced to walk in the road or along the corridors between buildings in town. The end result is a congestion of human traffic that makes walking unpleasant, time consuming and tiring. It can also be very dangerous. Waste, parked vehicles or informal businesses often obstruct walking routes making them generally unsafe and inconvenient. Consequently pedestrians are again forced to walk in the carriageway, or on unprotected road shoulders, exposing themselves to traffic hazards. There are few constructed footways and those that exist are generally filthy and in very poor condition, since they frequently are used as dumping grounds for solid waste or serve as drainage channels.” (Howe and Bryceson, 2000).

In China, cycling has been a very important mode of urban transport, particularly for the poor. In 1986, 58% of trips in Beijing were by bicycle, but by 2003, this had fallen to 39% (Ahmed, Lu and Ye, 2008). In Wuhan, a city of 7.5 million people, walking was the most frequently used mode for 50% of the poorest quintile of the population. Bus travel was the most frequent used mode for 30%, and

cycling 23% for this group of the population. Cycling is versatile, and the rider can take narrow lanes and alleys (where larger vehicles cannot pass easily). A major barrier to the use of cycles is the ease and frequency with which they can get stolen. Both pedestrians and cyclists are perceived to be at risk from dangerous driving. In Wuhan there has been a disappearance of cycle lanes and existing cycle lanes have now become crowded with other vehicles. There are also other hazards like potholes, missing manhole covers, poor lighting at night and poor drainage maintenance causing flooding of lanes and streets. Cyclists like protected 'level' crossing places: pushing bikes up and over a bridge crossing is resented (Zhong, Wei, Hou and Cheng, 2003).

7.4 Affordability of public transport

Apart from walking or cycling, bus transport is usually the cheapest mode of transport available. For example, in India a cycle rickshaw was six times more expensive per passenger-km than a bus while an auto-rickshaw was 15 times more expensive. However the rickshaws were a special service, going 'point-to-point' and as a result they were mainly used by the 'non-poor' (Jacobs, Maunder and Fouracre, 1981). Studies in Thailand and Indonesia found that the poor avoid using rickshaws and minibuses and other types of paratransit because they cannot afford the fares. In general middle and higher income groups use these services because of their convenience. Nevertheless, the poor will use rickshaws, paratransit and taxis in emergencies and non-routine situations when they have no other choice (Zhong et al, 2003).

Affordability of public transport is a major issue for the poor. Those who have to use it may spend a high percentage of their income. For example, in an influential publication, Armstrong-Wright and Thiriez (1987) noted that:

"Travel expenditure probably is perceived, particularly by low income groups, as the most important criterion in their choice of mode and may lead many to choose to walk. The extent to which a bus service is affordable is dependent on the income level of the users. In developing countries, a reasonable level of household expenditure on bus travel should not exceed 10% of household income. . . . In industrial countries, households without cars may spend in the region of 3-5% of their incomes on commuting. In developing countries, at the other extreme, studies have found that certain very low-income groups may spend in excess of 30% of their income on travel (Nairobi, Sao Paulo). Levels of expenditures in the region of 15% are not uncommon (eg, Kingston, Jamaica and Calcutta, India)." (Armstrong-Wright and Thiriez, 1987).

The idea that a maximum of 10% of income should be spent on public transport fares should become a 'standard' has been criticised by Gwilliam (2002) and Carruthers and Mitric (2005). They pointed out that households have a range of expenditures to meet and that affordability of transport depends on the household budget and costs of meeting these other goods and services. Furthermore there are substitutions and trade-offs (for example between rents and transport cost) that households will consider in their choice of location and mode of transport, including whether to walk or not. Carruthers and Mitric (2005) further discussed subsidies (to keep fares affordable) and pointed out that subsidies have a very high 'leakage' so that most of the advantages do not go to those who really need them. Unless a subsidy has a reliable and sustainable funding mechanism, the negative impacts on the transport operator can more than outweigh any benefits to poor passengers. So it was argued that: *'Fares unaffordable to passengers should not be replaced by subsidies unaffordable to the fare setting institution'*.

