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RURAL TRANSPORT SERVICE INDICATORS:
Final Report

Paul Starkey *in collaboration with*
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September 2013

IFRTD

RURAL TRANSPORT SERVICES INDICATORS

African Community Access Programme (AFCAP)
Project AFCAP/GEN/060
Developing Indicators for Rural Transport Services

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Cover photo
Bus on Kilolo Road, Tanzania (top left)
Motorcycle taxi on Pitoa Road, Cameroon (top right)
Motorcycles and midi-bus, Bagamoyo-Mlandizi Road, Tanzania (bottom left)
Passengers in rural taxi on Longisa Road, Kenya (bottom right)
Cover photo and other photos © Paul Starkey

RURAL TRANSPORT SERVICES INDICATORS

This project was funded by the Africa Community Access Programme (AFCAP) which promotes safe and sustainable access to markets, healthcare, education, employment and social and political networks for rural communities in Africa.

Launched in June 2008 and managed by Crown Agents, the five year-long, UK government (DFID) funded project, supports research and knowledge sharing between participating countries to enhance the uptake of low cost, proven solutions for rural access that maximise the use of local resources.

The programme is currently active in Ethiopia, Kenya, Ghana, Malawi, Mozambique, Tanzania, Zambia, South Africa, Democratic Republic of Congo and South Sudan and is developing relationships with a number of other countries and regional organisations across Africa.

This material has been funded by UKaid from the Department for International Development, however the views expressed do not necessarily reflect the department's or the managing agent's official policies.

For further information visit https://www.afcap.org

The International Forum for Rural Transport and Development (IFRTD) in conjunction with Paul Starkey was awarded a research contract by the African Community Access Programme (AFCAP) to develop and test indicators that can be used to assess how good rural transport services are at providing access for rural people. The envisaged outcome of the research will be appropriate rural transport services indicators that are tested and disseminated to the transport sector in various African countries.

The research aimed to identify, develop, test and share rural transport services indicators relevant to the key stakeholders, including rural people, transport operators, regulators, planners, roads authorities and development agencies. This was to be achieved using participatory methodologies involving local stakeholders and sector experts.

The Phase 2 research team comprised:
Paul Starkey *(Team Leader)*
Peter Njenga *(Project Manager)*
Guy Kemtsop *(Cameroon Researcher)*
Shedrack Willilo *(Tanzania Researcher)*
Romanus Opiyo *(Kenya Researcher)*
John Hine *(Technical Adviser)*
Krishan Jayatunge *(Website and design).*

This Final Report summarises the rural transport services situation and issues on the three roads surveyed in Phase 2. Lessons learned about the rural transport services are presented. The methodology developed is assessed and possible indicators are discussed. The report concludes with the recommended indicators and the further work that is needed.

The project website is http://www.ruraltransport.info/RTSi

African Community Access Programme (AFCAP)
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Valuable encouragement and help to the researchers was provided by the transport authorities and local government officers in Tanzania, Kenya and Cameroon. Thanks are also due to the various survey assistants, traffic count enumerators and map designers who supported the team.

Finally, this work would not have been possible without the excellent support of the many people who provided information from the points of view of the transport users, transport operators, the regulators and development personnel. The team would like to express their great appreciation for the contributions of all these people. It is sincerely hoped that the survey findings and the methodology developed will help towards the goal of improved rural transport services in Africa.

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Executive summary

Adequate public transport services are vital for rural communities. This paper reports lessons and recommendations from a 12-month project to develop indicators to 'measure' how transport services were meeting the access needs of rural people. The Rural Transport Services Indicators (RTSi) project was funded by AFCAP and implemented by an IFRTD team. In Phase 1 (Apr-Sep 2012), a methodology to acquire the data for indicator statistics was developed and tested on six roads in Tanzania and Kenya. In Phase 2 (Oct 2012 to Mar 2013), the questions and analysis systems were revised and tested on roads in Tanzania, Kenya and Cameroon. All indicator statistics are linked to specific roads. Road-based transport services indicators are relevant to the users, operators, regulators and development projects and such indicators could be used to appraise and evaluate road investments.

Survey information from users (balanced for gender and representing different user types) relates to transport prices (passengers and freight), frequencies, reliability, seasonality, safety and comfort. Operators of the main types of transport service are interviewed to obtain information on transport frequencies, seasonality, vehicle operating costs and regulatory and operational constraints. Local officials and people with relevant experience are questioned about regulatory compliance and the impact of the different transport services on agriculture, trade, health, education and other issues. Traffic counts are undertaken on normal and busy days at one or more points and disaggregated for gender and vehicle usage.

Data entry and analysis systems had to be developed to cope with the very variable and complex nature of rural transport services, particularly motorcycle taxis. While 'conventional' public transport (buses, minibuses, rural taxis) and motorcycle taxis were very important for rural people, they operated in very different ways in terms of pricing, loads, routes and frequencies. When surveys involved two traffic-count locations a few kilometres apart on the same road, very different traffic statistics were obtained, due mainly to the location of small motorcycle transport hubs. Key indicator statistics were summarised in eight standardised tables in the RTSi Road Reports. The tables were generated automatically from a spreadsheet, following data entry and the 'triangulation' of data to allow for adjustments due to data discrepancies (observations, different respondent views, traffic count locations).

Users of rural transport services would like services to be available, affordable, safe, convenient, predictable, timely, comfortable, clean and integrated. Nevertheless, people do will travel on unsafe, substandard or expensive transport if it is available and timely (and they can afford it). Assured availability and timeliness are crucial. Motorcycle taxis services have been embraced despite their high cost and poor safety.

On the rural roads studied, conventional rural transport services were generally inadequate. On many rural roads in Tanzania and in Cameroon the only transport services available were motorcycle taxis. People value motorcycle taxis for convenient, short distance transport but they also need access to other transport services for longer and cheaper journeys to towns and services. Conventional transport services (buses and minibuses) were mainly operating on national or regional roads. In the Kenya highlands, there were rural taxis on most roads, but these were often crowded and irregular. Despite the very poor services, on none of the roads surveyed was there any proactive planning for rural transport services based on user needs for frequency, vehicle operating costs and seat occupancy. Regulating authorities tended to be under-resourced and so they effectively 'ignored' rural roads. Transport operator associations concentrated on organising terminals and members' needs. There is much scope for proactive planning involving regulators, associations and users. Some regulatory authorities contacted embraced this idea.

The surveys demonstrated the great complexity and variability of rural transport services: transport services vary along roads and in weekly and seasonal patterns. Services provided by

motorcycle taxis are particularly variable. However, their rapid spread has been remarkable: people value their great convenience, being timely and providing point-to-point services including to villages off the roads. Despite their high costs they are popular and often transport a high percentage of annual passengers and small freight on rural roads. They are perceived as more accident prone and they seldom conform to regulations. Nevertheless motorcycle taxis were generally rated higher than conventional services for their contribution to development (agriculture, trade, access to health and empowerment). Even some pregnant women and people with disability value them for their availability and convenience.

Information was obtained on fares and freight: while services on national roads were generally 2-3 cents USD per passenger kilometre, rural fares were 4-10 cents and motorcycle taxis were 14-24 cents. Overloading is common on rural roads, with vehicles (including motorcycles) sometimes carrying twice their intended passenger loads. While motorcycle taxis are generally quite new, conventional vehicles are old. They generally only start on rural routes when they are already more than ten years old and no longer adequate for more profitable routes.

It proved impractical to gain reliable estimates of vehicle operating costs on specific roads. This was partly due to small numbers of interviews sizes, lack of records, inadequate recall of operators and highly complex and variable permutations of different people owning and operating vehicles and sharing the various costs. Operating motorcycle taxis and leasing them out appears profitable and attractive, as indicated by their rapid spread and regular renewal. Conventional services are only marginally profitable on rural roads, as indicated by the failure of operators to renew their vehicles. The RED (Roads Economic Decision) transport planning model which assumes that new vehicles are bought and replaced could be updated or calibrated using more realistic data obtained from rural transport operators.

All rural transport services operators and the majority of rural transport passengers were men. On many roads the number of men using motorcycle taxis was four times that of women. While cultural issues and safety concerns play some roles, it appears a major issue is the gendered pattern of resource access: women find it more difficult to afford transport. Women generally appreciated motorcycle taxis but objected to their high costs (and the high costs of other means of transport). A higher percentage of passengers were women in conventional means of transport, which were cheaper and deemed safer and more acceptable to some women. On one Kenyan regional road there was gender parity in minibuses and on motorcycle taxis.

This report discusses whether interview numbers, disaggregated for gender, were adequate for meaningful statistics. The required 45 interviews were sufficient for valuable qualitative information when implemented by a transport professional able to recognise spurious responses. The numbers were appropriate for quantitative data that were relatively uniform (fares, transport frequencies, disruption patterns). They provided illustrative assessments of more subjective judgements such as user satisfaction, regulation compliance and development impact. Such assessments can be reported, with explanations and examples, in the RTSi Road Reports. Increasing the respondent numbers would not necessarily increase the accuracy, particularly if survey enumerators were employed. The survey and analysis methodologies did not yield reliable estimates of vehicle operating costs (VOCs) from the very varied, informal sector operators interviewed. Suggestions are made for larger interview numbers and possibly widening the geographic scope for operating costs (eg, district-level assessments). This would be essential in Northern Cameroon, where the larger public transport vehicles operate on several different roads so that meaningful road-based VOCs cannot be obtained for them.

Rural transport services indicators should be relevant, valid, reliable, sensitive, measurable, ethical, appropriate, transparent, interpretable, actionable and be based on cost-effective data. They should allow comparisons over time and space, and should respond to appropriate changes to road conditions, operating systems, regulatory environments and to strategic incentives.

The full RTSi survey methodology developed is recommended for obtaining a raft of indicator statistics. However, some indicators should be obtained in simpler ways. Two types of RTSi indicators are proposed. 'Headline' indicators will be clear, simple to acquire and actionable. RTSi Road Reports will contain a full set of indicators, complemented by explanatory text.

It is unrealistic to develop composite indicators that combine the very different attributes of 'conventional' public service vehicles and motorcycle taxis. In many countries, authorities do not recognise motorcycle taxis as legitimate forms of public transport. Therefore, it is proposed that all 'headline' indicators have two (or three) classes of transport. One class would be authorised, conventional public transport (eg, buses, minibuses). A second class would be intermediate means of transport (including motorcycle taxis). A third class could be used for non-authorised transport such as passenger trucks. Countries would collect statistics appropriate to their situations, with policies and strategies orientated to improving the headline indicators for particular vehicle classes.

This report reviews the main indicator statistics that have been developed. Passenger fares per kilometre are important and make reliable, actionable indicators when disaggregated for the different vehicle classes. Small freight costs are much more variable and the indicators are less measurable. However the costs of accompanied and consigned freight could make valuable and actionable indicators for the vehicle classes. Travel frequency is important and would make meaningful indicators for each vehicle class. It is recommended to assess transport opportunities on normal (non-market) days, as these allow access to health services and many development opportunities. The 'headline' frequency indicator would not capture market-day surges, but these would be measured and discussed in the RTSi Road Reports. Journey times did not make useful indicators. Transport predictability and reliability were particularly important for women wanting to make day-return trips to markets or health facilities. An indicator for this has not yet been developed but this could be easily done, based on this research experience. A disruption index was developed to assess problems due to seasonal road impassability, operational failures due to weather and increased waiting and journey times due to disrupted services. This indicator needs refining and further testing, but should make a valuable 'headline' indicator. Safety and security indicators gave reasonable assessments of user perceptions, but were insufficiently measurable for 'headline' indicators. VOCs, user satisfaction, operator perspectives, regulator judgements and development impact assessments will not be used for 'headline' indicators but all will feature in the RTSi Road Reports, where explanations can be given about key issues. Full RTSi Road Reports with comprehensive indicators, could be produced on stratified samples of roads within a district (or other area) and on all roads subject to appraisals and evaluations. With a simplified acquisition methodology (to be developed), the 'headline' indicators could be obtained for most rural roads. Six headline indicators are proposed for each vehicle 'class':

- Fare price per passenger kilometre
- Transport frequency on normal days
- The costs per tonne-kilometre of accompanied small freight (50 kg loads)
- The costs per tonne-kilometre of consigned medium freight (200 kg loads)
- RTSi reliability and predictability index for return trips to the market/services hub
- RTSi transport services disruption index.

There is a need for international debate on the results of this innovative project. Project outputs should stimulate this, as would further publications and workshops. Follow-up work is required to improve the questionnaires and analysis system which should then be tested by roads authorities in the context of road appraisals and evaluations. Work is needed to develop and test the methodology for rapidly producing the headline indicators. Follow-up research should be undertaken in collaboration with district-level transport authorities to develop valid, reliable, meaningful and actionable district-level indicators for rural transport services. Such indicators could link transport services to catchment population data to assess 'latent' demand.

Acronyms and abbreviations

4x4	Four-wheel drive vehicle
AFCAP	African Community Access Programme
AIDS	Acquired immune deficiency syndrome
DFID	Department for International Development, UK (UKaid)
eg	for example
Frt	Freight
GIS	Geographical information systems
GPS	Global positioning system
HDM4	Highway Development and Management Model
HIV	Human immunodeficiency virus
hr	hour
ICT	Information and communication technologies
ie	that is to say
IFRTD	International Forum for Rural Transport and Development
IMT	Intermediate means of transport
IRR	Internal rate of return
KAMUNA SACCO	Kangema Murang'a Nairobi Savings and Credit Cooperative
KeRRA	Kenya Rural Roads Authority
kg	kilogramme
km	kilometre
kph	kilometres per hour
m	metre
MNT SACCO	Murang'a, Nairobi, Thika Savings and Credit Cooperative
N	Number/sample size
n/a	Not applicable
NGO	Non-governmental organisation
No	Number
Pax	Passengers
RED	Roads Economic Decision (software)
RTS	Rural transport services
RTSi	Rural transport services indicator
SACCO	Savings and Credit Cooperative
SSATP	Sub-Saharan Africa Transport Policy Program, World Bank, USA
SUMATRA	Surface and Marine Transport Regulatory Authority, Tanzania
T2	Africa Transportation Technology Transfer
TANROADS	Tanzania National Roads Agency
TLB	Transport Licensing Board
TZS	Tanzania shilling
UK	United Kingdom (of Great Britain and Northern Ireland)
UN	United Nations
USA	United States of America
USD	United States Dollar
USDc	United States Dollar cent
VC	Village Chairman
VEO	Village Executive Officer
VOC	Vehicle operating costs
WEO	Ward Executive Officer

1 INTRODUCTION

1.1 Introduction to the purpose of the RTSi project

Rural roads are vital for poverty reduction and economic development. To be able to gain from the great social and economic benefits of roads, people need to be within a reasonable distance of a motorable road. Therefore proximity to a road has become an important indicator of access.

Poor people in rural areas seldom own motorised transport, and so they rely on the transport services that operate on the roads. It is the rural transport services operating along the roads that provide rural communities access to markets, health services, education, livelihoods and numerous economic, social and civic opportunities. Some rural transport services are inadequate in terms of affordability, safety, frequency and quality. However, to date, there are no clear indicators of what defines appropriate transport services, from the point of view of the users, the operators, the regulators and the various rural development sectors. In addition to roads, rural people need transport services that are safe, affordable and predictable and have adequate capacity to carry them and their goods.

Once there are appropriate indicators that can 'measure' transport services, it may be possible to counteract the prevailing 'laissez-faire' attitude to rural transport services held by many national authorities and some aid agencies. This project is about developing rural transport services indicators (RTSi) that can be used for planning and evaluation purposes in order to improve the transport services that are vital for rural poverty reduction and sustainable growth.

1.2 The work of RTSi Phase 1

Phase 1 (Apr-Sep 2012) aimed to develop and test a methodology to acquire the information required to develop indicators. In April 2012, the team met to plan the research framework and participatory survey methodology. The IFRTD team was led by Paul Starkey and Peter Njenga and was supported by a Project Consultative Group as noted in the Acknowledgments.

One premise of the research proposal had been that the data needed for indicator development should be specific to particular roads. Researchers should obtain information on transport services along the designated road from users, operators, regulators and development personnel. Data should be easy to obtain, relevant to key stakeholders, reliable, replicable and comparable. Researchers should verify the accuracy of information during the survey by interviewing several people per stakeholder category and by observations and triangulation between the sources.

The survey methodology developed involves information being collected from a range of users with a particular emphasis on gender balance. Older persons, people with disability and parents responsible for children are interviewed to learn of their particular transport issues. For each type of transport used, people are asked about prices, frequencies, predictability, reliability, convenience, capacity, seasonality, safety, security, accessibility, comfort and connectivity. The cost and convenience of transporting small (20-50 kg) and medium (200 kg) freight is ascertained from users.

Operators (and/or owners) of each mode of transport service are interviewed. Information is also collected concerning fares, frequencies, reliability, predictability, seasonality, safety, security and freight transport. The information is compared with that provided by users and discrepancies investigated immediately. Detailed information is also obtained relating to operating costs and income, transport user associations, regulation, incentives and disincentives.

Local regulating authorities and/or competent individuals are interviewed about compliance with technical, financial, operational, safety and environmental regulations. People with knowledge of the road and the appropriate sector are interviewed to assess how the road and transport

services on it contribute to key development issues. These include agriculture, trade facilitation, health, maternal health, HIV/AIDS, education, gender, disability, information technologies (including mobile phones), cultural heritage and the environment. Traffic counts are undertaken and all data are geo-referenced.

Initial surveys were carried out on six roads in Tanzania and Kenya. Survey questions were adjusted in the light of experiences. The diversity of transport modes, the complexity of operational arrangements and the fluctuating nature of the services added to the challenges of the participatory survey methodology. On most roads, motorcycle taxis had recently started operations and had greatly affected transport services, mainly in good and complementary ways. Although pricey and not suitable for all users, they were seen as convenient, timely and responsive (using mobile phones). One advantage of motorcycle taxis was their ability to travel off the roads. One disadvantage was their greater risk of accidents.

The key indicator statistics derived from the survey are summarised in eight tables. Four tables summarise most of the statistics considered particularly relevant for subsequent indicator development. These include key statistics about the road (including maps), traffic and transport services patterns (disaggregated for mode and showing service fluctuations), key operational statistics (costs, frequencies, safety, security, regulation compliance and development impact) and user satisfaction (disaggregated for gender).

Developing a data entry and analysis system to automatically generate the summary tables proved very challenging. The process was complicated because much survey data was disaggregated for gender, for several transport modes and for road seasonality (four categories). A provisional analysis framework was developed as an Excel spreadsheet. This incorporated and facilitated several processes of data triangulation. It was hoped that data entry at the time of the survey would allow discrepancies to be identified while in the field, which would then allow immediate correction or further investigation into any anomalies. The surveyor (a transport professional) would be able to see the developing statistics, tables and interview numbers for the different survey categories of users and transport modes. This was intended to facilitate the survey implementation and reduce the problem of small ‘sample sizes’ and incomplete data sets.

The work of Phase 1 was summarised in a number of reports which are all available on the project website. These include, Starkey, Njenga, Odero, Kemtsop, Willilo and Mbathi, 2012a and 2012b; Starkey, 2012; Odero and Starkey, 2012; Willilo and Starkey, 2012. The Project Consultative Group reviewed the progress of the work and recommended that it continue for a second phase.

1.3 The work of RTSi Phase 2

Phase 2 (Oct 2012 to Apr 2013) started with the research team meeting to critically review the methodology, questionnaires and spreadsheet. In the light of the increasingly varied systems of rural transport services operations, several modifications were made to the data collection tools (questionnaires), the in-field triangulation methodologies, the data entry spreadsheets and the systems of tallying data and creating the various tables of statistics. The number of defined vehicle modes used within the methodology was substantially increased, as were various options for financing vehicles and operating them.

Following the review, the number of formal data triangulations was also increased. After data entry, the researcher undertakes a series of ‘triangulations’ in the ‘Intermediate Tables’ worksheet. Twenty separate data triangulations are required for each mode of transport services. For each triangulation, statistics from the operators, the users and/or other sources are compared side-by-side. The researcher decides on the value carried forward, based on field observations and discussions held during the survey. The value may be a simple average or may be weighted to increase the relative importance of one of the data sources. Triangulation allows the researcher

to put forward figures that can compensate for potential errors (a traffic count on a difficult day; the under-reporting of passenger numbers by operators; disproportionately high or low traffic count figures due to the counting point). As the researcher can adjust the survey figures based on perceived reality, it is important that a second person verifies that these adjustments are justified and legitimate. As part of the quality controls built into the methodology, all triangulated figures should be approved or confirmed by a colleague or supervisor. It is important that triangulated figures are appropriate and robust as these are taken forward into the final indicator statistics.

The revised methodology was tested on the Kilolo Road in the Iringa Region of Tanzania (Willilo and Starkey, 2013). One issue arising from this survey was the highly localised nature of motorcycles, pedestrians and intermediate means of transport along the road. The place chosen for the traffic count was good for recording the traffic that went all the way along the road, but being far from a motorcycle taxi hub, it greatly underestimated the importance of motorcycle taxis. A work-in- progress paper was prepared in January 2013 (Starkey, Njenga, Kemtsop and Willilo, 2013). Minor modifications were made to the spreadsheet (revising equations and debugging errors).

A road survey was carried out on the Pitoa-Djallou Road, Northern Cameroon (Kemtsop and Starkey, 2013) and another in on the Gitugi Road, Murang'a, Kenya (Njenga, Opiyo and Starkey, 2013). Following the experience of the Kilolo Road, Tanzania, it was decided to use two separate traffic count locations. These gave very different traffic flows, but helped to explain the localised patterns of transport along the roads. The Cameroon survey illustrated a very different type of organisation of transport services. In Tanzania and Kenya, buses, minibuses and rural taxis operated on clearly defined routes with each road having a small fleet of rural transport services vehicles that shared the transport market on one road. In the Northern Region of Cameroon, the various vehicles operated on several different transport routes. Each operator had their own unique combination of different roads and routes on different days. Their choice of road was influenced by the pattern of the large weekly markets, the condition of particular roads, the transport demand along each road and the competition with other services on each road. It was as if there was a regional-level fleet that allocated itself across the roads in the region to meet the special demands of the various market days (although it was not planned or systematically organised). As a result, on the Pitoa Road studied, the larger transport services only operated on market day, with five or six vehicles from different parts of the region coming together on the road, just one day a week. For six days a week, the only rural transport services were motorcycles. This pattern of vehicle operations had not been anticipated, and this provided challenges for the data analysis, particularly in terms of Vehicle Operating Costs (VOCs).

Following the surveys, it had been proposed to hold a team meeting to review the progress and discuss possible indicators, but this was not possible due to budgetary constraints. The team therefore had to discuss all the issues remotely.

The work of Phase 2 was summarised in a number of reports which are all available on the project website. These include: Starkey, Njenga, Kemtsop and Willilo, 2013; Kemtsop and Starkey, 2013; Njenga, Opiyo and Starkey, 2013; Starkey, 2013; Willilo and Starkey, 2013 and Starkey, Njenga, Kemtsop, Willilo, Opiyo and Hine, 2013. Guidelines to the methodology have also been prepared (Starkey, Njenga, Kemtsop, Willilo, Hine, Odero, Mbathi and Opiyo, 2013).

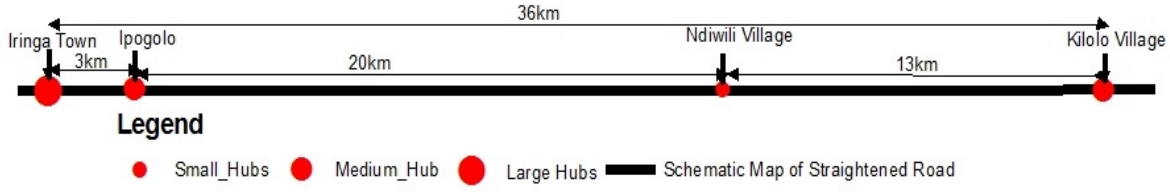
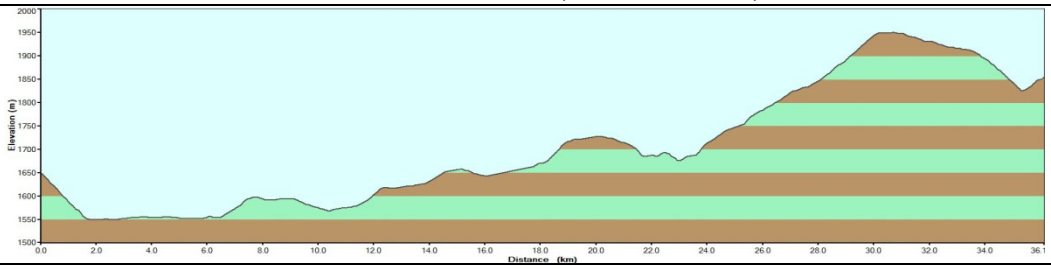
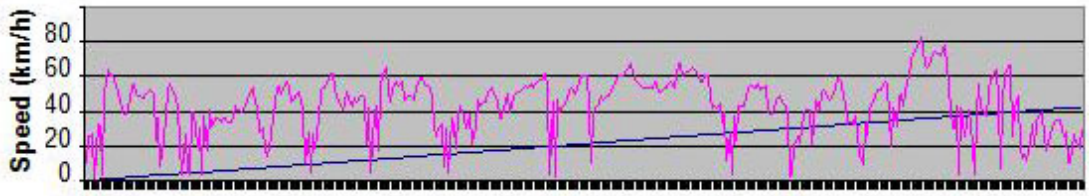
2 SUMMARY OF THE ROAD SURVEYS AND REPORTS OF PHASE 2

2.1 Introduction to the summarised road reports

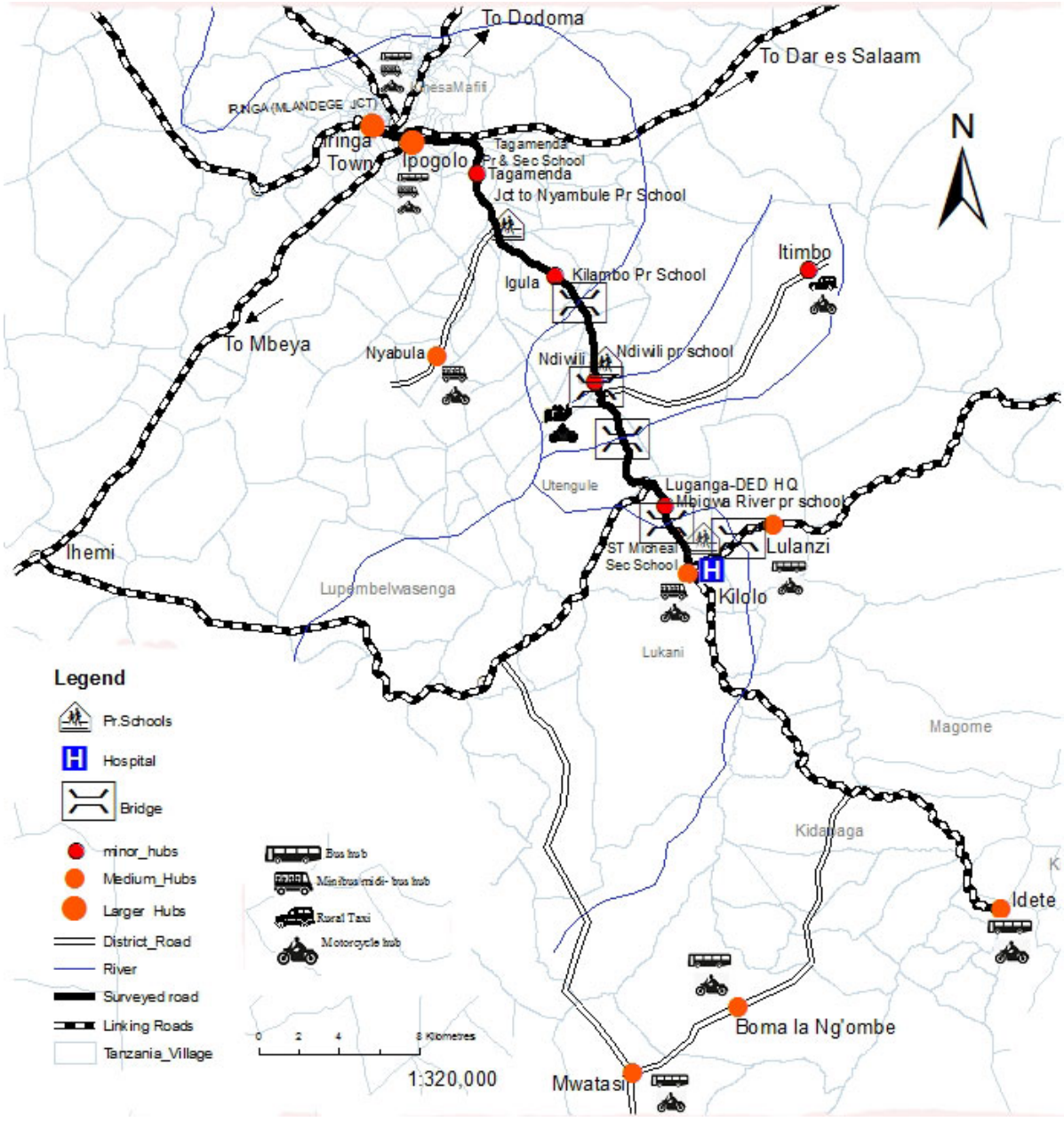
As reported, during Phase 1, six road reports were produced (three in Kenya, three in Tanzania). During Phase 2 three more were produced (one each in Tanzania, Kenya and Cameroon). All these reports are available on the project website. The three most recent ones are attached to this report as annexes. Key information and emerging issues are summarised in the following pages.

2.2 Kilolo-Iringa Road Survey in Tanzania: key information

The Kilolo-Iringa road is a regional road, and was selected in order to test the methodology on a road with a variety of traffic types and for which some previous traffic count data was available. Most district roads in Tanzania have very few transport services.

RTSi Table 1. Road information			
Road name: Iringa–Kilolo			
Dates of Survey: *15-26 November 2012*			
District, Region and Country: Iringa Urban, Iringa Rural and Kilolo, Iringa, Tanzania			
Road type: Regional road. Gravel	*Responsible authority: TANROADS*		
Road start location: Iringa Town	*GIS: 7°47'03.54" S 35°41'07.80*		
Road finish location: Kilolo	*GIS: 8°00'19.89" S 35°50'35.68"*		
Road length: 35 km	*Catchment population*		
Road quality and condition from different perspectives			
Road authority	*Operators*	*Development*	*Safety*
	★★★☆☆	★★☆☆☆	★★☆☆☆
Summary of road geography and socio-economic situation			
This road is located in Iringa Region and passes through Iringa Urban, Iringa Rural and Kilolo Districts. The first 3 km from Iringa town are a paved national road to Ipogolo junction on the TanZam highway. From Ipogolo a good graded, all-weather, regional gravel road passes through rolling terrain and small hills to Kilolo town which is 33 km from Ipogolo. The 36 km Iringa-Kilolo Road is managed by the Tanzania National Roads Agency (TANROADS). Ten years ago, Kilolo was small community, but it is now being rapidly developed as a new district centre, with much investment in public and private buildings and the start of an urban road network. The major economic activities along the survey road are agriculture and livestock keeping, and crops grown include maize, sunflowers, beans, peas, vegetables and tomatoes. Beyond Kilolo are hills with productive agriculture and forestry, so that farmers and traders use the Kilolo road to bring produce and timber to Iringa town. Both men and women participate in farming and marketing, but gender relations mean that men tend to have greater access to money and resources for transport. Tomatoes are an important crop and women often transport these by the basket load to markets and buying points. Male traders buy and transport truck-loads of purchased tomatoes to Iringa and Dar es Salaam.			
Schematic map of 'straightened' road with features			
			
GPS elevation track *(same horizontal scale)*			
			
GPS speed track *(same horizontal scale)*			
			

Description of hub and spoke patterns				
Kilolo is a growing district market town and transport hub. Several district spokes feed into Kilolo town along which operate many motorcycles, bicycles and some freight trucks. Large buses start in four villages beyond Kilolo and pass through the town en route to the major national hub of Iringa town. Fifteen minibuses and one midi-bus provide quite frequent services between the Kilolo hub and Ipogolo, the junction hub on the highway close to Iringa town. Motorcycle taxis provide mainly short-distance transport services on parts of the road, with motorcycle hubs at the 'bus stops' at Kilolo, Ndiwili and Ipogolo. Several small district and village roads feed into the road, so that traffic levels nearer to Ipogolo/Iringa are higher than those near the Kilolo end of the road.				
Intermodal connectivity *(one to five stars, the more stars the better)*				
'Feeding' *(getting to the road)*	*User satisfaction*	★★★★☆	*Development impact*	★★★★☆
'Linking' *(to onward destinations)*	*User satisfaction*	★★★★★	*Development impact*	★★★★★
The more stars (or the higher score) the better. ★☆☆☆☆ *= Very dissatisfied (= 1).* ★★☆☆☆ *= Dissatisfied (= 2).* ★★★☆☆ *= Medium (=3).* ★★★★☆ *= Satisfied (= 4).* ★★★★★ *= Very satisfied (= 5).*				



RTSi Map 1: Schematic map of Iringa–Kilolo Road showing context and linking roads

RTSi Table 2. Traffic and transport along road												
Daily traffic flows (in both directions)					**Fleet**	**Transport services: passengers and small freight**						
	Normal	*Busy*	*Disrupted*	*Impassable*	*No of vehicles operating on road*	***Trip transport*** *normal day per vehicle*		***Daily transport*** *normal day all vehicles*		***Annual transport*** *adjusted for traffic fluctuations*		***Change*** *in past year*
						Pax (no)	*Frt (kg)*	*Pax (no)*	*Frt (kg)*	*Pax (no) 000s*	*Frt (t)*	*- - 0 ++*
Large bus	8	8	4	0	4	85	2150	340	8600	308	3,692	0
Midi-bus	2	2	0	0	1	45	120	90	480	27	96	+
Minibus	30	30	20	0	15	20	242	600	14500	508	3,515	0
Saloon/estate	86	86	80	0	43							
Pickup/freight	6	10	6	0	3							
Light truck	14	20	4	0	7							
Medium truck	20	30	10	0	10	0	0	0	0	0	45,372	0
Large truck	8	10	4	0	4							
Motor tricycle	0	10	0	0	0							
Motorcycle	392	520	60	3	98	1	8	392	13067	96	850	+
Bicycle	54	100	40	5	27							
Pedestrian	24	80	20	10	12							
Totals	**644**	**906**	**248**	**18**	**224**	**152**	**2520**	**1422**	**36,647**	**939**	**53,476**	

Figure 1: Middle section of the road, at the junction with the road to Nyabula (with Nyabula minibus)

Figure 2: The transport hub at Kilolo, with waiting motorcycles and minibuses

RTSi Table 3. Rural transport services key operational statistics for major transport modes				
				