Despite these reservations it is still useful to record and analyse the proportion of income spent on transport for different cities and different income groups. One such analysis was carried out by Diaz Olvera, Plat and Pochet (2008). The study examined data from 42 surveys undertaken in 18 African cities carried out between 1979 and 2000. Eliminating extreme values it was found that households devoted between 8% and 15% of their total expenditure to transport. In general it was found that expenditure allocated to transport increased with income whether analysed by 'poor' and 'non-poor' categories, or by quartile ranges. This is illustrated in Table 3 and Table 4.

Table 3: Share of total household expenditure allocated to transport by poor and non-poor households (%)

	Poor	Non-poor
Niger, urban areas, 1989/90	4.2	16.1
Yaoundé 1993	9.6	16.3
Nairobi 1997	6.3	7.8

Source: Diaz Olvera, Plat and Pochet, 2008

Table 4: Share of total household expenditure allocated to transport by household expenditure quartile (%)

	1 st Quartile (Bottom)	2 nd Quartile	3 rd Quartile	4 th Quartile (Top)
Libreville 1993/4	7.3	7.8	9.1	11.3
Port Gentil 1993/4	5.2	6.2	14.1	10.6
Yaoundé 1993	9.9	10.1	15.6	22.8

Source: Diaz Olvera, Plat and Pochet, 2008

However the patterns were not uniform between cities. In Accra the poorest class allocated 14% of household income for transport, and for the second poorest class allocated 24%, while for the fifth and wealthiest class it was only 4%. This may illustrate the danger of analysing data rather than talking to the stakeholders concerned. Poor people who cannot afford public transport may have to walk, and if surveyed, they declare expenditure on transport would be very low. While percentage of household expenditure allocated to transport can be an interesting indicator, if poor people cannot afford to take public transport, the indicator may not be accurate, unless the 'discontinuity' is understood, analysed and adjustments are made.

The statistics presented by Diaz Olvera, Plat and Pochet (2008) showed that the proportion of household expenditure devoted is not static. An analysis of South African data found that transport expenditure had increased substantially in the recent past, mostly as a result of car purchases. Even for the 20% of households with the lowest income, transport expenditure as a proportion of total expenditure increased from 4% in 1995 to 10.6% in 2006. It is not completely clear why this happened. However it is observed that there appears to be a trend to send children further away to school in pursuit of better education, a trend to live further away from work and that salaries had not been keeping up with fuel costs and the costs of living (Mokonyama, 2008).

7.5 Trip distances, and travel time and the journey to work

Trip distance to work is an important factor in household transport costs. However there does not appear to be a very close relationship between city size, trip distance and the proportion of income spent on transport. For example three surveys were undertaken in Contonou (Benin), with population around one million. It was found the average proportion of household expenditure on transport was around 14%. This compares with two surveys in Lagos (current population around 17 million) where the average household budget spent on transport was found to be around 2.3%. (Diaz Olvera, Plat and Pochet, 2003). Likewise a survey of the Greater Mumbai Region with a population of around 12 million in 2001 found that the mean one-way commute distance was just 5.3 km for all workers and 3.9 km for the poor (27% of all households). In this case, 40% of all workers and 50% of the poor commuted less than 2 km. Average one-way commuting time was just 25 minutes. However 11% of all commuting trips and about 7% of those of the poor were over 15 km. Despite its large population the Greater Mumbai Region has a very high population density at over 25,000 people per square km (compared with about 8000 for urban regions in developing countries). Nevertheless, people are able to find work close to where people live (Baker et al, 2005).

In the early 1970s, Zahavi (1974) put forward evidence for the idea that there was an average constant 'travel time budget'. People would adjust their travel behaviour to spend about an hour per day in travelling. Hence any permanent increase in speed would, on average, likely lead to an increase in travel distance. Most of the data relating to the approach had been derived from

developed countries. It is debatable how well the approach works in developing countries. However the approach does provide a perspective for analysing urban travel budgets in different situations. Despite the findings of the approach, a number of authors have identified very lengthy travel journeys for the poor settlements located on the outskirts of major cities. Examples drawn from Karachi (Pakistan), Bogota (Colombia) and Soweto (South Africa) are discussed below.