	Large bus	**Midi-bus**	**Minibus**	**Motorcycle**
Contribution to annual passenger transport (% of market)	40	3	53	4
Contribution to annual small freight transport (% of market)	58	1	38	3
Fare per km in USDc	4	5	5	34
Journey time (average speed on normal days) in km/hr	23	23	24	28
Transport frequency on normal days (number of opportunities to travel towards hub per day)	4	1	11	34
Number of days a year with 'normal service'	209	264	264	209
Number of busy days a year	36	36	36	36
Number of days a year with disrupted service	120	65	65	120
Number of days a year with no transport services	0	0	0	0
Reliability factor(s) (%)	46	-3	80	49
Men as % of passengers/day	54	24	57	100
Women as % of passengers/day	37	65	37	0
Children as % of passengers/day	9	10	5	0
Cost of 50 kg accompanied freight in USDc per tonne-km	45	46	43	602
Cost of 200 kg consigned freight in USDc per tonne-km	75	42	91	n/a
Safety: Recalled no. of accidents per 100,000 vehicle trips	198	0	165	3831
Security: Recalled no. of incidents per 100,000 vehicle trips	0	0	3	66
Typical age of vehicle (years)	23	17	19	1
Typical fuel consumption of vehicles (litres per 100 km)	31	38	17	2
Typical operating distance per year in km	7,992	19,008	23,408	26,361
Daily hire charge for use of vehicle (entrepreneurial mode)	0	0	22	6
Indicative vehicle operating costs per day for entrepreneurial mode, includes all costs and hire charges but not operational labour/profit (USD)	49	53	45	13
Daily cost of vehicle ownership/fixed costs (ownership mode) (USD)	24	37	5	2
Indicative vehicle operating costs per day for ownership mode (includes all costs for ownership mode except profit and operational labour) (USD)	132	122	38	13
Total revenue per day (USD)	169	100	52	23
Total revenue per kilometre (USDc)	196	125	73	27
Total revenue per passenger kilometre (USDc)	3	4	4	20
Percentage total revenue due to freight (%)	26	5	15	9
Regulation compliance (overall assessment)	3	3	3	1
Development impact (overall assessment)	3	3	3	3
*Operators interviewed**	*2*	*1*	*3*	*3*
*Users interviewed**	*18*	*13*	*21*	*11*
** The statistics in this table are derived from multiple sources, including transport operators, transport users and the traffic counts*				

RTSi Table 4. User satisfaction with main transport services (disaggregated for gender)								
	Large bus		**Midi-bus**		**Minibus**		**Motorcycle**	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
'Sample size' (N)	*9*	*9*	*7*	*6*	*11*	*10*	*9*	*2*
Fares	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆
Journey time	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★★★☆	★★★★☆
Operational features	★★☆☆☆	★★☆☆☆	★★★☆☆	★★☆☆☆	★★★☆☆	★★☆☆☆	★★★★☆	★★★★☆
Freight	★★★☆☆	★★★☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆
Safety and security	★★★☆☆	★★★☆☆	★★★☆☆	★★☆☆☆	★★★☆☆	★★★☆☆	★★☆☆☆	★★☆☆☆
Comfort	★★★☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★★☆☆	★★★☆☆
Universal access	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆
Overall satisfaction	**2.0**	**2.0**	**2.0**	**1.7**	**2.1**	**1.9**	**2.4**	**2.4**

The more stars (or the higher score) the better. ★☆☆☆☆= Very dissatisfied (= 1). ★★☆☆☆= Dissatisfied (= 2). ★★★☆☆= Medium (=3). ★★★★☆= Satisfied (= 4). ★★★★★= Very satisfied (= 5).

Figure 3: Buses on the Iringa-Kilolo Road

Figure 4: A bus with standing passengers and much freight on the roof rack

Figure 5: Minibuses on the Kilolo-Iringa road

Figure 6: Motorcycles operating from the Kilolo hub

2.3 Kilolo-Iringa Road Survey in Tanzania: emerging issues

The all-weather, gravel regional road joins the rapidly-growing Kilolo District Town (and its productive, agricultural hinterland) with the regional town of Iringa. It is not an inter-urban road, as Kilolo is still a small rural community. Most bus passengers travelling on the road start in the rural communities beyond Kilolo. In addition to transport services (buses, midi-buses, minibuses and motorcycle taxis), there are many private and official vehicles (associated with the town) and many trucks (associated with the town and the agricultural and forestry resources beyond).

A study of the road had been carried out in 2005 (Awadh, 2007). Table 1 compares the traffic flows in 2012 and 2005. The 2005 traffic count was carried out slightly closer to Iringa than the 2012 count and so may have had slightly more traffic feeding in. It was also closer to some villages and so may have had higher levels of pedestrians and bicyclists passing that spot.

Table 1: Daily traffic along Kilolo-Iringa road *(including both directions)*

	2012 [1]	*2005* [2]
Large bus	8	10
Midi-bus	2	0
Minibus	30	6
Rural taxis	0	16
Saloon/estate	86	13
Pickup/freight	6	6
Light truck	14	10
Medium truck	20	15
Large truck	8	0
Motorcycle	124	5
Bicycle	54	140
Pedestrian	24	288
Totals	**644**	**509**

[1] *Based on traffic count and triangulations.* [2] *After: Awadh, 2007*

The number of large buses had decreased slightly. Minibuses had increased and had replaced the rural taxis, providing more vehicles and greater carrying capacity. Private and official cars and pickups had increased greatly due to the new district headquarters. All types of trucks had increased, providing significantly greater carrying capacity. In 2005, only five motorcycles were recorded. By 2012 motorcycles had become the commonest vehicle type. Many motorcycles passing the traffic count point were not motorcycle taxis, but were used by individuals for their livelihoods. The numbers of bicycles and pedestrians had decreased. This may partly be explained by the different traffic count locations, but may also have been due to greater access to motorcycles and to the better minibus services. In 2012, about 940,000 passengers were carried each year on the road, by minibuses (53%), buses (40%), motorcycles (4%) and midi-buses (3%).

The motorcycle taxis have only recently started to operate at Kilolo and other small hubs. They are increasing rapidly. They charge high fares and provide relatively short distance transport, particularly to villages not on the main road. While motorcycles did not generally comply with financial and technical regulations, their level of loading was modest compared with other roads surveyed. It was rare to see more than two adults on a motorcycle. In contrast, the loading levels of the larger public transport vehicles were remarkably high, even by the standards of remote rural roads. Several busy, early morning services carried twice their nominal capacity of passengers. Minibuses in the middle of the day were less crowded and often left Kilolo with vacant seats. All transport services vehicles, particularly the buses, carried much small freight in both directions. Despite high seat occupancy, fares were quite high and caused major dissatisfaction. There was minor dissatisfaction with comfort (seating and space available) but major dissatisfaction with the travelling environment (heat, fumes, dust). Although the reported accident rate for motorcycles was high, safety and security did not appear priority issues for users.

2.4 Gitugi-Kiamara Junction Road Survey, Murang'a, Kenya: key information

The Gitugi-Kiamara Junction road was selected for the survey as it was a rural road with several transport types that is due to be upgraded. A repeated survey after a year or two will help to evaluate the effects of the road upgrading.

RTSi Table 1. Road information

Road name: **Gitugi-Kiamara Junction Road- D427/E538/E539**

Dates of Survey: **14th December 2012-18th January 2013** *(intermittent)*

District, Region and Country: **Murang'a County, Kenya**

Road type: ***Gravel. Class D***	*Responsible authority* **Kenya Rural Roads Authority (KeRRA**)
Road start location: **Kiamara Junction**	*GPS coordinates at start:* **Longitude : 37.122910; Latitude :-0.709532**
Road finish location: **Gitugi**	*GPS coordinates at finish:* **Longitude : 37.020037; Latitude : -0.651706**
Road length: **15.3 km**	*Catchment population*

Road quality and condition from different perspectives

Road authority	*Operators*	*Development*	*Safety*
	★★★☆☆	★★★☆☆	★★★☆☆

Summary of road geography and socio-economic situation

The surveyed road runs 15.3 km from Kiamara junction (also known as Gitugi-Kangema junction) to Gitugi Shopping Centre. Kiamara junction is 6.7 km from Murang'a, a county town and a major transport hub. Gitugi is the main commercial hub of Gitugi division. There are many small shops, a post office and a large open-air market that trades daily but with Wednesdays and Saturdays as the main market days.

The area is hilly with numerous parallel ridges and valleys. The road follows the shoulders and ridges of hills as it traverses several wards and the small hubs of Gakoe, Kiwanduma and Kiuu. There are five schools and two health facilities along road. The hilly terrain with its light, erodible soils has only medium smallholder agricultural potential and crops grown include maize, legumes, vegetables, mangoes, bananas and avocados. Coffee production has been declining. Households are located on either side of the ridge and are linked to the road through small access tracks, most of which are only accessible by foot or motorcycles. The access tracks often channel run-off water which causes erosion and gullies in the rainy season.

Description of hub and spoke patterns

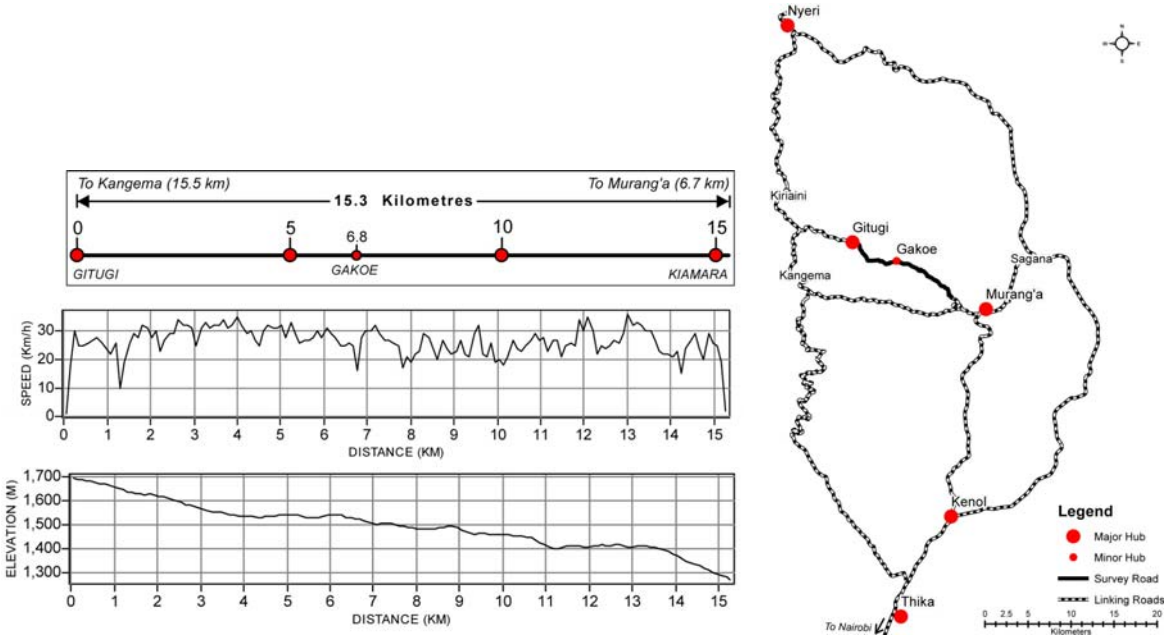
The road is a district road under KeRRA. The lower, east end of the road joins a regional road linking to Murang'a town, the commercial and administrative centre of Murang'a County. The continuation of the road to the northwest joins a regional road linking to the neighbouring Nyeri District. Nairobi can be reached through either linking road, but traffic for Nairobi does not normally pass along the survey road because of its poor condition. This may change as at the time of the survey (December 2012-January 2013), the road was being upgraded and may receive a bitumen pavement.

There is a major transport hub at Murang'a town, with midi- and mini-buses offering outward services to Nairobi and other towns in Kenya as well as local destinations within the county such as Gitugi. The Gitugi transport hub has midi- and mini-buses going to Murang'a (via the surveyed road) and to Nairobi (via Kangema). Along the surveyed road, two midi-buses and eight minibuses provide passenger and goods transport services between Gitugi and Murang'a town, all making an average of two return journeys per day. There are also about 50 motorcycle taxis that are very important for transporting people and goods for short distances along the road and to and from homesteads. Most motorcycles are based at Gitugi, but small fleets of motorcycle taxis are found at the small hubs of Gakoe, Kambara, Kiawanduma and Kiuu Junction. A few bicycles and donkey carts are used by households despite the hilly terrain.

Intermodal connectivity *(one to five stars, the more stars the better)*

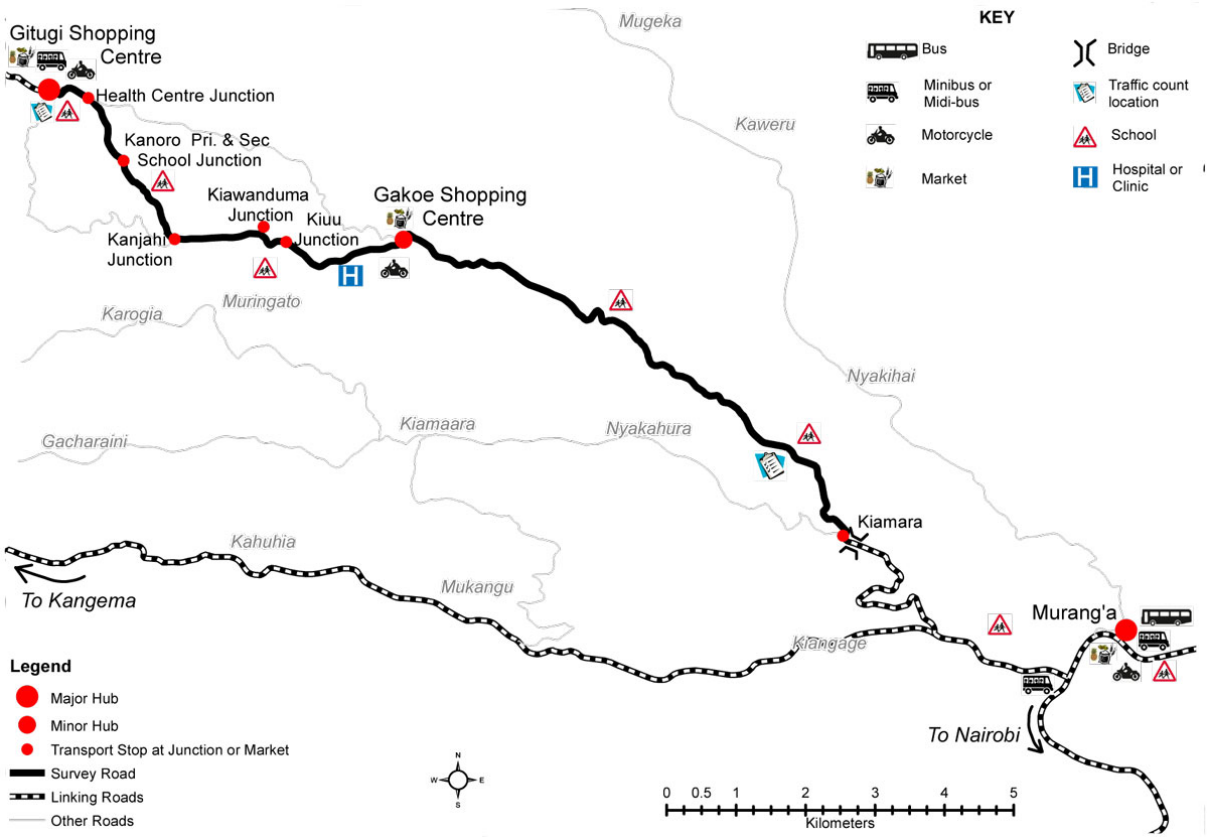
'Feeding' *(getting to the road)*	*User satisfaction* [8]	★★★☆☆	*Development impact*	★★★★☆
'Linking' *(to onward destinations)*	*User satisfaction* [11]	★★★☆☆	*Development impact*	★★☆☆☆

The more stars (or the higher score) the better. ★☆☆☆☆ *= Very dissatisfied (= 1).* ★★☆☆☆ *= Dissatisfied (= 2).* ★★★☆☆ *= Medium (=3).* ★★★★☆ *= Satisfied (= 4).* ★★★★★ *= Very satisfied (= 5).*



Schematic map of 'straightened' road with features (top), GPS speed track and GPS elevation track

RTSi Map 1: The regional context of the road showing Murang'a and other towns



RTSi Map 2: Diagram of surveyed road showing transport hubs, services and features of interest

RTSi Table 2. Traffic and transport along road

Daily traffic flows *(in both directions)*					**Fleet**	**Passengers and small freight**						
	Normal	*Busy*	*Disrupted*	*Impassable*	*No of RTS vehicles operating on road*	***Trip transport*** *normal day per vehicle*		***Daily transport*** *normal day all vehicles*		***Annual transport*** *adjusted for traffic fluctuations*		***Change*** *in past year*
Transport type						*Pax (no)*	*Frt (kg)*	*Pax (no)*	*Frt (kg)*	*Pax (no) 000s*	*Frt (t)*	*- - 0 ++*
Midi-bus	4	6	4	0	2	20	500	80	4000	33	1030	0
Minibus	20	36	12	0	8	14	75	420	2400	110	908	+
Private saloon/estate	23	23	20	0								
Pickup/freight	8	10	6	0								
Light truck	2	2	2	0								
Medium truck	10	10	8	0								
Large truck	2	4	2	0								
Motorcycle	80	80	70	70	50	1	50	350	21,000	113	6400	+
Bicycle	2	4	2	2								
Pedestrians (>5km)	15	25	15	10								