In Karachi, Pakistan, it was reported that in the 1960s low income citizens were evicted from the centre of the city and relocated to the outskirts. By 1987 half of Karachi's population lived more than 10 km from the central business district however the jobs in the port and heavy industry remained in the centre, leading to long travel distances. The problems were compounded by further expansion of the city. A survey was carried out among 108 transport users living in eight low income settlements of Karachi. It was found that at 65% of respondents spent more than two hours going to and from work, while 15% spent more than four hours daily. It was found that 51% of respondents were spending 10% or more of their income on transport (Urban Resource Centre, 2001). A range of other problems were identified by the travelling public including: no services after 9 pm, absence of schedules, waiting for up to half an hour at bus stops, no seats at the stop so old people have to sit on the ground, poor safety and pollution. There were also complaints about inadequate coverage with one third of respondents reporting that it took them between 16 and 45 minutes to reach the bus stop. One airport employee reported that he needed to change three times to reach the airport from his home (Urban Resource Centre, 2001).

A study was carried out in Soacha area on the outskirts of Bogota, Colombia. The area has one of the highest migration rates of ethnic minorities, mostly due to internal forced displacement arising from the low-intensity internal conflict of Colombia. The migrant population was reported to be low income, with little or no education, that tended to do unqualified work. The migrants settled in Soacha because of lower land prices. Typical travel distances from Soacha were between 17 and 24 km. It was found that 85% of trips were via public transport with an average one-way travel time of 79 minutes, while 8.6% of internal trips in Soacha were non-motorised, with an average travel time of 40 minutes. It had been planned that Bogota's Transmilenio Bus Rapid System would connect to Soacha. However there were concerns as to whether the residents of the area could afford to pay the higher fares of the BRT service, compared with current bus services (Oviedo and Davila, 2013).

A study was carried out in the Soweto area of Johannesburg, South Africa, covering the location of the 26 km Bus Rapid Transit system from Thokoza Park to the central business district in Johannesburg. Soweto was formerly a sprawling township area for black South Africans who worked in Johannesburg and in the gold mines. For people travelling along the route the average one-way door-to-door journey time was about 80 minutes using conventional public transport. It was found that using the BRT there would be an average saving of 13 minutes, or around 10% to 20% of their journey time (Vaz and Venter, 2012).

7.6 Urban transport for women and disadvantaged groups

Women living and working in urban areas are disadvantaged when accessing transport services. Women have less access to funds and less access to personal means of transport such as a bicycles, motorcycles or cars. As a result they may be more inclined to walk than men for shorter journeys and they may use public transport more than men when the latter have the option of private transport. In general women do not travel as far as men for work. Poorer women tend to find work closer to home, often in the informal sector, such as street vendors, looking after children, working as domestic servants or doing jobs like office cleaning or working in a factory (Zhong et al, 2003).

Women tend to have a very different pattern of trip making to men, undertaking multiple purpose trips, such as taking children to school, shopping, health-related trips and going to work. They tend

to use public transport at off-peak times when there are fewer services available. Transport arrangements in peripheral urban areas do not suit women's needs since they may have to visit scattered facilities and public transport service frequencies are less. Furthermore the fare structure makes multiple stops more costly, making it difficult to combine household errands (Booth, Hanmer and Lovell, 2000). Turner and Grieco argued that because of their more complex multi-purpose trips women are 'time poor' and face many more constraints than men in fitting their busy schedules into the day (Turner and Grieco, 2000).

Women may also face issues of sexual harassment when travelling on public transport and they may feel more vulnerable when walking or waiting for transport at night in poorly lit areas. Examples of measures to make women's travel safer and more acceptable, are given below:

"Women-only subway, buses and train cars have been introduced to combat taunting, sexual aggression and harassment in a number of countries, including Japan, Brazil, Egypt, Mexico, India, Belarus and the Philippines. There have also been women-only taxis in the UK, Mexico, Russia, India, Dubai and Iran. Women-only policies and infrastructure options vary from country to country, from policies implemented only during rush hour to women-only cars in rapid service trains. For example, in Manila's light rail system, the front two rail cars are reserved exclusively for women and children while in Mexico City, recent female-only buses along busy routes have been added to the ladies' only cars during rush hour in its subway, with policy segregating men and women on the platforms." (Babinard, 2010)

A number of authors have pointed out that people entitled to free and concessionary fares such as students, older persons and people with disabilities are often not welcome on public transport. In most instances private operators are not compensated for taking these passengers and they will often try to avoid or discourage people entitled to concessions from travelling. The following example is reported from Wuhan, China.