Figure 7: Views of farmland from the road and the road with upgrading roadworks

Figure 8: Minibuses at the Gitugi, at Kiamara Junction and at Murang'a bus station

Figure 9: Gitugi transport hub and shops

RTSi Table 3. Rural transport services key operational statistics for major transport modes

			
	Midi-bus	**Minibus**	**Motorcycle**
Contribution to annual passenger transport (% of market)	12	45	42
Contribution to annual small freight transport (% of market)	29	26	45
Fare per km in USDc	6	10	18
Journey time (average speed on normal days) in km/hr	19	19	19
Transport frequency on normal days (number of opportunities to travel in direction of main hub)	2	10	24
Number of days a year with normal service	216	231	221
Number of busy days a year	104	104	104
Number of days a year with disrupted services	45	30	40
Number of days a year with no transport services	0	0	0
Reliability factor	84	76	85
Men as % of passengers/day	47	47	83
Women as % of passengers/day	38	44	14
Children as % of passengers/day	16	10	3
Cost of 50 kg accompanied freight in USDc per tonne-km	68	103	116
Cost of 200 kg consigned freight in USDc per tonne-km	86	46	56
Safety: Recalled no. of accidents per 100,000 vehicle trips	23	10	5
Security: Recalled no. of incidents per 100,000 vehicle trips	34	0	1
Typical age of vehicle (years)	11	14	3
Typical fuel consumption of vehicles (litres per 100 km)	25	27	3
Typical operating distance per year (km)	34,560	38,220	19,552
Daily hire charge for use of vehicle (entrepreneurial mode) (USD)	n/a	10	n/a
Indicative vehicle operating costs per day for entrepreneurial mode, *includes all costs and hire charges but not operational labour/profit* (USD)	n/a	56	n/a
Daily cost of vehicle ownership/fixed costs (ownership mode) (USD)	7	6	7
Indicative vehicle operating costs per day for ownership mode *(includes all costs for ownership mode except profit and operational labour)* (USD)	46	66	11
Total revenue per day (USD)	98	126	16
Total revenue per kilometre (USDc)	84	101	29
Total revenue per passenger kilometre (USDc)	3	7	29
Percentage operating income due to freight	58	28	9
Regulation compliance (overall assessment)	3	3	2
Development impact (overall assessment)	4	4	4
*Operator 'sample size' **	*1*	*2*	*3*
*User 'sample size' **	*5*	*7*	*23*

** The statistics in this table are derived from multiple sources, including transport operators, transport users and the traffic counts*

RTSi Table 4. User satisfaction with main RTS modes (disaggregated for gender)

	Midi-bus		Minibus		Motorcycle	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*
'Sample size' (N)	*2*	*3*	*3*	*4*	*12*	*11*
Fares	3	3	2	3	3	2
Journey time	2	3	2	3	4	3
Operational features	2	2	2	3	4	3
Freight	2	2	3	3	4	3
Safety and security	4	4	4	4	4	4
Comfort	3	3	2	3	3	4
Universal access	2	1	3	4	3	3
Overall satisfaction	**2.6**	**2.7**	**2.6**	**3.1**	**3.4**	**3.3**

The higher the score the better.
1 = Very dissatisfied. 2 = Dissatisfied. 3 = Medium. 4 = Satisfied. 5 = Very satisfied

Figure 10: Motorcycles at Gitugi hub and on the road

Figure 11: Midi-bus at Gitugi hub

2.5 Gitugi-Kiamara Junction Road Survey, Kenya: emerging issues

The road density in the highlands around Murang'a is high and there are alternative routes between Gitugi and the town of Murang'a. The surveyed road has been in poor condition, and most long-distance traffic travelling to Nairobi and other towns take a longer route with a better surface that passes Kangema where passengers may be waiting. It will be interesting to see how the planned upgrading to a bitumen surface will influence traffic patterns. At the time of the survey, 8 minibuses and 2 midi-buses operated along the road between Gitugi and Murang'a providing about 12 travel opportunities on normal days. They were supplemented by eight other vehicles on market days which together provided 22 travel opportunities. Minibuses carried about 110,000 passengers per year (45% of annual passenger numbers) and midi-buses carried 33,000 passengers (12% of total). Motorcycles carried 113,000 passengers a year (42% of total). As the distances travelled by motorcycles were shorter than other transport modes, their share of the market would be lower if expressed as passenger-kilometres. Passengers complained of the waiting times for minibuses and midi-buses. They liked motorcycles as they set off immediately.

While motorcycle taxis were extremely important along the road, they were very localised. Most (80%) of the motorcycle taxis operated close to Gitugi, and very few passed the mid-section of the road. They provided short-distance transport along the surveyed road, its feeder roads and tracks leading to people's homes. Motorcycles charged 18 cents USD per kilometre, about twice that of the other forms of transport (10 cents USD for minibuses and 6 cents USD for midi-buses). Short distance journeys are relatively more expensive per passenger-kilometre for all forms of transport. Motorcycles accounted for 45% of the small freight transport, followed by midi-buses (29%) and minibuses (26%). Although there were few midi-buses they carried more small freight.

Users explained how motorcycles were transforming rural mobility and improving access, with services that operated on the small roads and could be called by mobile phone. They greatly assisted access to markets and to health services. However they were mainly used by men (83% of passengers). This was probably for economic reasons and gender-related access to resources. Women were more critical of motorcycle fares.

The operators of all forms of transport were quite positive about their operating conditions. Motorcyclists complained of the state of the road, while minibus operators pointed out that recent regulations encouraging larger vehicles made it difficult for them to access credit for vehicle replacement. The minibuses and midi-buses were said to have satisfactory levels of technical, insurance and safety compliance. Because they went into Murang'a and travelled along regional roads for part of their journey, they were obliged to comply with insurance and some other regulations. Motorcycle taxis generally stayed around Gitugi and had poor compliance with insurance, operational and safety regulations: few operators wore helmets or reflective jackets.

In terms of socio-economic development, all transport services rated highly, but the highest survey assessments went to motorcycle taxis. These had had a major beneficial impact in the past 5-7 years. They were rated good for facilitation of agriculture and enterprise development. Transport for trade and agriculture in the area is quite localised and motorcycles are well adapted to carry relatively small volumes of goods. They also scored very well in terms of youth empowerment (employment opportunities) and transport for people with disability (due to point-to-point transport from people's homes to nearby facilities).

Users and operators seemed relatively happy with transport services along the road, particularly around Gitugi where there were many motorcycle taxis. Although the services leaving from Gitugi towards Murang'a were not timetabled there was a predictability regarding service frequency as the number of operating vehicles each day was fairly constant. This allowed people to plan their outward and return journeys accordingly. Operators were concerned with low volumes of passengers along the road, and the low probability of picking up passengers along the route. Key concerns among users were the fares for passengers and freight, as incomes in the area were low.

2.6 Pitoa-Djallou Road, Northern Cameroon: key information

The full RTSi Road Report of the Pitoa-Djallou road (Kemtsop and Starkey, 2013) is available as an Annex of this report. In this section, some key statistics are presented with some of the main observations. The road was chosen as being reasonably representative of a rural road in Northern Cameroon. It had been constructed and maintained by the cotton company. It appeared to have a clear catchment area with a rural population requiring transport to access markets and services.

RTSi Table 1. Road information

Road name: Pitoa – Djallou	
Dates of survey: 15-24 January 2013	
District, Region and Country: Pitoa, Northern Region, Cameroon	
Road type: Rural road (unclassified)	*Responsible authority: Rural roads directorate, Ministry of Public Works in collaboration with Sodecoton*
Road start location: Pitoa (centre town)	*GIS: N9 23.360 E13 30.187*
Road finish location: Djallou	*GIS: N9 35.877 E13 30.080*
Road length:26 km	*Catchment population: 15 000*

Road quality and condition from different perspectives

Road authority	*Operators*	*Development*	*Safety*
★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆

Summary of road geography and socio-economic situation

The 26 km surveyed road is unclassified and maintained by the 'Sodecoton' cotton development company. The road was constructed many years ago to access an important cotton production area. The road starts in Pitoa town, a sub-divisional capital, at a junction with the national N1 tarred road. The junction is 2 km from the town centre and an important weekly market. From the Pitoa junction, the graded, gravelled all-weather road gradually ascends through rolling countryside to the small market village of Djallou, 24 km away. The road has several seasonal river crossings and clay-soil sections that require regular maintenance by Sodecoton. Many smaller roads feed into this road, and the network serves many villages and services such as primary schools, health centres and markets. Many of the inhabitants are immigrants from other areas. The road is commercially important for the transport of cotton inputs and harvested crops and for connecting people with the important market at Pitoa every Sunday. The road also carries traders between Pitoa, other local markets and northeast Nigeria. Market day leads to much greater traffic volumes. The road has great economic significance for agricultural production and marketing in the region and for trade in manufactured products from Nigeria.

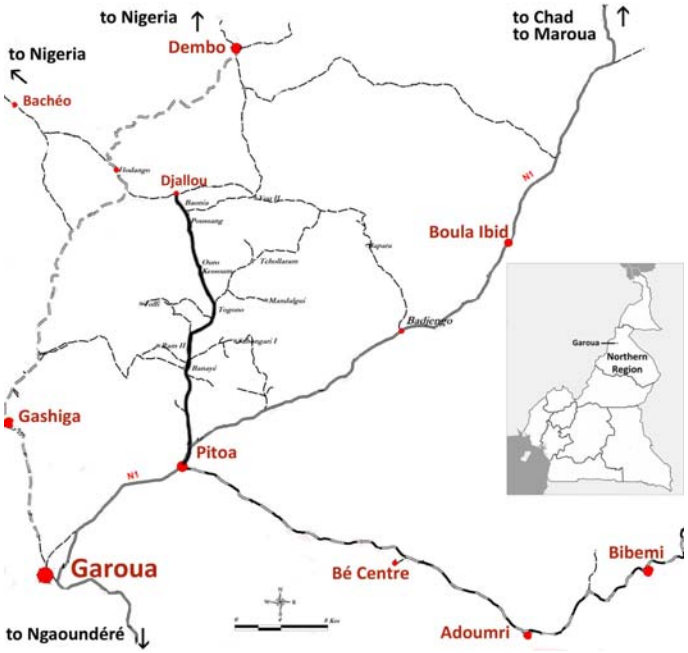
Description of hub and spoke patterns

Pitoa is the main transport hub associated with the road. From Pitoa, transport services connect with the regional town of Garoua (17 km to the southwest) and towns to the north and east, including Maroua. On Sundays, mixed light trucks and one minibus provide transport services along the survey road to and from Pitoa market. Some start at the small market hub of Djallou: these are light trucks travelling from Dembo to the north that overnight at Djallou before market day. Some minibuses and light trucks start at Pitoa, or further afield, and travel up the road to the market-day hub of Ram village (11 km) to collect passengers and goods. Sometimes 4-wheel traffic increases the day before the market as traders (some from Nigeria) bring loads to the market. On non-market days (six days a week) motorcycles are the only transport services that regularly operate on the road. They mainly operate from Pitoa and Djallou and the intermediate hubs of Banayé and Poussang. While motorcycle taxis are very busy on market days, on other days demand is lower, and so some motorcycle operators only work a few days a week. There are feeding roads from agricultural villages, mainly in the lower sections of the road, and these are served by motorcycle taxis, some of which are part time. Traffic on the lower section of the road is double that of the upper section.

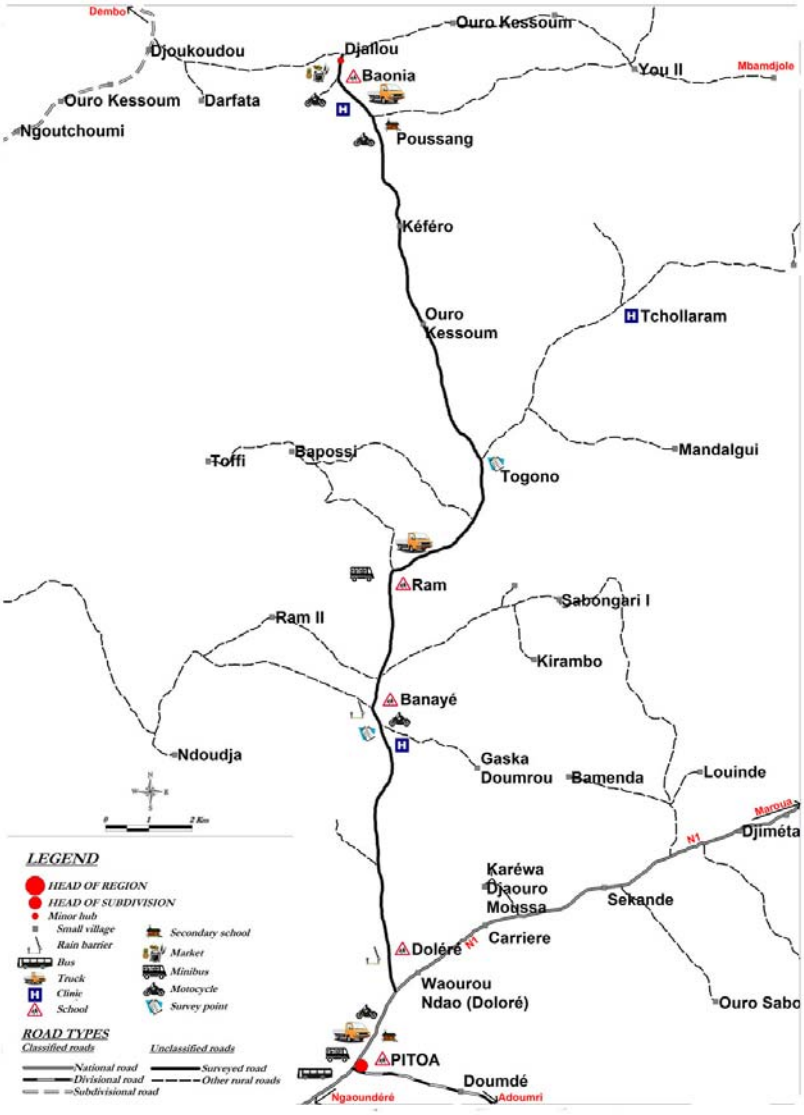
Intermodal connectivity *(one to five stars, the more stars the better)*

'Feeding' *(getting to the road)*	*User satisfaction*	★★★☆☆	*Development impact*	★★☆☆☆
'Linking' *(to onward destinations)*	*User satisfaction*	★★★★☆	*Development impact*	★★★☆☆

The more stars (or the higher score) the better. ★☆☆☆☆ *= Very dissatisfied (= 1).* ★★☆☆☆ *= Dissatisfied (= 2).* ★★★☆☆ *= Medium (=3).* ★★★★☆ *= Satisfied (= 4).* ★★★★★ *= Very satisfied (= 5).*



RTSi Map 1: The context of the road, showing the main routes and markets in the area



RTSi Map 2: Overview of the surveyed road and socio-economic features

RTSi Table 2. Traffic and transport along road												
Daily traffic flows (in both directions)					**Fleet**	**Transport services: passengers and small freight** [3]						
	Normal	*Busy*	*Disrupted*	*Impassable*	*No of RTS vehicles operating on road (normal day)*	***Trip transport** normal day per vehicle*		***Daily transport** normal day all vehicles*		***Annual transport** adjusted for traffic fluctuations*		***Change** in past year*
						Pax (no)	*Frt (kg)*	*Pax (no)*	*Frt (kg)*	*Pax (no) 000s*	*Frt (t)*	*- - 0 ++*
Minibus	0	8	4	0	0	0	0	0	0	14.7	109	0
4x4/pickup	1	1	0	0	0							
Pickup/freight	2	4	1	0	0							
Light truck	0	30	6	0	0	0	0	0	0	36.2	5,157	0
Medium truck	1	15	4	0	0							
Large truck	3	4	3	0	2							
Motor tricycle	0	1	0	0	0							
Motorcycle	170	400	30	10	20/72*	2	22	300	33,700	228	27,900	+
Bicycle	15	30	10	10	0							
Totals	**192**	**493**	**58**	**20**	**32/84***			**300**	**33,800**	**279**	**33,000**	

** 72 motorcycles were operating on road, but this was triangulated down to 20 as the vehicles were localised along the road and not all motorcycles were available on all parts of the road*

Figure 12: Road sections at lower (left), middle (centre) and upper (right) parts of the road

Figure 13: Bicycles are used for personal transport and livelihoods but not as transport services

Figure 14: Road sections showing cotton marketing and a cattle herd

RTSi Table 3. Rural transport services key operational statistics for major transport modes			
			
	Minibus	**Light truck**	**Motorcycle**
Contribution to annual passenger transport (% of market)	5	13	82
Contribution to annual small freight transport (% of market)	1	24	74
Fare per km in USDc	6	8	13
Journey time (average speed on normal days) in km/hr	23	24	31
Transport frequency on normal days (number of opportunities to travel per day)	0	0	8
Number of days a year with 'normal service'	253	268	243
Number of busy days a year	52	52	62
Number of days a year with disrupted service	30	30	60
Number of days a year with no transport services	30	15	0
Reliability factor(s) (%)	68	64	65
Men as % of passengers/day (busy days)	48	62	84
Women as % of passengers/day (busy days)	43	35	11
Children as % of passengers/day (busy days)	9	3	5
Cost of 50 kg accompanied freight in USDc per tonne-km	138	86	151
Cost of 200 kg consigned freight in USDc per tonne-km	90	80	152
Safety: Recalled no. of accidents per 100,000 vehicle trips	0	0	201
Security: Recalled no. of incidents per 100,000 vehicle trip	0	0	136
Typical age of vehicle (years)	NA	31	2
Typical fuel consumption of vehicles (litres per 100 km)	NA	18	4
Typical operating distance per year in km	NA	12 480	26 496
Indicative vehicle operating costs per day for ownership mode *(includes all costs for ownership mode except profit and operational labour)*	NA	131	27
Total revenue per day (USD)	NA	182	34
Total revenue per kilometre (USDc)	NA	142	21
Total revenue per passenger kilometre (USDc)	NA	3	13
Percentage total revenue due to freight (%)	NA	65	66
Regulation compliance (overall assessment)	2	2	1
Development impact (overall assessment)	2	3	4
*Operator 'sample size' **	*1*	*3*	*3*
*User 'sample size' **	*10*	*15*	*24*

*** Notes**. *The statistics in this table are derived from multiple sources, including transport operators, transport users and the traffic counts. For all transport means above, the operations were undertaken under ownership mode and not entrepreneurial mode. For the minibus, complete data could not be gathered during the limited time of the survey as only one minibus operated on that road, and only on one day a week. Its owner provided some information, but he then became unavailable due to the breakdown of his vehicle.*

RTSi Table 4. User satisfaction with main RTS modes (disaggregated for gender)								
	Minibus		**Light truck**		**Passenger truck**		**Motorcycle**	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
'Sample size' (N)	*3*	*7*	*9*	*6*	*9*	*6*	*12*	*12*
Fares	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★☆☆☆☆	★★☆☆☆
Journey time	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆
Operational features	★★★☆☆	★★★☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★★☆☆
Freight	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆
Safety and security	★★☆☆☆	★★☆☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★☆☆☆	★★☆☆☆
Comfort	★★★☆☆	★★★☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★★☆☆
Universal access	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆
Overall satisfaction	**2.7**	**2.7**	**2.5**	**2.6**	**2.5**	**2.6**	**2.3**	**2.6**
The more stars (or the higher score) the better. ★☆☆☆☆= Very dissatisfied (= 1). ★★☆☆☆= Dissatisfied (= 2). ★★★☆☆= Medium (=3). ★★★★☆= Satisfied (= 4). ★★★★★= Very satisfied (= 5).								