"I have a free pass but many buses don't accept it and drivers look down on those who use them. In 1999, I was studying in Shipailing, often taking the 557 bus. Initially, I was allowed to take the bus, but once the drivers figured out I was blind, they wouldn't open the bus door right at the stop, but some ways away. Other riders just ran for the bus, but I was just left there. Sometimes when I managed to scramble after the others and get on, the driver said, "You are here again!" I was very angry and I complained to the bus company management. But it was useless. I eventually threw away that free pass – I only recently started using it again. Sometimes drivers claim not to know anything about it for the disabled. – They insist I pay full fare. One time our disabled group took the bus on an outing. When we showed the driver our disabled passes, he exclaimed, "Gao Gui..." (Zhong et al, 2003).

A wide range of issues confront people with disabilities when travelling in urban areas including: high curb heights, a lack of warning barriers in front of obstacles such as open manholes, pavements that are encroached by traders and kiosks, a lack of access for wheelchairs, open gutters, poor street lighting, insufficient assistance with crossings at intersections, inadequate timing of green lights for pedestrians, rude staff when travelling on public transport, drivers not announcing stops (an issue for the visually impaired), buses not stopping at minor stops, buses unable to take wheelchairs, buses with high steps, handrails too high for the physically disabled, prohibitions on the use of disabled vehicles in parts of the town, dishonest taxi and bus staff who cheat on giving change (Zhong et al, 2003).

Many of the physical measures needed to help people with disabilities travelling in urban areas are now widely understood, and in the last decade there have been substantial improvements particularly in developed countries. However, because of shortage of funds, and perhaps a lack of priority, these improvements still need to be implemented more widely in developing countries. Useful guidance is provided in Venter, Sentinella, Rickert, Maunder and Venkatesh (2004) and in AusAID (2013).

8 Urban transport externalities and the poor

8.1 Road crashes

There are major uncertainties relating to the effects of road crashes worldwide. This is partly because there appears to be considerable underreporting of deaths and injuries to the police, particularly in developing countries. Nevertheless the Global Road Safety Facility (GRSF) at the World Bank and the World Health Organisation (WHO) have attempted to estimate global figures of deaths and injuries. Road crashes are now the 8th leading cause of deaths worldwide. In 2010 it was estimated that about 1.3 million people died from road injuries. In addition it is estimated that there were 78 million road injuries warranting medical care, including 9 million that warranted hospital admission. Since 1980 road injury death rates have grown by 77% in East Asia and by 66% in South Asia, while they have steadily declined in most high income countries. They have also declined in Latin America and Central and Eastern Europe. Around 90% of road injury deaths occur in Middle and Low income countries (GRSF, 2014).

There are no global statistics on the urban/rural split or extent to which the poor and non-poor are at risk. In developing countries, a high proportion of road crashes involve pedestrians (accounting for 35% of global road injury deaths) while relatively few car passengers are killed or injured. In this way the poor may be at greater risk. Likewise because the poor have fewer resources, a crash that kills or seriously injures an income-earner can have huge negative effects on the livelihoods of poor households.

A comprehensive study of the impact of road crashes on the poor was undertaken in Bangladesh and India by Aeron-Thomas et al (2004). In Bangladesh a survey was administered to 59,000 rural and 24,000 urban households, covering over 414,000 people. In Bangalore in India, 20,000 households were interviewed (covering 96,000 people) stratified in equal numbers for rural, urban and slum areas. Socio-economic data was collected in order to stratify households into poor and non-poor categories. Table 5 and Table 6 give the annual incidence of road-traffic-related deaths and serious injuries per 100,000 of the population. Table 7 and Table 8 give the breakdown of the transport mode for those killed.