Figure 15: Mixed passenger-freight trucks on market day

Figure 16: Large minibus operating on market day

Figure 17: Motorcycles carrying passengers on market day

Figure 18: Motorcycles carrying freight

2.7 Pitoa-Djallou Road, Northern Cameroon: emerging issues

On 'normal days' (Mondays to Saturdays), the only transport services were motorcycle taxis. Motorcycle taxis started operating in nearby Garoua town in the 1990s. The use of motorcycles for private use and taxi services have been increasing and spreading in Northern Cameroon. This trend is continuing. On an annual basis motorcycle taxis carried 82% of the passenger transport market on the surveyed road and 74% of the small freight. The majority of motorcycle passengers were men. On 'normal' days women comprised 11% of motorcycle passengers, rising to 16% (of 1396 passengers) on market days. Women do use and appreciate motorcycle taxis. The suggested main reason for the gender disparity in motorcycle taxi use was gendered access to resources. Motorcycle fares are quite expensive and rural women generally have less access to money than do men.

On Sundays, the Pitoa market day, other public transport modes shared the market with motorcycles. Three multipurpose passenger and freight trucks started at Djallou and travelled together down the road. Another truck and a minibus ran two or three shuttle services between Ram and the Pitoa market. Compared to motorcycles, a higher proportion of the passengers were women in the minibus (43% of 56 passengers) and the trucks (35% of 296 passengers).

In Northern Cameroon, the larger rural transport services are geared to meeting the transport demands on market days. In the area surrounding the surveyed road there are about eight other major weekly markets apart from Pitoa, most of which are on different days of the week. Transport service operators (mainly mixed trucks and some minibuses) are generally based near one of these markets. Each operator has their own particular combination of markets and roads that they serve. This means that on almost all rural roads, the larger means of public transport are only available on market days. Daily minibus and midi-bus services operated on regional roads and on national roads there were also large buses (mainly inter-city operations). On rural roads, there were motorcycle taxis every day and other public transport vehicles only on market days.

Transport operators had little access to investment resources, but ownership of motorcycles was possible though hire-purchase. The operators of larger vehicle were members of associations that controlled access to terminal parks and assisted members. Operational and regulatory compliance was low, particularly for motorcycles. Although the regulators were aware of the many problems and issues, the officials at the regulatory barriers did not appear to enforce compliance. People considered motorcycles and the old minibus to be more dangerous than the open trucks.

On a 'per passenger-kilometre' basis, the passenger fares of minibuses and light trucks were quite similar but those of motorcycles were almost twice as expensive. The same was true of small freight costs. Despite the large price differences users did not express particular dissatisfaction with motorcycle prices: they were critical of all prices. Motorcycles are relatively new vehicles (often less than three years), but the larger vehicles are much older (about thirty years old).

Traffic volumes vary greatly, with weekly and seasonal factors. The numbers and types of vehicles using the road vary on a weekly basis in relation to the Pitoa market. They also vary during the year, based on the climatic seasonality and crop harvests. Transport services are not homogenous along the road. Motorcycle taxis operate around a series of hubs. There are more transport services near the Pitoa end, which include the services that start at Djallou and those starting from Ram.

The road is close to international borders and freight vehicles from Nigeria use the road to access Pitoa market. There is a locally-manned security barrier to reduce banditry. Regulator barriers operated close to the market on market days, and operators resent the charges (bribes) to pass.

The development impact of motorcycle taxis was reportedly high. These are available every day and accessible by mobile phones. They provide very flexible services and help with agricultural inputs and marketing, trade and access to health services and they empower young men. The development contribution of other means of transport could be increased through more regular services.

3 LESSONS RELATING TO TRANSPORT SERVICES

3.1 Over-riding lesson: need for access and frequent, predictable services

During the course of this research, the team had very many opportunities to see rural transport services in action. They were able to talk with a wide range of rural transport users and to see transport services from the perspectives of the users, the operators, the regulators and those concerned with socio-economic development. This has led to a much greater understanding of rural transport and very many inter-related lessons.

At the outset of this research, the team were aware that people around the world want transport services that are:

- Available
- Affordable
- Accessible and convenient
- Safe and secure
- Regular and predictable
- Consistent and dependable
- Convenient for destinations and/or connections
- Timely (good journey and waiting times)
- Comfortable and spacious
- Allow reasonable baggage (or small freight)
- Clean and attractive
- Integrated with information technologies, such as mobile phones
- Allow choices of transport types and/or providers.

Many of the questions for the transport users were intended to rate their satisfaction on these issues. It was anticipated that indicator statistics might be developed to 'measure' the adequacy of the most important issues. It was considered unrealistic to ask users to rank the various criteria by importance as the underlying issues are very complex and interactive. However, during interviews the various desirable characteristics were discussed with users. When asked what was really important to them, a common response was 'it depends'. People would like all these characteristics in different ways, and it can be difficult to single out particular priorities.

Clearly people want safe services: they would not board a vehicle if they knew it was going to crash. However, when faced with the option of travelling on an unsafe vehicle, or not travelling, they will generally opt to travel. When faced with a safe but slow service, with a less safe but quicker service, many (but not all) users opt to travel speedily (with women more likely to opt for safety than men).

It was anticipated that price would be a major issue. It is, but not in simple way. In all surveys, people expressed dissatisfaction with fare prices, but the level of dissatisfaction for different modes was not related to actual fares. Motorcycle taxis are much more expensive than other rural transport modes, but in all surveys there was no more dissatisfaction with motorcycle taxi fares and freight prices than any other fares and prices. Transport users seemed to mentally offset price with availability and convenience. Perhaps there was some stoicism or fatalism: those are the prices we have to pay for transport, and we need transport. Prior to the rapid spread of motorcycle taxis in some countries, no one would have predicted the extent to which rural people would accept the high prices. Transport operators charging 6 cents USD per passenger kilometre on some rural roads had argued that there was insufficient economic rural transport demand to make a profit, which is why services were few or inexistent. If someone had said that a profit could be made by providing a service at two to four times that price (12-24 cents USD per passenger kilometre) people would have laughed. Yet that is what has happened. Perhaps not everyone can travel at this price (a relevant issue that could be followed-up) and perhaps people do not travel as much as if there were cheaper

transport. However, it seems clear that when people need to travel, price may not be the key limiting factor.

The overcrowding and discomfort of some transport types was very clear during the survey. However, people accept such discomfort if they need to travel: they may not be satisfied, but they do travel. People also accept relative discomfort for lower prices (which is one reason for the overcrowding on motorcycles). There can be similar arguments relating to accessibility, cleanliness and convenience. People want these, but the lack of them may not be decisive (although poor accessibility did stop some people with disability from travelling).

The conclusion is that, first and foremost, people need the availability of some transport services. This suggests that one of the key headline indicators should relate to basic service provision (eg, the number of travel opportunities per day in the direction of the hub). Since the availability of services appears a key issue, the reliability of the service (in terms of predictability and disruption) is a closely related concern. Based on discussions and survey responses, it is also clear that people want to be able to carry baggage or small freight, and this should feature in indicator statistics. As relatively reliable day-return services were available on most of the roads studied, this issue did not figure very strongly in these surveys. However, discussions on the surveyed roads and on roads surveyed in other countries suggested that this can be an extremely important issue, particularly for women.

Although people are prepared to accept high fares in order to travel, travel costs are a major concern and should be considered as headline indicators. Safety, security and comfort are important to people, as are the other issues, and these should not be ignored. However, regulators must be careful not to prevent transport services from operating by enforcing unrealistic standards: from the user perspective, poor transport services are much better than no transport services.

3.2 Inadequate rural transport services provision: markets not responding

One of the biggest myths within the transport sector is that if there are roads, 'the market' will respond and provide transport services. 'Evidence' to support this comes from urban and intercity roads (national, regional and major urban routes) where 'the market' generally does provide transport services. The survey of the Kilolo Road in Tanzania provided an example of the market responding on a regional road. However, there is very little 'evidence' from low-volume, rural roads, which are primarily roads between villages to towns. In wealthy countries, it is often acknowledged that rural transport services are poor and may need regulatory stimuli or subsidies. In developing countries, the issue is much more important as fewer people own their own motorised transport. However, the problems of rural transport services in developing countries have tended to be ignored by the transport sector. This is partly because few decision makers ever visit rural roads, and few researchers have documented clearly and systematically the actual transport services being provided.

This research has documented clearly some of the problems with rural transport services. Indeed the transport services were so poor that some of the RTSi surveys reported here had to be carried out on regional roads in order to have something to 'measure'.

In 2012, in Bagamoyo District in Tanzania, which is neither poor nor remote, there were NO rural roads (district roads) with 'conventional' transport services (such as minibuses or rural taxis). The only transport services were provided by motorcycle taxis. One rural road in Bagamoyo had been rehabilitated by an AFCAP-supported project and had a range of experimental surfaces, including some Ottoseal and some concrete strips. This did not have any 'conventional' transport services at all: the only public transport available was provided by motorcycle taxis. In Dodoma Region in Tanzania, only 40 km from the capital city, the rural road surveyed had one daily bus service that operated for just six months of the year. There was one minibus that operated on just a portion of the road for about nine months a year. Apart from that, there were no transport services, on the

road itself, or on the roads feeding into it. Full-time motorcycle taxis had not yet become established on that road, and so for much of the year there were no rural transport services at all, although several motorcycle owners did provide transport services on special request. The road surveyed in the Iringa Region of Tanzania was a regional road, because most of the rural roads in the region had either no transport services at all, or very low levels (one daily bus or minibus, plus some motorcycle taxis).

In January 2013, in the Northern Region of Cameroon, the only roads with daily 'conventional' transport services were national and regional roads. For most of the week, the only transport services on rural roads were provided by motorcycle taxis. On many of the roads, transport services were provided by light trucks (mixed passengers and freight) and/or by minibuses on the day of the local large market. In Northern Cameroon, the rural roads were all of reasonable graded standard and passable by the large trucks and other vehicles used by the local cotton company. They were certainly adequate for rural transport services and on market days (one day a week) these were provided throughout the year. On these roads, people travelling to hospital (for health problems or to give birth) could travel on conventional vehicles on one morning a week. Otherwise the only public transport option was a motorcycle taxi.

The situation in the highlands of Kenya was actually much better. There were some 'conventional' (either minibus or rural taxi) services on all the roads surveyed, as well as motorcycle taxis. To obtain a diversity of transport modes, one of the roads surveyed was a secondary (inter-urban) road. The surveys conducted in Kenya were areas of relatively high population, high road density, significant agricultural production and/or high land values. They were typical of that part of Kenya, but were not necessarily representative of the remoter and less populated areas of Kenya.

During the course of this research, the Team Leader was able to study some roads in China and Nepal, using aspects of the RTSi Methodology. In Pu'er, in southwest China, despite the availability of some rural transport services fuel subsidies, the majority of rural roads had no conventional rural transport services (buses or authorised minivans). In Nepal, several newly-constructed rural roads had very little traffic and few transport services.

While it was apparent that motorcycle taxis are highly beneficial and appreciated, motorcycle taxis are not enough. People like them for their availability and convenience for short journeys. For longer journeys, rural people need 'conventional' transport services (buses, minibuses, rural taxis) which are cheaper (per passenger kilometre) and more comfortable for longer distances.

The conclusion is clear that many rural roads have inadequate transport services and that the private sector does not automatically respond to road provision by providing adequate transport services. Where transport services operate on rural roads, they seldom conform to the stipulated regulations and safety standards of the country concerned. Rural transport services vehicles tend to be overloaded and below national standards. This observation also applies to Kenya, which was otherwise found to have relatively good rural transport services.

3.3 Inadequate transport services planning and regulation

On none of the roads surveyed, was there any proactive planning for rural transport services based on the needs of the rural people and/or the requirements of transport services operators in terms of fares, operating costs and seat occupancy levels. There is no real planning framework for rural transport. The regulating authorities concentrate their limited resources on the busy national and regional roads and urban services. They have very little presence at decentralised (district) levels, and their role is mainly administrative: dealing with licensing, testing and compliance with technical standards.

The regulating authorities have some roles allocating route licenses, but mainly for vehicles that travel some, or all, of their route on main national and regional roads. For example, the regulating

agency in Tanzania is the Surface and Marine Transport Regulatory Authority (SUMATRA). This issues large buses with licenses that have conditions relating to timetables and fares. Minibuses and midi-buses also have licenses linked to routes (or to operating areas), but no timetable obligations. However, any regulatory control generally takes place on the outskirts of towns and cities. What happens on rural roads is seldom supervised: very few, if any, of the transport services operating on rural roads fully comply with national regulations relating to public service vehicles (technical tests, loading levels, insurance, fares charged and emission controls). Many transport services vehicles are not recognised as being public service vehicles (including cars acting as rural taxis, motorcycles and mixed passenger-freight trucks). The rapid growth of motorcycle taxis has posed problems for the regulatory authorities, with the fundamental questions of whether and how they should regulate such non-conventional transport services. The local police almost invariably 'turn a blind eye' to the blatant noncompliance of all transport services, but also generally stretch out their hands to receive 'tips' (or bribes) from the vehicle operators as they pass regulatory barriers on the outskirts of towns.

The absence of any planning framework for rural roads, and the lack of regulations designed to meet the particular needs of rural roads, puts the regulators in impossible positions. They do not have the staff and resources to ensure regulatory compliance on rural roads. The local regulatory staff (including local police officers) know that full regulatory compliance may not actually be in the interests of local people. They know that rural people want to travel with small freight loads, but that mixed passenger and freight transport is technically illegal. While some dangerous practices should be discouraged, enforcing rigid loading levels could have negative impacts on the transport services provision: there is a need for proactive planning to see what would be a suitable combination of loads and fare levels that meets the transport demand and is acceptable to the operators, the passengers and the regulators.

The research team spoke with various officials in the transport planning and regulating authorities in Tanzania, Kenya and Cameroon and discussed the RTSi methodology. The reaction of people was extremely encouraging. Firstly, people recognised this was an area of their profession in which they had very little relevant experience or training. They also could see the benefits of understanding rural transport services and helping to plan and regulate better transport provision. There seems much scope to work with such authorities to enable them to undertake RTSi training, surveys and planning. RTSi data and indicators should allow them to set targets for local transport services and monitor these, in collaboration with local stakeholders. Decisions would have to be made as to who should be responsible for such proactive monitoring and planning (at national level and at decentralised levels). Capacity building would be essential, and additional resources would probably need to be allocated.

On the roads surveyed, there were some transport associations, but they did not engage in any proactive route planning. In Kenya, the minibus and midi-bus operators were all members of Savings and Credit Cooperatives (SACCOs). Being a SACCO member is now a requirement to obtain an operating permit. The SACCOs arrange service rotas, supervise queuing at terminals and engage with the authorities on issues such as fares and changes to regulations. They may also provide support to members in the case of accidents, sickness or financial issues. In Northern Cameroon, the owners of trucks and minibuses were members of transport associations that had similar roles: they controlled access to the terminal parks, acted as a negotiating interface with the authorities and assisted members in difficulties. In Bagamoyo in Tanzania, the minibus associations controlled queuing and terminal access and looked after their members' interests. Most operators of motorcycle taxis surveyed did not belong to associations, but there were some associations that provided support to members. None of the associations were actively involved in planning better routes either in the context of self-regulation or in discussions with the regulatory authorities. In the future, there would clearly be scope for involving associations as part of the participatory processes of planning and regulating transport services.

3.4 Varied and complex patterns of transport services

The research has illustrated the great complexity and variability of transport services. The services vary greatly in time (daily, weekly and seasonal patterns) and space (the services are not homogenous along roads and vary greatly between roads). The types of vehicles, fleet organisation and ownership and operating systems are very varied too. The original conceptual model used by the researchers had been simplistic, imagining people coming to a road and waiting for a passing transport service that would have a clearly defined route, and would operate regularly along that route. This model is still valid for bus routes in many countries, and some rural taxis and minibuses also operate in this way. However motorcycle taxis and other intermediate means of transport do not operate like this. Furthermore, in Northern Cameroon, the organisation of rural transport services is very different, with transport operators having a series of different routes during the week, to meet the transport demands for several different periodic markets. Transport services operating around periodic markets are also seen in some other West Africa countries. In such cases, road-based transport services indicators may make sense for the users, but the operators have a wider perspective as they are operating on several very different roads.

Even on a short road, the transport services may not be homogenous or consistent along the length of the road. On a road with feeding roads, the transport services (rural taxis, buses and minibuses) may become more frequent as one moves from the remotest village towards the destination transport hub. Just as rivers increase in volume as they are enhanced by joining streams, so traffic tends to increase along the road. With rivers, the changing volume can be related to increasing catchment area. With roads, there may be a relationship between transport services and the catchment population (this is something being studied further), but it is not a simple relationship. Water inevitably flows into rivers through gravity, but people do not automatically travel. At the remote end of the road, there may be a large catchment population of potential passengers who actually travel very little. With limited transport services, people are not used to travelling and there appears to be little demand. People living closer to the market and service hub have more transport options, and make greater use of transport services. The relationship between transport services, catchment population, economic activities and socio-economic travel patterns are complex and changing.

The metaphor of a water catchment area can be taken further: on some roads there are clear transport ‘watersheds’. Just as water will flow in different directions, depending on which side of the watershed ridge it falls, so there may be points along a road where people tend to travel in different directions towards different markets, shops or services. A clear example of this was seen on a low-volume road in the highlands of Kenya that linked several national roads. Although it had one designated road number, conceptually it was a series of roads, each with different transport routes and characteristics. For the first ten kilometres, rural taxis moved to and from the local market town. On the subsequent section, people were mainly moving in the other direction, towards another transport hub. There was a transport ‘watershed’ point, where rural taxis set off in two different directions along the road. Furthermore, in one direction, the rural taxis took a 'short cut' on an unclassified road to reach a national road which provided more convenient access to the market town. It proved quite possible to survey the road and to collect meaningful data. However, the resulting statistics did not relate to the entire road, but to the particular transport catchment patterns or routes on the road.

Similarly, where there are motorcycle taxis, their transport service frequency can vary greatly at different points along the road. There will be many motorcycles around the various motorcycle hubs along the road, but surprisingly little motorcycle traffic midway between these hubs. Pedestrian and bicycle traffic is likely to be high close to the major and minor transport hubs. Midway between minor service hubs (which may be in villages with small stores and bus-stops) the traffic flows will be least, and will comprise mainly vehicles travelling along the length of the road. This has implications for the traffic counts used in this RTSi methodology. It also means that ‘conventional’ traffic count

figures may need to be interpreted with caution: the figures will depend on where on the road the traffic count was located, and no single counting point will provide a 'true' representation of the entire road.

3.5 Great importance of motorcycle taxis

In the three countries where the RTSi surveys were piloted, motorcycle taxis have become extremely important transport services. They have been economically viable as transport services due to the low price of motorcycles imported from China and India. In Cameroon, they had started being used in the urban areas in the 1990s, and have been spreading to rural areas ever since; in Kenya they probably started as motorised 'boda-boda' taxis around the border with Uganda in the early years of the decade beginning in 2000. In Tanzania, they started in about 2007. The process of diffusion in Tanzania is still clearly apparent, with some areas (notably in central, western and southern regions) only having small numbers of early 'pioneer' motorcycle taxis. In all three countries motorcycle taxis have been increasing rapidly in numbers, in their geographical spread, and their various roles in rural transport. In all countries, they were relatively new, and the regulatory position concerning their role as public transport services was still being assessed and developed.

Many countries in Africa and elsewhere in the world do not have motorcycle taxis. This was the case of Tanzania less than a decade ago. In countries without motorcycle taxis it is almost impossible to imagine how rapidly motorcycle taxis can spread (entirely by private sector processes). It is also difficult to perceive how important they can become to rural people in ways that might appear surprising (including facilitating agricultural production and marketing and even improving access to maternal health care). In all countries, whether or not there are motorcycle taxi services, there are concerns about safety and some unease as to whether or not such motorcycles should be recognised as public transport vehicles. However, one of the major lessons of this research was the great impact of motorcycle taxis on rural communities and the importance of this transport mode in meeting the access requirements of rural men, women and children.

Motorcycle taxis are much more expensive than conventional transport services. Where motorcycles operate on the same routes as rural taxis, they may be 50-100% more expensive per passenger-kilometre. However, where they provide unique services, with short distance trips and in situations where they may not get a load on the return journey, they can be five times more expensive, based on their price per kilometre. Some people such as the older persons, people with disability and pregnant women reported that they preferred to travel in buses, minibuses or rural taxis (although they generally did use motorcycle taxis if there were no alternative means of transport). Motorcycle taxis are more likely to have accidents than conventional transport services. However, they offer services that are extremely convenient. On the roads surveyed in Tanzania, Kenya and Cameroon, people can use mobile phones to call motorcycle taxis. Unlike conventional transport services, that pick people up and drop them along the road side, motorcycles will travel off the road, even along footpaths, to collect people from their homes. They will also drop people and their goods by their homes, which may be two kilometres from the roadside. They are willing to carry bulky loads, weighing up to 200 kg.

In the conceptual framework for planning the rural transport services indicator, the researchers imagined a rural woman, man and child walking with their goods a notional two kilometres from their home to the roadside (the 2 km being the rural access index standard). It was envisaged that the rural transport services indicator would try to encapsulate their subsequent experience in waiting for transport services and travelling to the local hub in a public transport vehicle. However, with the new motorcycle taxi services, the woman, man and child could use a mobile phone to call a motorcycle to ride along the path to pick them up at their house to take them and their goods on their journey. Motorcycle taxis have therefore affected the concept of access and taken transport services beyond the roads. Clearly motorcycles cannot travel along all footpaths, particularly in hilly,

sandy or muddy areas, but they have moved the boundaries of the transport services. Their charges make them premium services, but for those who can afford them, they greatly improve access.

Motorcycle taxis generally have a different transport 'niche' to that of ‘conventional’ transport services (buses, minibuses and rural taxis). On rural roads, ‘conventional’ services tend to be relatively cheap (per passenger kilometre) and spacious but with few travel opportunities each day. Motorcycle taxis are always more costly and may be less spacious and comfortable (depending on the alternatives), but they are very timely and more likely to be available. Motorcycle taxis tend to operate on short distances, often less than 5 km. They tend to complement conventional services, by transporting people to and from roadside transport stops. There can be some direct competition when people decide not to wait for conventional transport but to take a more timely motorcycle to their destination. However, other rural transport operators do not see them as a major threat. Indeed, they see them as helping their own transport roles by bringing and taking people from outlying village to the routes of the ‘conventional’ transport operators.

The importance and complementary nature of motorcycle taxis was particularly clearly demonstrated on the Djallou-Pitoa road in Northern Cameroon. On this road there was a catchment population on 15,000 located in 15 villages, some of which were along the road and some of which were connected to the surveyed road by feeder roads and tracks. ‘Conventional’ transport services (including mixed freight trucks that carried passengers) only operated on the ‘main’ rural road that was surveyed and only on one day of the week. Motorcycle taxis provided transport services on the feeder roads and tracks, and also on the ‘main’ road. On six days of the week they were the only transport services on the ‘main’ road. On market days they provided both feeder transport and transport along the road: with much higher passenger and freight volumes than on non-market days. They complemented the ‘conventional’ services, providing feeder transport and some people used them instead of ‘conventional’ services due their timeliness and their convenience. As a result, on an annual basis, motorcycles were estimated to provide 82% of the passenger market and 74% of the small freight market on that road. People involved with development issues (teachers, medical staff and village leaders) were asked to assess the different transport services in terms of their contribution agriculture, trade, health, education, empowerment of women, the young and other groups and integration with communications technologies. In all categories, motorcycles were assessed as having the most important development impact, with an overall rating higher than ‘satisfied’ (4.3 out of 5) compared to the minibus and light trucks (which only operated one day a week) with overall ratings between medium and unsatisfied (scores of 2.2 and 2.6 out of 5 respectively).

On the Gitugi Road in Kenya (where there are regularly minibuses), motorcycles taxis were only used for short distance transport but their annual contributions to the annual passenger and small freight market were estimated to be 42% and 45% respectively. The development impact of motorcycle taxis was assessed to be higher (4.1 out of 5) than minibuses and midi-buses (both 3.6 out of 5).

On the regional Kilolo Road in Tanzania, motorcycle taxis are a recent development, and they mainly operate on smaller feeding roads, including those beyond Kilolo. On the main Kilolo-Iringa road that has several large buses and many minibuses, motorcycle taxis still only account for 4% of the passenger market and 3% of the small freight market. This is likely to grow, as will the importance of motorcycle taxis on the feeder roads and tracks to the villages. The development impact was assessed as being similar to those of the conventional public transport modes (about 3.0 out of 5). On rural roads and feeder roads in the Bagamoyo District of Tanzania, motorcycle taxis account for 100% of the rural passenger and small freight market, as these are the only transport services available there. On the Talawanda Road in Bagamoyo, the development assessment of motorcycle taxis was positive (3.7 out of 5).

In all the surveys, the regulatory assessment of motorcycle taxis was very low (generally 1-2 out of 5). Their operators tend to ignore administrative, technical, operational and safety regulations. Many

operate without insurance. Very few operators use crash helmets and an even smaller number of passengers use them. Motorcycles are perceived as being more dangerous than other forms of transport.

The researchers were not able to obtain any reliable road-related accident data in any of the countries where surveys were carried out. The research team were in contact with another AFCAP-funded project that was investigating road traffic injuries on low volume roads in Tanzania. The opportunity for complementary research was high, as the two teams surveyed the same Talawanda-Baga rural road in Tanzania. Unfortunately, the datasets produced could not easily be compared. The accident-related research quantified injuries in terms of accidents per 100 person-years (Jinadasa, Zimmerman, Maegga and Guerrero, 2013). That study did indicate that accidents involving motorcycles and motorcycle taxis were important, but it also included injuries gained on other roads. The accident rate due to riding ordinary motorcycles was slightly higher than that for motorcycle taxis, but people were more likely to be hit by motorcycle taxis than by ordinary motorcycles (Jinadasa et al, 2013).

In the RTSi methodology, people were asked to recall the number of accidents along the surveyed road in the past year of which they were aware. It is not known how this information correlates with actual accidents, but the data do provide indicators of people's perceptions about accidents involving the different means of transport. On the Pitoa Road in Cameroon, the indicator statistic worked out at about 200 accidents per 100,000 motorcycle trips (with no recall of accidents for the other means of transport). On the Kilolo Road in Tanzania, the perceived accident rate was nearer 4000 accidents per 100,000 trips, with other means of transport being one twentieth of this rate. On the Gitugi Road in Kenya, people recalled more accidents for motorcycles, but because there were many motorcycles each with very many trips per year, the accident statistic (5 accidents per 100,000 trips) was actually lower that of minibuses (10) and midi-buses (23). Interestingly, on the Gitugi Road, users gave similar satisfaction about safety to all means of transport. On the Kilolo Road in Tanzania (with the highest apparent accident statistic), motorcycles were rated below other forms of transport for safety. On the Pitoa road in Cameroon, motorcycles were considered less satisfactory for safety than were open passenger-freight trucks, but were rated only marginally less safe than the old minibus that operated on the road (and was not reported to have had any accidents in the past year). It appears that most people regard motorcycles as a potentially dangerous form of transport, but they will use motorcycle taxis either because they have no option or because their timeliness and convenience are of greater importance than the perceived small risk.

3.6 Rural transport services fares

The fares for using 'conventional' rural transport services ranged from 4-10 cents USD per passenger kilometre, as shown in Table 2. The prices were generally cheaper in the larger vehicles. As is common with rural transport services, the fares are about two to three times those of long-distance transport on national roads (which tend to be about 2-3 cents USD per passenger kilometre). The motorcycle fares tend to be two-to-four times those of 'conventional' services. The high figure for Kilolo, Tanzania, was probably associated with short journeys on routes where the motorcycle is empty for the return journey. The fares in Bagamoyo, Tanzania, were cheaper than Kilolo, but more expensive than the fares in Kenya and Cameroon. This may be associated with competition and market stability. Motorcycle taxi services in Cameroon and Kenya have been operating for more years, and there is greater competition.

Small freight costs tend to be very variable, and are particularly expensive for short journeys. The very high costs charged by motorcycles in Kilolo were for short journeys and for relatively 'immature' transport services. The cheaper freight costs on 'conventional' transport service were mainly for long distance journeys (about 40 km).

Table 2: Fares and freight costs on rural transport services

Road location *(all roads were graded, all weather roads)*	**Transport mode**	**Passenger fares** *(cents USD per passenger-kilometre)*	**Small freight costs** *(cents USD per tonne-kilometre)*
Kilolo, Iringa, Tanzania,	Bus	4	45
	Midi-bus	5	46
	Minibus	5	43
Gitugi, Murang'a, Kenya	Midi-bus	6	68
	Minibus	10	103
Pitoa, Northern Cameroon	Open truck	8	86
	Minibus	6	138
Kilolo, Iringa, Tanzania,	Motorcycle	34	602
Gitugi, Murang'a, Kenya	Motorcycle	18	116
Pitoa, Northern Cameroon	Motorcycle	13	151

3.7 Transport services overloading

A common feature of rural transport is over-crowding. Examples observed included five people on one motorcycle, twenty people in one estate car, thirty people in one minibus, fifty people in one midi-bus and one hundred people in one large bus. These were all extremes, but they illustrated the issue clearly. Reasons for the over-crowding are several: without regulatory enforcement, over-loading is an option. It is exacerbated by the desire of the operator to maximise the financial return from each journey. The shortage of transport means that passengers do not have the option of waiting for a vehicle with more space. Another factor is that people often rate timeliness above comfort.

To put the overloading in perspective, those who have travelled in the 'rush hour' on the London Underground or the Tokyo Metro will see that people are prepared to tolerate what appears to be intolerable crowding, in order to travel at a particular time. They are not prepared to wait for the much more pleasant ride that would be possible if they delayed their journey. However over-crowded trains and urban buses are probably not particularly dangerous. Similarly slow moving over-crowded buses are probably not too risky, provided the centre of gravity is low and the brakes are in good condition. There is much greater risk if the overcrowding affects the driver. Two people in the driver's seat of a rural taxi appear to represent a dangerous scenario. When there are three or more passengers on a motorcycle, the operating geometry is completely changed, giving the driver much less control of the vehicle. There are also greater risks if people are hanging onto moving vehicles.

3.8 The age of rural transport fleets and reinvestment potential

On the surveyed roads, 'conventional' (ie, four wheels or more) rural transport services vehicles tended to be quite old, particularly the larger vehicles. The ages of the vehicles used by the surveyed operators are shown in Table 3. Public transport vehicles can have long lives on good roads, but the roads being surveyed were quite challenging. Problems of vehicle maintenance and breakdowns were reported and observed. The fact that people are operating old vehicles suggests that operators are not making large profits that would allow them to invest in replacements. There were no reports of people buying second vehicles from the profits of transport services. During discussions, operators said if they could get better vehicles that were less old, they would try to move to a national or regional road to operate. The rural transport services vehicles tend to be the end of the line: the vehicles may have been used for some years in another country, then imported second hand. They were then often used on urban routes or main roads, before being sold on to the rural transport sector, where standards are lower and profits are lower, so that cheap vehicles are considered essential.

Table 3: Ages of transport services vehicles on surveyed roads

	Transport mode	Average age	'Sample size'
Kilolo, Iringa, Tanzania,	Bus	23	2
	Midi-bus	17	1
	Minibus	19	3
Gitugi, Murang'a, Kenya	Midi-bus	11	1
	Minibus	14	3
Pitoa, Northern Cameroon	Open truck	31	3
Kilolo, Iringa, Tanzania,	Motorcycle	1	3
Gitugi, Murang'a, Kenya	Motorcycle	2	3
Pitoa, Northern Cameroon	Motorcycle	2	3

Motorcycle taxis offer a very different picture. They tend to be quite new vehicles. People often buy them new and either lease them out to operators or operate them themselves. They may sell them after only six months or a year, and few keep them for more than two years. In the case of motorcycle taxi services, the profits are sufficient to invest in new vehicles. Some of those leasing out the vehicles have invested their profits and built up small fleets of vehicles to rent out.