Table 5: Annual Incidence per 100,000 for death and injury in Bangladesh

	<i>Urban</i>		<i>Rural</i>	
	<i>Poor</i>	<i>Non-poor</i>	<i>Poor</i>	<i>Non-poor</i>
Road death	9.4	10.4	11.0	8.5
Serious injury	179.2	188.7	91.3	123.9

Source: Aeron-Thomas et al, 2004

Table 6: Annual Incidence per 100,000 for death and injury in Bangalore, India

	<i>Urban</i>		<i>Rural</i>	
	<i>Poor</i>	<i>Non-poor</i>	<i>Poor</i>	<i>Non-poor</i>
Road death	13.1	7.8	48.1	26.1
Serious injury	151.1	210.6	222.2	302.6

Source: Aeron-Thomas et al, 2004

In Bangladesh there was no marked difference in the incidence of death between poor and non-poor groups, although the non-poor rural population appeared to have had a greater incidence of serious injuries. This may be partly explained by fewer road journeys for the poor, and so less exposure to accidents. In Bangalore the death rates were much higher for the rural population (poor and non-poor) with the death rate for the rural poor particularly high. In contrast the non-poor were more likely to be injured, as in Bangladesh.

Table 7: Breakdown of mode of transport for those killed in Bangladesh

	Urban		Rural	
	Poor %	Non-poor %	Poor %	Non-poor %
Pedestrian	42	22	49	41
Cyclist	4	0	6	5
Rickshaw	8	13	5	8
Motorcycle	8	9	0	3
Auto rickshaw	8	3	10	9
Car/taxi	0	16	2	3
Minibus/bus	17	31	20	25
Truck/lorry	13	6	6	3
Other	0	0	2	3
	100	100	100	100

Source: Aeron-Thomas et al, 2004

Table 8: Breakdown of mode of transport for those killed in India

	Urban		Rural	
	Poor %	Non-poor %	Poor %	Non-poor %
Pedestrian	60	38	46	21
Cyclist	6	6	19	4
Motorcycle	31	47	8	39
Auto rickshaw	0	3	0	0
Car/taxi	0	2	0	0
Minibus/bus	2	3	12	25
Truck/lorry	0	1	12	7
Other	0	0	4	4
	100	100	100	100

Source: Aeron-Thomas et al, 2004

With regard to the mode of transport the poor are at greatest risk as pedestrians in both countries. In Bangladesh being a minibus/bus occupant was a high risk factor for the non-poor, while in Bangalore the non-poor were most at risk riding motorcycles.

Males were the main group that were killed or seriously injured, accounting for 80-90% of the total casualties. The dominant age group for deaths and serious injuries was 16-45 years, with 50-70% of deaths and injuries being males in this age group. In Bangladesh, children accounted for around a quarter of all deaths apart from the urban non-poor. In Bangalore, children accounted for less than 10% of urban deaths and less than 20% of rural deaths. Deaths and serious injuries were found to have a range of serious effects on households, these included those listed below. The figures in brackets are for percentage of bereaved Bangladesh urban households answering 'Yes' to these consequences and coping strategies.

- Decrease in standard of living (75% poor, 59% non-poor)
- Decrease in income (71% poor, 50% non-poor)
- Decrease in food consumed (71% poor, 47% non-poor)
- Arranging a loan (65% poor, 25% non-poor)
- Selling assets (35% poor, 19% non-poor)
- Taking on extra work (33% poor, 6% non-poor).

In Bangladesh these effects were found across the board for both bereaved families and families with serious injuries although the effects on the latter were less. Similar effects were also found in Bangalore. As expected the poor were much harder hit than the non-poor. For bereaved families in Bangladesh 33% of urban poor households and 49% of rural poor households were believed to be non-poor before the death. Hence the road crashes contributed to an increase in poverty. Similar effects were also observed in Bangalore (Aeron-Thomas et al, 2004).

8.2 Transport-induced air pollution and the effects on health and poverty

Transport-induced air pollution affects welfare through its contribution to greenhouse gas emissions and global warming and to its direct effects on health. In this section only the direct effects on health are considered.

For the year 2010, the World Bank and the Institute for Health Metrics and Evaluation estimated that 184,000 premature deaths and 4,100,000 Disability Life Adjusted Years (DALYs or years of healthy life lost) could be attributed to motorised road transport pollution (GRSF, 2014). The International Council for Clean Transportation concurs with the mortality estimates (Chambliss et al, 2013). The main disease effects from vehicle emissions are on ischemic heart disease, stroke, chronic obstructive pulmonary disease, lower respiratory infections and lung cancer. Vehicle emissions account for about 1% of the total deaths from these diseases (GRSF, 2014). The GRSF together with the Institute for Health Metrics carried out a detailed country-by country study of the effects of transport induced air pollution on health, based on an analysis of fine air-borne particulates (PM_{2.5}). The results were confirmed by a study by the International Council for Clean Transportation (Chambliss et al, 2013). The traffic fractions of PM_{2.5} in China and India as a whole were just 2% and 6%, but for Delhi and Beijing they were 20%. In the USA, the traffic fraction of PM_{2.5} was 15% (GRSF, 2014).

There are wide differences in the policies to control vehicle emissions. Currently the 'best practice group' comprises high income countries, together with Eastern Europe, Russia and Latin America and these countries are reducing the effects of vehicle emissions on health. However for other countries the effects on health are likely to get much worse, because of the rapid rise in vehicle numbers and the lack of stringent implementation policies.

"Accelerated adoption of clean vehicle and fuel policies would save 25 million years of life cumulatively by 2030 and reduce early deaths by more than 210,000 lives in 2030, as a lower bound estimate. The greatest single health gains would occur in China and India, with benefits nearly equal to those of China and India combined distributed among countries in the Middle East, Africa and the rest of developing Asia." (Chambliss et al, 2013).

In most cities, the richer sections of the population tend to live in places with less pollution. Compared with the poor, they tend to have more living space, larger gardens and more nearby green space and live further from traffic and other sources of pollution. In terms of travel behaviour the rich may also be less affected by vehicle pollution, spending less time walking, cycling or waiting for public transport on congested and polluted streets.

A number of studies have suggested that the poor suffer more from general air pollution than the rich. For example a study by Drabo (2010) found that sulphur dioxide (SO₂) emissions and particulate matter (PM₁₀) partly explain the large differences in child and infant mortalities between and within developing countries. As an explanatory variable, a wealth index was used, based on household possessions. The study suggested that the poorest sections of the population received the highest exposure to pollutants and therefore suffered larger health effects. In contrast the richer sections had a greater ability to prevent exposure and had better access to medical care when they were sick. In countries with good institutions the differences in health effects from pollution may be mitigated by universal health care policies, better advice and better health care infrastructure (Drabo, 2010).

Vehicle emissions are only part of the air pollution problem, as emissions also come from power stations, factories and from a range of natural sources. Indoor air pollution, which is believed to be extremely serious, is another compounding factor. Hence tracing the effects of vehicle pollution to different sections of the population is obviously very difficult. Research in Hong Kong by Wong et al (2008) tried to clearly link vehicle emissions with health effects. They compared daily concentrations of air pollutants and mortality data (with a time lag) and found that people living in socially deprived

areas had a higher risk of death from NO₂ and SO₂ pollutants, than those living in less deprived areas. Possible explanations were:

- a) that socially deprived subgroups were more likely to have poorer health and nutrition resulting in increased susceptibility to adverse air pollution
- b) people living in socially deprived areas were exposed to higher levels of pollutants.

In many cities, including Hong Kong, some deprived areas are located in the inner city or next to multiple busy traffic routes and that a large proportion of ambient air pollution can be attributed to road traffic emissions (Wong et al, 2008).

8.3 Effects of traffic congestion on the poor

The differential effects of traffic congestion on the poor and other income groups do not appear to have been comprehensively examined. When pedestrians are walking on pavements, their journey times may not be particularly affected by vehicle traffic congestion although there can be additional delays when crossing roads. Very heavy pedestrian movements during rush hour in locations with inadequate pedestrian infrastructure, as experienced in Nairobi, can be unpleasant and dangerous as people have to walk in roads competing with other people and vehicles using the same space (Howe and Bryceson, 2000). In Wuhan, it was observed that cyclists were not as affected by congestion as other traffic, when they were able to use cycleways, alleys and short cuts that other traffic were prevented from using. However, it was warned that there would be negative effects if cycleways were reduced and cyclists had to ride alongside other traffic (Zhong et al, 2003).