3.9 The operating costs and benefits of rural transport services

The research team had hoped to develop ways of calculating indicative vehicle operating costs based on detailed discussions with a small number of operators. However, robust and repeatable statistics were not obtained in this way. This was partly due to the small number of interviews. Three operators per transport mode had been envisaged, but this was not a large enough number to mask spurious responses. On some roads there were not even three operators of some transport types. The lack of reliable statistics was also due to the lack of any formal accounts or records, and the need for operators to recall or estimate their annual spending and income (based on their perceived average daily, weekly, monthly and annual costs). There were problems of operators over-estimating or under-estimating their costs, their incomes and their travel patterns (number of trips per day or per week). Furthermore, the owning and operating arrangements can be quite complex. Often there is an owning and leasing person, responsible for capital purchases and some annual costs who may receive a flat rate leasing income per operating day. Another person is responsible for the daily operating costs and income, and for some, or all, of the maintenance costs. They may keep all the income and pay the fixed leasing fee, or may share the daily profit in various ways. Some operators are informally-paid drivers, who pay over all (or some) of the operating income to the owner. Sometimes drivers hand over the income from passenger fares, but retain small freight income as a personal bonus. The different permutations are many and complex, and with no records it is difficult to build up reliable statistics. This is further discussed in the section relating to future indicators.

Despite the lack of accurate statistics, various lessons were learned from the data and discussions with the operators. Motorcycle taxi operations are often quite profitable, and allow owners and operators to replace their vehicles. Most motorcycle taxis are less than three years old. The rates of return are good, due to high fares. However, the total incomes are not large, particularly where there is much competition. Motorcycle taxi operators said they had interesting and enjoyable work that funded a reasonable lifestyle in rural areas, but it was not easy to build up capital. People who leased out motorcycles to operators did appear to be able to build up capital. There were people, including shopkeepers and civil servants, who had increased the number of motorcycles they owned and leased out.

The larger, 'conventional' rural transport operations had greater daily income and expenditures. Most operations were only marginally profitable. There was little or no evidence of people being able to re-invest in younger and better vehicles, based on their operating profits. Several operators

reported concerns of what would happen if their vehicle could not operate. While there was some suggestion that some minibus owners who leased out vehicles on main roads had been able to build up small fleets, this was not common on rural roads. Operators seem to feel trapped by poor vehicles and poor roads. If they had better vehicles, they would try to move to better roads. But it was difficult to operate with old vehicles in poor condition on the main roads. Therefore, with their old vehicles, they were forced to find transport 'niches' on the poor rural roads.

All operators longed for better road conditions. Many also complained about the costs in tips (bribes) for passing regulatory barriers. They did not feel the solution was regulatory compliance as they felt that the police or other regulators would always find something that was wrong, so it was cheaper to bribe than to comply.

It proved difficult to obtain reliable vehicle operating cost statistics when talking with the people most knowledgeable about vehicle operating costs (the vehicle operators themselves). Transport planners do not generally try to obtain such statistics that would (if accurate) be directly relevant. Instead they use the various costs and assumptions imbedded in transport planning software such as RED (Roads Economic Decision). These models include many assumptions do not conform to the reality of rural transport services. For example, vehicle depreciation is based new vehicle prices. None of the operators of 'conventional' vehicles that were interviewed could consider purchasing a new vehicle. Their vehicles were generally at least ten years old when they were purchased. Even replacement tyres and spare parts may be second-hand. There is therefore scope to develop some more realistic models of vehicle operating costs on rural roads. This research showed that it was not easy to obtain very accurate data on one road and in a short time. However, it may well be possible to use similar techniques but involving more operators, over a longer period of time and perhaps including some monitoring technologies (such as GPS and metering systems). This would allow models such as RED to be 'calibrated' based on local realities.

3.10 Gender issues

The RTSi user questionnaires and traffic counts are disaggregated for gender, allowing various gender issues to be raised. Although the numbers of women and women questioned were low (about 15 women and 15 men interviewed on each road) the comments and discussions provided some interesting perspectives. One of the clearest issues is that all the transport operators were men. Motorcycle taxis are rated very highly for empowering young people and providing employment, but the young people were all men on the roads surveyed. Most of the owners of transport were also men, but a few vehicles were owned by women but the drivers were all men (either employees or leasing the vehicles).

There were some gender-related patterns emerging from the passengers travelling in different transport types. Table 4 provides the breakdown of passengers for the larger vehicle types and Table 5 provides a similar breakdown for motorcycle taxis. For conventional means of transport, the gender balance in Kenya was relatively equal. This was also true of the minibus in Cameroon. On the open trucks in Cameroon there were more men than women passengers. This was also true for most forms of transport in Tanzania, with the exception of a single midi-bus in on the Kilolo Road (there was only one of these counted). The figures for motorcycles are more striking. With the notable exception of the Tala road in Kenya (where equal male and female passengers used motorcycles), male passengers outnumbered woman by at least 4:1. The Kilolo data is not included for motorcycles as the traffic count position meant that only two motorcycle taxis passed with passengers, and both carried male passengers.

Table 4: Examples of passengers carried by various transport services during traffic counts

Road	Transport mode	Passengers *(total)*	Men *%*	Women *%*	Children *%*
Kilolo, Iringa, Tanzania,	Bus	355	54	37	9
	Midi-bus	49	24	65	10
	Minibus	310	57	37	5
Mlandizi, Bagamoyo, Tanzania	Midi-bus	201	57	36	6
	Minibus	275	63	34	4
Mindora, Dodoma, Tanzania	Bus	61	52	33	15
	Minibus	10	60	40	0
Tala, Matungulu, Kenya	Minibus	345	43	48	9
Longisa, Bomet, Kenya	Rural taxi	311	32	37	31
Gitugi, Murang'a, Kenya	Midi-bus	248	47	38	16
	Minibus	52	47	44	10
Pitoa, Northern Cameroon *(market day)*	Minibus	46	48	43	9
	Open truck	292	62	35	3

Where women travelled less on transport services, it may have been due to cultural factors, including gendered access to resources: women generally have less access to money than men. In Tanzania, Kenya and Cameroon, women tended to be more critical of the high fares charged by motorcycles than were men. They rated motorcycles highly as convenient means of transport, but found them particularly expensive. There may also have been some cultural inhibitions about women travelling on motorcycle taxis, and women appeared more aware of the dangers than were men. Where there were choices in transport modes, women appeared more likely to opt for the safer options.

Table 5: Examples of passengers carried by motorcycle taxis during traffic counts

Road	Passengers *(total)*	Men *%*	Women *%*	Children *%*
Pitoa, Northern Cameroon *(market day)*	1319	80	16	4
Tala, Matungulu, Kenya	222	47	47	6
Longisa, Bomet, Kenya	320	61	31	8
Gitugi, Murang'a, Kenya	358	83	14	3
Mlandizi, Bagamoyo, Tanzania	156	78	16	6
Talawanda, Bagamoyo, Tanzania	43	88	12	0
Mindora, Dodoma, Tanzania	34	82	15	3

4 CRITICAL ANALYSIS OF RESEARCH ASSUMPTIONS AND METHODS

4.1 Challenges of key assumptions in the planning frameworks

The logical framework for this research included two key assumptions that are shown in Table 6. These assumptions and the conceptual framework will be explored and discussed here, together with the practical implications of the rapid rural appraisal survey methodology that was adopted.

Table 6: Critical assumptions in the logical framework

Outputs	Assumptions
1) Methodology for obtaining RTS indicators developed and discussed with key stakeholders	The project team and key stakeholders are able to isolate a simple, clear and reliable set of variables that are key to defining the access provided by transport services
2) Preliminary RTS indicator developed and reported	The identified variables can be used together to form a meaningful RTS indicator

It was assumed from the outset that the project team would be able to isolate a simple, clear and reliable set of variables that could be used to define the quality and/or quantity of the access being provided by transport services. It was also assumed that these identified variables could be used together to form one, or more, meaningful composite RTS indicator(s).

The initial conceptual model was in some ways linked to the World Bank's Rural Access Index, which referred to rural people having 'access' if they were within two kilometres of a road. It had been assumed that the transport services would be broadly similar along the relatively short (10-30 km) rural roads that would be surveyed. It had been assumed that the main types of transport services operating along the road (buses, minibuses and rural taxis) would probably start or finish their routes at a rural village hub from where they would proceed to the nearby town (market and administrative centre and transport hub). The main transport services along the road would be complemented by intermediate means of transport, such as bicycles, motorcycles and animal-drawn carts.

In the conceptual model, a rural family living in a village in the catchment area of the surveyed road would gain access to markets and services by walking to the road (perhaps the 2 km required for the Rural Access Index) and would then wait for, and board, a passing rural transport services vehicle. The idea was to 'measure' what access these people would have on reaching that particular road. The indicator data to be collected was intended to 'measure' the quantity and quality of the transport services' that passed along the road.

This conceptual model would have been valid a decade ago, and would still be valid in some countries in the world. However, motorcycles taxis have completely changed the nature of rural transport services on the roads surveyed in Tanzania, Kenya and Cameroon. This has fundamentally affected implementation of this research, and its findings and conclusions. It would have been relatively straightforward to develop indicators for the 'conventional' rural transport services: it proved extremely difficult to identify simple variables and make meaningful indicators that included motorcycle taxis.

If the conceptual framework were to be updated, the farming family might now not even have to walk the two kilometres to the road and wait for a transport service. They might call a motorcycle taxi by mobile phone. The motorcycle taxi might well travel to their village on the footpath, and it could transport them to a suitable roadside hub, or all the way to the market town. The rural transport systems being studied were much more complicated than the 'passengers waiting at the bus stop' approach that had been anticipated.

4.2 The challenge of including motorcycle taxis as rural transport services

Some of the crucial differences between 'conventional' rural transport services and motorcycle taxis are summarised in Table 7.

Table 7: Some key differences between motorcycle taxis and 'conventional' transport services

Characteristic	'Conventional' transport services	Motorcycle taxis
Vehicle numbers	Low	High
Uniformity of service provision or frequency along the road	Little variation: service often the same all along the road	Extreme variation: very localised service provision
Route fixing	Routes fixed	Routes variable
Road adherence	Keeps to roads	Travels on roads, footpaths and trails
Trip length	Normally fixed, prefers long trips	Highly variable, prefers short trips
Types of trips per day	Little variation: generally passenger trips carrying some (mixed) freight	Very varied: passenger trips, freight trips, mixed trips
Daily trip numbers	Few and fairly constant	Many and highly variable
On-demand services	Seldom, if ever, provide 'on demand' trips	Regularly available 'on demand' along road and in villages off the road
Reaction to market changes	Generally difficult to change location and operational system	Rapid changes possible in location and operational system
Fare prices per kilometre	Relatively low with little flexibility	Relatively high and much flexibility
Regulatory compliance	Medium to high compliance	Low or minimal compliance
Transport associations	Often important	Seldom important
Safety features	Vehicle's 'cage protection'	None (helmets seldom used)
Accidents	Very few	Many
Gender balance (users)	Women often 30-40%	Women often 10-15%

The 'conventional' services are relatively stable, with fairly constant operational patterns. The number of operating vehicles and the average number of trips per vehicle per day may change in relation to market days and the rainy season, but in relatively constant, predictable and measurable ways. Motorcycle taxis greatly increase the variability of all transport services data and statistics. Where motorcycle taxis operate, the overall vehicle numbers increase greatly. More importantly, the ranges of all data and all statistics increase, as well as the amount of variation.

4.3 Traffic counts

Traffic counts clearly illustrate the complexity caused by including motorcycle taxis as rural transport services. The results for conventional rural transport vehicles would be more-or-less the same, wherever the traffic count points were located on a road. With motorcycles (and also with pedestrians), completely different traffic count results are obtained on different parts of the road, with variations in data and statistics sometimes being more than ten-fold.

Initially, the traffic flow was measured using traffic counts on 'normal' and 'busy' days at a single traffic count location. Subsequently, traffic counts were taken on different parts of the road. These showed that even on relatively short (10-30 km) rural roads the frequency of vehicles can be very different in places just 10 km apart. One single traffic count point could not capture the complexity of the situation. If two (or more) points were surveyed, there was no logical way of combining the different datasets. An 'average' traffic count would have little meaning as such a traffic pattern was being experienced by nowhere along the road.

4.4 Operational patterns

On many rural roads, the same operators of public transport vehicles make regular trips between a village 'terminus' and the destination town. The route and trip length are generally constant and the main variable is the frequency. Depending on the transport demand, the distances and the number of other vehicles sharing the market, trips on 'normal' days might be weekly, daily or twice daily. Initially, questions were asked to operators (and users) on the number of trips per day (or per week) as well as weekly variations (eg, markets) and seasonal changes (eg, rainy season disruption).

The situation for motorcycles became increasing complex, as there were passenger trips, freight trips and mixed trips, on busy days and normal days and on weather-disrupted day. The spreadsheet was adjusted to cope with this complexity. It was ironical that by attempting to accurately record all the different transport categories, there was greater scope for possible inaccuracies. A motorcyclist might do an average of ten 'trips' a day. These would be to a range of destinations, and trip length could be very variable. Asking questions that tried to break these down into freight and passenger trips on normal days, busy days and disrupted days introduced greater risks of overestimating or underestimating average frequencies and average trip lengths. In addition, with more trip categories and questions, there were more opportunities for possible errors in recording responses and in the subsequent data entry.

4.5 Different systems of vehicle ownership and operation

Initially, questions relating to vehicle operating costs were based on the assumption that the operators of rural transport services had relatively straightforward patterns of vehicle use and ownership. The planning models used in the transport sector, notably HDM4 and RED are based on conventional, formal-sector financial procedures with investment costs, depreciation, maintenance routines, labour costs and fiscal compliance. However, most rural transport operators on the rural roads surveyed operated in the informal sector with a variety of ownership systems, minimal record keeping and day-to-day survival strategies. As more was learned, the greater the complexity of the systems emerged. The questions and analysis systems were adjusted to try to capture the different situations. Operators were asked about the importance to their businesses of journeys on other roads. They were asked if they owned or leased their vehicles and the prices they paid, to try to establish their overhead costs. However, while it was possible to obtain fairly accurate data on some costs, these related to particular vehicles. Averaging the statistics from different vehicles was not necessarily appropriate. Moreover, on relatively complex issues like vehicle operating costs, the researchers had to be very clear in their own minds about what figures were compatible with the other data supplied by that respondent. The researchers had to query, at the time of interview, any responses that were not consistent. If discrepancies were not spotted in the field, it became difficult to decide which of the conflicting responses was spurious.

4.6 Responding to complex and variable transport patterns

From the start, the team's aim was to understand, describe and measure the actual situation on the road. Every time a new issue of variability and complexity was raised, the team endeavoured to 'capture' the situation, by increasing the scope of the data collection and analysis.

The initial research response to try to capture the complexity proved self-defeating and made questioning, analysing and interpreting much more difficult. Perhaps it might have been better to try to ignore the complexity and concentrate only on more superficial surveys and analyses. However, it is actually difficult to ignore the additional factors, when it appears they could be incorporated (albeit with increasingly complex analyses). Since starting this research, the team has learned that in some countries (including Nepal), some rural transport operators double their bus fares on rural roads during the rainy season (in Nepal, for about three months of the year). This fare change can be really important for users and for operators. Should this be ignored (the simplistic situation), or

taken into consideration? If they were to be considered, this would involve including an additional question in all surveys with some new calculations added to bring this extra information into fare-based indicator statistics.

The researchers were faced dilemmas as they tried to understand and capture relevant data from complex rural transport systems. Perhaps it had been unreasonable to assume that it would be possible to isolate a simple, clear and reliable set of variables. In particular, it seemed impossible to ignore the crucial roles of motorcycle taxis, but by including them they greatly increased the complexity of the rural transport services situation that had to be 'measured'. The unforeseen complexity and variable nature of rural transport services when motorcycle taxis were included almost turned the original conceptual framework and research assumptions into 'killer' assumptions. However, with much hard work, the team was able to identify variables that could be used to develop meaningful indicators. This was certainly not straightforward due mainly to the great variability of the data and statistics relating to motorcycle taxis.

4.7 Appropriateness of the qualitative rapid appraisal methodology

As noted earlier, the methodology developed and tested was based on qualitative rapid appraisal techniques, designed to get a quick understanding of the rural transport services issues, together with some quantitative estimates of transport costs and volumes (Starkey, 2007). The numbers of people to be interviewed were intentionally small so that the surveys could be rapid and cost-effective. From the outset, this research aimed to obtain information that was as close to the 'truth' as possible, because it would be reported by a small number of reliable stakeholders who 'knew' the real situation on the road. The methodology involved mid-level transport professionals talking with a hand-picked selection of relevant stakeholders.

The methodology developed was very different from quantitative socio-economic surveys or public opinion sampling. These surveys generally involve simpler questions and much larger interview numbers. They include some form of randomisation in the selection of the respondents to allow conventional statistical analyses.

This qualitative methodology involves small interview numbers and the non-random selection of respondents. The respondents are expected to be able to articulate assessments that would be broadly in line with those of others in their stakeholder category (development authorities, transport operators, users of particular transport types and people within the ten categories of transport users). The people interviewed are not representative samples of their 'groups' and their assessments are deemed to be 'indicative' but not statistically significant.

When trying to obtain a legitimate 'best estimate' of a situation, one qualitative research tool is a focus group discussion. People in a community (or other subset of society) are brought together and led through various issues and questions. Depending on the topics being discussed there may be unanimity or many ideas. People have different recollections and opinions and so even if an external issue is being discussed, there may be some debate about the actual qualities and quantities involved. However, it is generally possible to reach a consensus: after discussing each issue, the focus group can often agree a common assessment or conclusion.

In planning the methodology, one option had been to gain the required assessments of transport services from four (or more) focus group discussions: users, operators, regulators and development personnel. Each focus group would have been expected to conclude with agreed assessments about the transport services and associated issues, together with some agreed indicative quantitative estimates that would help to define 'the truth' about the actual situation. In the process of the focus groups discussions, the researcher(s) would learn interesting new aspects, they would openly 'triangulate', and in their facilitation they would be able to explore areas of ambiguity, disagreement

or controversy. Focus group facilitators should not impose their own opinions, but they should (with politeness and respect) probe issues and challenge apparent anomalies.