Private transport, such as cars and motorcycles, have faster journey times for the same distance compared to most bus operations using the same road space. Although heavy congestion tends to reduce the speeds of cars and buses to a similar value, buses still have to stop to drop and pick up passengers along the route. This significantly affects journey times. During rush hours, passengers may have to wait for long periods (sometimes half an hour or more) before they can find a bus that has space for them. An example of the difficulties and unpleasantness of travelling by bus during peak times, in Karachi, is given below.

'Due to overcrowding during peak hours, people have to travel hanging onto the doorways or sitting on the rooftops. More than 60 types of problem were recorded and particular concerns included having to travel either standing up or hanging partly out of the bus; having to walk to other stops in the hope of securing a seat; clothes and shoes getting soiled and wrinkled; suffocation and accompanying nausea; losing one's balance and even falling over while standing in the fast-moving vehicles. The issue of speeding is partly a result of peak-hour efforts by drivers to load quickly as many passengers as possible and complete the trip. Mr Shakoor Khan of Awami Colony said: "Every day I have to travel dangling from the bus, there is space only for one foot ... because of the crush inside the bus there is a lot of pushing and shoving and the passengers end up getting into quarrels with each other ... the conductor keeps on loading the people in his greed for money."' (Urban Resource Centre, 2001).

Many cities, particularly in richer countries try to provide exclusive lanes for public transport and they may also give buses priority at junctions. On a larger scale, Bus Rapid Transit (BTR) and metros also help provide faster journeys for those using public transport, particularly when congestion is heavy. These measures may, of course, help redress the imbalance in journey times between rich people and poor people. However, there are concerns that in many cases the poor cannot afford to use these more expensive solutions such as the Transmilenio BRT in Bogota (Oviedo and Davila, 2013).

8.4 Displacement of the poor resulting from transport projects

The Centre on Housing Rights and Evictions (COHRE) has attempted to document forced evictions around the world. It presents a disturbing picture, with settlements being bulldozed by force, often

just a few days after eviction notices have been issued. Often no compensation or alternative accommodation are offered. COHRE's Global Survey 11 (COHRE, 2009) found that 4.3 million people were affected by threatened and implemented forced evictions in 2007-2008. While the Global Survey 10 (COHRE, 2006) estimated that the number of forced evictions in 2003-2006 was 5.6 million.

It is not known what proportion of these reported evictions were as a result of transport infrastructure projects. However a number of high profile transport investments were documented. Examples included:

- **Nairobi:** *In 2004 evictions were announced threatening 300,000 people in Kibera, Nairobi's largest informal settlement. These were justified that the settlements were illegally situated on 'dangerous' public land (rail reserves or areas under electrical power lines) or on land reserved for future road-construction. That meant that all structures and settlements built on land set aside for road reserves, near roads, railway tracks or power-lines faced eviction. Raila village was the first area to be evicted and 2000 people were affected and 400 structures were demolished, along with schools churches and a clinic that lay along the path of a planned bypass. After serious criticism the government suspended the eviction although various Ministers declared the suspension did not apply to their departments (COHRE, 2006). (Note the issue of the destruction of Githurai market in Nairobi, and the associated loss of jobs, was discussed in an earlier section of this document on community participation).*
- **Mumbai:** *The Mumbai Urban Transport Project (MUTP) was an ambitious road and rail renewal plan involving the involuntary resettlement of more than 17,000 households. The project was partly financed by the World Bank. By March 2006, approximately 14,000 households had been resettled to new dwellings. However, the World Bank suspended its financial support in February 2006 because of delays in implementing the resettlement programme. Many of the relocated people also faced problems at the resettlement sites due the lack of provision of basic services. (COHRE, 2006).*
- **Manila:** *It was estimated that 80,000 families (400,000 people) might be forcibly evicted because of the Northrail-Southrail Linkage project in Manila. By 2006 29,000 families (145,000 people) who had lived as informal settlers along the railway track, had been moved to several relocation sites up to 40 km from Manila. "The Government began the implementation of the project before a comprehensive relocation plan was in place, with the result that as few as half of the evicted families received compensation or were relocated. Living conditions at most of the relocations sites were grossly inadequate due to a lack of potable water, electricity and sanitation facilities. Local NGOs in Manila reported that most of the families who were moved from the Northrail tracks had to live in tents for several months at the relocation sites. According to Urban Poor Associates, the incidence of hunger in the relocation sites was double that experienced by communities living adjacent to the railway tracks. Each family was provided with a loan which was payable in 25-30 years with interest rates between 6-9 per cent. In many cases, the loan was not sufficient to construct a house. Large numbers of homes at Cabuyao remain incomplete, without roofs and with dirt floors." (COHRE, 2006).*

A report by the World Bank on resettlement covering the period 1986 to 1993 found that 36 transport projects involved resettlement with 311,000 people displaced. This was from a total of 146 projects involving 1,963,000 people displaced. Transport projects accounted for 16% of displacements linked to the World Bank investments analysed (World Bank, 1996). Like other MDBs, the World Bank has a strict policy to minimise the adverse effects and disruption for those people displaced. Specifically where displacement is unavoidable, the Bank policy includes:

- Assist displaced people to improve or at least restore their former living standards and earning capacity
- Displaced people should be compensated for their loss at replacement cost and given opportunities to share in project benefits

- Displaced people should be assisted in the transfer and in the transition period at the relocation site
- Moving people in groups can cushion disruptions. Minimizing the distance between departure and relocation sites can facilitate the resettlers' adaptation to the new socio-cultural and natural environments
- The trade-offs between distance and economic opportunities must be balanced carefully
- Resettlers' and hosts' participation in planning resettlement should be promoted
- The existing social and cultural institutions of resettlers and their hosts should be relied upon in conducting the transfer and reestablishment process
- New communities of resettlers should be designed as viable settlement systems equipped with infrastructure and services, able to integrate in the regional socio-economic context (World Bank, 1996).

9 Implications for pro-poor urban transport policies

The urban poor in developing countries suffer from a wide range of accessibility and transport issues that, to a large extent, are 'off the radar' of government institutions. Walking is the predominant mode of transport for the poor that are able to live within about 7 km from their workplace. In most cities in developing countries there is insufficient provision for pedestrians. Pedestrian sidewalks are few, and those that exist are often unavailable, being blocked by parked vehicles, traders or building materials. Cycling is generally unsafe, because of the lack of provision for cyclists, the poor driving of other road users and the lack of appropriate traffic enforcement. There is also the concern over the high frequency of cycle theft. Both the walkers and the cyclists have to suffer the effects of vehicle-generated air pollution. For those who have to live far out from the city centre (sometimes because they have been evicted or moved out from redeveloped squatter locations in the centre), a journey may mean a one-and-a-half hours of standing up on an overcrowded bus (for which they may have waited for over half an hour and sometimes more) or being squeezed tightly within a cramped minibus. For their monthly journeys it is not uncommon for the poor to spend 10-20% of their income. Women, students and people with disabilities face a range of problems accessing public transport. Concessionary fare principles may not be implemented by transport operators.

Government plans to reduce congestion through road schemes and rapid transit solutions will tend to have little impact on the poor. The car populations of the richer sections of the population are likely to grow faster than the improvements in infrastructure can cope, as has been seen in cities in Asia where, despite massive road construction, car journey speeds continue to decline. Transit schemes generally go to the richer suburbs that are well away from where the poor live. Without integrated services and through-ticketing it is often too expensive for the poor to make the more complex journeys they require to meet their various requirements and get to their destination.

The solutions to providing a better urban transport environment for the poor include:

- Encourage proper participation of all stakeholders, including the poor, in all matters related to city planning, transport systems, traffic matters and development schemes
- Plan for compact cities, where all people can move easily and quickly by affordable public transport, cycling and walking
- Pay much more attention to walkers and cyclists, provide safe sidewalks free from obstacles
- Control polluting vehicles and enforce traffic laws and parking restrictions
- Where schemes demand resettlement, ensure that it is done in fair manner to the residents, whether or not they have formal 'legal' rights. Try to ensure that people are relocated as close as possible to their previous locations and/or new work opportunities.
- Ensure transit schemes provide good access to poor areas
- Introduce road pricing and area traffic controls
- Introduce integrated transport services and through ticketing
- Introduce city transport authorities that have the powers to impose vehicle and property charges and taxes to help pay for integrated transport services.

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