In implementing the surveys, spontaneous, informal focus group discussions have often arisen: outside a small market, in the compound of a village elder, at a transport terminal or a motorcycle taxi hub, groups of people have gathered round and discussed the various topics and questions. Such opportunities have provided valuable insights and lessons.

However, focus group discussions were not built into the survey methodology for several practical reasons. Focus group discussions can be dominated by particular influential individuals. Even if a wide range of people are present in focus groups, the less 'powerful' voices may not be heard. Men often dominate mixed gender groups. Powerful women often dominate women's focus groups. If there is an authorised official (village head, police officer, transport association leader) in a focus group, people may be unwilling to discuss unauthorised transport operations. A second problem with focus group discussions is that for logistical reasons they tend to be centred on one or more large village along a road, so that the information is coming from a limited portion of the road. It was intended that this survey be more stratified (in a non-random way), by interviewing people from many places within the road catchment areas. A third problem is that focus groups require time to organise and to implement. Once the organisational processes have started the researcher may 'lose control' of the agenda in terms of timing, participation and the subjects discussed. Given the short timescale intended for the surveys, a researcher would have much greater flexibility if they were to seek out the various categories of people to interview. If certain individuals were not available at one time or place, it would be possible to continue the survey by interviewing alternative people and categories on that day.

For these reasons, this research did not use focus groups but concentrated on having many different dialogues with individuals, with the various assessments made being averaged by the analysis software. This allowed a wide range of types of users to be interviewed (twenty different categories, after disaggregation for gender). Three operators were interviewed for each transport mode and three different people were involved in assessments relating to the regulators' perspective and the development perspective. The methodology allows and encourages researchers to engage with a wide range of users, operators, regulators and people with a development perspective. The researchers should not just complete questionnaire forms; they should probe and triangulate issues and so have very many opportunities for learning. As the lessons learned may not be apparent from the various RTSi tables, they must be reported clearly by the researchers within the RTSi Road Reports.

4.8 Numbers of transport users interviewed

At an early stage in the planning it was decided that an overview of the different perspectives of the various stakeholders could be obtained through about 50 interviews with users, operators, regulators and people concerned with development. This target would allow a broad range of people to be contacted without putting an unreasonable workload on the implementing researcher(s). The minimum number of interviews required would be 45, as illustrated in Table 8. This was broadly in line with the rapid appraisal of rural transport methodology (Starkey, 2007) from which this methodology was developed.

To ensure an appropriate mix of users, at least 15 men and 15 women would be interviewed with at least two people who were farmers, traders, people with disability, older people, students, and people travelling to do with health, maternal health, employment, financial services and socio-cultural reasons. Where possible, some 'non-users' of transport services should be interviewed as well. These would be people who would like to use the transport services, but felt excluded from doing so, due to issues such as unaffordable prices, inappropriate schedules, problems with physical

access or local discrimination. The various categories of users were not disaggregated, as the numbers of people involved were much too small (eg, two students, one female and one male).

Table 8: Suggested minimum number of survey interviews required for the methodology

User perspective interviews	Minimum number of interviews	Minimum female respondents *
Farmers	5	2
Traders	3	1
People with disability	4	2
Older people	4	2
Students	2	1
Health users	2	1
Maternal health care	2	2
Transport for employment	2	1
Transport for financial services (bank, salaries, etc.)	2	1
Transport for socio-cultural, religious reasons	2	1
Non-users ('excluded' people with travel needs)	2	1
Subtotal	**30**	**15**
Development perspective interviews		
Educational professional	1	n/a
Health professional	1	n/a
Village leader	1	n/a
Subtotal	**3**	
Regulator perspective interviews		
Transport services authority (if knowledgeable about survey road; if not another professional, eg teacher)	1	n/a
Police	1	n/a
Local authority / village leader	1	n/a
Subtotal	**3**	
Operator perspective and VOC interviews		
Per mode of transport service	At least 3 per mode	n/a
If three transport modes	9	n/a
Subtotal	**9**	
Overall total (minimum number of interviews)	**45**	
** It is not realistic to set gender targets for officials or operators, but a gender balance would be preferred if practicable*		

The users interviewed provided opinions on each of the means of transport they used. For the major transport services, from 30 users interviewed (15 of each gender) it is likely that most respondents will provide information. However, 30 interviews would generate smaller datasets for the forms of public transport that had a low 'market share'. In some surveys, very few of the people interviewed could give information and opinions on the less common modes of transport. These included midi-buses on the Kilolo Road in Tanzania (3% share), minibuses on the Pitoa Road in Cameroon (5% share) and midi-buses on the Gitugi Road in Kenya (10% share). On the Kilolo Road, out of twenty eight users interviewed, only five (2 men, 3 women) had used the midi-bus.

To avoid very low 'sample sizes', towards the end of the survey process, the researcher needs to seek out users of particular transport types. There is a similar targeting process to ensure there are, for example, four people with disability. It is suggested that there should be a minimum of five men and five women for each transport mode. If ten passengers (five men, five women) are deemed insufficient to highlight meaningful gender differences, it may be appropriate to aggregate the gender data for the 'minor' means of transport.

The information to be obtained from the users was of two types:

- qualitative assessments of services (rating satisfaction on a five point scale).
- indicative quantitative estimates relating to the transport services (prices, frequencies, times, seasonality).

The quantitative estimates from the users are for factual information relating to the transport services. The quantitative data do not 'measure' any attributes of the users themselves. For the quantitative estimates, if one had perfect knowledge of the road over time, there would have been only one 'correct' answer. There would have been precise numbers for actual prices paid, transport frequencies, days of disruption and accidents along the road: people were being asked to recall or estimate these. The questions are not measuring variations between the people surveyed: they are estimating the 'truth' of the actual transport services situation. As the quantitative estimates are aggregated for gender, the 'sample sizes' of user-derived statistics are about 30 for common transport types and questions answered by most people. The research team has found such numbers of interviews appeared to be reasonable and seemed to provide good estimates of the various costs and frequencies. As noted, the datasets can be small when it comes to the less common transport types, or questions that not everyone answers (such as the cost of consigned freight).

The 'qualitative' questions for users are assessments of satisfaction with various aspects of transport services. Although they are assessments related to transport services, they are personal assessments based on the opinions and transport needs of those people. As they are disaggregated for gender, the 'sample sizes' are half those of the 'quantitative' estimates. For the common forms of transport, the responses may be 14-15, but they may be as few as 5 people providing information for the transport types that are less used.

The user assessments are not integrated into any of the proposed 'Headline Indicator' statistics. Rather, it is recommend that they are displayed in RTSi Tables with 'star-ratings', with numerical overall averages on a five-point scale.

Two closely related questions have arisen in relation to the surveys:

- Is this qualitative methodology appropriate for the organisations who may wish to obtain rural transport services indicator statistics?
- Are the numbers of people interviewed adequate to obtain valid assessments and to allow meaningful conclusions to be drawn?

One reviewer suggested that 30 men and 30 women users should be interviewed, as well as larger numbers of operators and people providing the perspectives of the regulators and development personnel.

If a 'sample size' of 30 users is deemed appropriate, this could be achieved by interviewing 15 men and 15 women and aggregating the results. This would be a very small change in the interview numbers that would not affect the implementation of the survey. At present data from people with disability, older persons, students and the various socio-economic categories are aggregated: the particular issues relating to the different groups lessons are reported in the text of the RTSi report. The same could be done with gender. This is not a recommendation of the research team, but it would be one solution to the apparent problem of 'sample size'.

While larger 'sample sizes' (such as 60 users) would be appropriate for a quantitative, enumerator-based surveys, this methodology has been based on rapid rural appraisal techniques. With the qualitative methodological approach used here, increased interview numbers rapidly lead to diminishing rates of return in terms of new information. Doubling the interview numbers would slow the survey and increase the resources required. It would also become more repetitive and less interesting for transport professionals. With increasing time requirements and more repetitive

processes, the surveys would probably be delegated to junior professionals or to survey enumerators. However, this methodology and the questionnaires were not designed for such people.

With the methodology developed, small numbers of interviews can yield valuable lessons and insights when implemented by competent researchers. The methodology was designed as a small 'accurate' survey of a hand-picked selection of people, with all information triangulated for consistency and apparent validity. It is recognised that this puts a great responsibility on the implementing researcher(s). When implementing the surveys reported here, the researchers rapidly reached diminishing returns in terms of new knowledge as the survey progressed. After a few interviews, it became clear what were the main transport types, what were their relative strengths and weaknesses and what were the main issues. This qualitative information could be obtained rapidly, as could the basic parameters relating to the actual transport numbers, frequencies and costs. In subsequent interviews, lessons could be learned from different occupational perspectives as well as insights from different anecdotal experiences shared.

With the current methodology, increasing the interview numbers and using enumerators would not necessarily result in more accurate information. Enumerators would be more likely to record spurious information. Interview numbers would need to be much larger to mask the data problems introduced by the enumerators themselves. With much larger numbers of interviews, the non-randomised basis of the current sampling could become an issue.

Therefore it is suggested that a different but complementary methodology is developed using quantitative research techniques, with larger interview numbers for implementation by enumerators. Such a methodology could be much more focussed, with the aim of generating a smaller number of statistics for use in the 'headline indicators'.

4.9 Interview numbers for operators, regulators and development personnel

For the operators, regulators and development personnel there are also various qualitative assessments of the transport services situation on five-point scales. These are not integrated into indicator statistics but are displayed in tables, with average 'star' ratings and numerical overall assessments on a five-point scale. The operators are also asked to provide quantitative information about their vehicle operating costs, and these are discussed in the following section of this report.

The methodology is intended to result in various assessments from the operator, regulator and development perspectives that are appropriate and that most people would agree were valid. While these assessments will be influenced by the personal experiences and temperament of the respondents, the questions ask for objective assessments about the prevailing situation. Since focus group discussions have not been built into the methodology guidelines, the requirement is that at least three separate people will be interviewed for each perspective (with each transport mode having its own operator perspective). The assessments made by the three (or more) people will be averaged by the analysis software. In normal circumstances, the three assessments of each perspective should broadly similar (as they are based on assessments of the actual situation on the road by knowledgeable people). If there are discrepancies, these should be investigated by talking with more people (triangulation). If such investigation suggests one assessment was actually spurious, the guidelines make it clear that it can be ignored and not entered in the data sheet.

The research team has found that the assessments of the various respondents to the operator, regulator and development perspectives questions have been broadly consistent and similar. They have appeared to be understandable and reasonable, based on the transport services and the roads in question. They appeared to be broadly 'repeatable'. Since the respondents were often asked to provide explanations for their assessments, many lessons were learned and discussed in the RTSi Road Reports. Examples included different credit availability for transport modes in Kenya, dust

problems with motorcycle taxis in Cameroon and point-to-point transport of people with disabilities in all countries.

Given the apparent repeatability of the assessments and the way the information is used (in tables of star-ratings and not in indicator statistics), the research team is happy with the recommended numbers of people to interview for the operator, regulator and development assessments. As the administration of these three questionnaires and the subsequent data entry are relatively straightforward, it would be possible to increase the number of interviews. For example, four or five of people in each category could be included if the relevant stakeholder organisations would be more comfortable with this. However, many rural roads have fewer than five operators of 'conventional' rural transport services.

4.10 Interview numbers for Vehicle Operating Costs

At the beginning of the research, it was assumed that in-depth interviews with two or three operators of each form of transport would provide a good insight into the operations of that particular transport mode. They would also provide some good estimates of Vehicle Operating Costs. In theory, the best way to obtain Vehicle Operating Cost data would be to sit down with a vehicle operator and go through all their records (on paper or in the operator's memory). In this way, one would get the most accurate estimate possible of the operating costs of that vehicle in that situation. Repeating that with a second operator with another vehicle would get the best possible estimate for that second vehicle. The same would be true for a third operator. The three surveys should be accurate for those particular vehicles.

Unfortunately, obtaining meaningful information on Vehicle Operating Costs proved more difficult than expected. There were few, if any records to consult. The questions were technical and required explanation: the income and expenditure categories of questionnaires did not necessary correspond with the way the operators gained and disbursed money. There were problems with the data recorded due to inadequate recall, different systems of operation and different ways of sharing out the various costs and benefits of the transport operations. Even if the individual figures had been reliable, calculating average statistics proved problematic. The averages did not represent any one vehicle. They may have been averaging different types of engine, travel patterns, maintenance strategies and funding systems. Increasing the interview numbers might help, but on many roads there were only a small number of operators.

It is accepted that with the existing questionnaires, the three interviews are insufficient. Five to ten interviews might be better, but they probably would not be compatible with the rest of the survey methodology. On many rural roads, there are only a small number of operators. Going beyond the road could increase the 'sample size', but the resulting statistics would not be road-based. With interview numbers more than five, one would probably use enumerators, and by doing so one would decrease the accuracy of the recorded data. Enumerators are less likely to understand the nuances of transport operators' responses.

The question of possible Vehicle Operating Cost indicator statistics is discussed later. It will be necessary to review and to further test the methodology, questions and interview numbers relating to Vehicle Operating Costs.

4.11 Implications of methodology and interview numbers for indicator statistics

In the subjective opinions of the team, the qualitative survey methodology developed is still the best available for the rapid appraisal of rural transport services. Naturally, the methodology should be reviewed, and where appropriate the questions and the interview numbers should be adjusted. The methodology should be implemented by mid-level transport professionals to obtain a rapid understanding of the 'reality' of transport services, the key issues and some quantitative data

relating to costs and traffic volumes, all of which should be included in RTSi Road Reports. In such reports, the authors should acknowledge the small interview numbers, and they should not highlight minor differences in the statistics developed by the software. The reports should concentrate on sharing an understanding of the broad picture and the major issues emerging from the many survey discussions.

As will be discussed in the following sections, the team suggests that:

- The existing survey methodology is retained for surveys to produce RTSi Road reports. All statistics in these reports will be presented with explanatory text. If reviewers and stakeholders are concerned by the interview numbers, the number of interviews could be increased by a modest amount, without changing the methodology.
- The proposed 'Headline Indicators' will not include any statistics derived from very small datasets. The 'Headline Indicator' statistics proposed will not be disaggregated for gender (which permits 'sample sizes' twice as large as those used for gender-disaggregated statistics). The 'Headline Indicator' statistics will be relatively straightforward (based on prevailing prices and frequencies) which do not involve subjective assessments.
- A complementary highly-targeted rapid quantitative survey methodology should be developed to allow the headline indicators to be generated without having to conduct the full survey. This survey methodology should be designed to be implemented by enumerators.
- The methodology, questions and interview numbers for acquiring good Vehicle Operating Cost data should be reviewed and adjusted appropriately.
- Where the fleet of vehicles operating on a road is small, data can be collected from other operators in the area. This should be on the understanding that such information should be used with great caution in any road-based assessments and conclusions.

5 PROPOSED INDICATOR CHARACTERTICS AND METHODOLOGY

5.1 Indicator requirements

The aim of this research has been to identify and test indicators that can 'measure' rural transport services in valid ways that are meaningful to the key stakeholders. Indicators should be relevant, valid, reliable, sensitive, measurable, ethical, appropriate, transparent, interpretable, actionable and be based on cost-effective data (Gudmundsson, 2010). The rural transport services indicators developed should be consistent and replicable and they must be sensitive to changes in the transport services. They should allow appropriate comparisons over time and space. They should be based on data that are easy to collect and should measure parameters that are relevant to the main stakeholders (passengers, operators, regulators) and which could be improved by appropriate actions. This 'actionability' is crucial, as it allows stakeholders (governments, operators, users) to instigate improvements to roads, vehicles, operational practices or pricing systems that will lead to better transport services and in doing so, 'improve' the indicator. Local, national and international targets can be set, based on measurable and 'actionable' indicators.

From the outset, the research team considered that key indicator components might include actual passenger fares, frequency and journey time. If practicable, they should also reflect safety, security, reliability, predictability, accessibility and comfort, taking into account issues concerning gender, age, disability and socio-economic disadvantage. Other issues might include transport capacity, freight transport and the integration of alternative modes of transport.

The research team worked on the premise that rural transport service indicators would relate to individual roads. Subsequently they might be aggregated to develop indicators for wider areas such as districts. Road-specific indicators were considered appropriate because each road has unique transport services characteristics. Furthermore, road-specific transport services indicators could be

used by those concerned with road management to justify, monitor and evaluate road investment and maintenance.

5.2 Disaggregation for intermediate means of transport

During the collection, analysis and presentation of transport services information, the modes of transport have been disaggregated. This has meant that most of the indicator statistics generated have related to particular types of transport. This has been very important.

On all the roads surveyed in Tanzania, Kenya and Cameroon, motorcycle taxis played very important roles. They primarily operated for distances less than 10 km, but for these short journeys they carried large numbers of people and significant quantities of small freight, making them, on some roads, the major providers of rural transport services. In the Cameroon study, motorcycles provided 82% of the annual passenger transport and 74% of the annual small freight transport. Fares per kilometre were significantly higher than the larger forms of transport, and there were more reported accidents. In these countries, and in many other countries in the world, motorcycles are recognised as an important means of public transport. In France, and some other European countries, motorcycle taxis are an elite and expensive, traffic-beating form of transport. However, it is generally acknowledged that motorcycle taxis create a challenging situation for transport regulators.

In many countries in the world, motorcycle taxis have not (yet) become established. In South Africa, Botswana and Lesotho, and several neighbouring countries, motorcycles for personal use are not yet common. This could change very quickly. In Tanzania, motorcycles were uncommon eight years ago, and motorcycle taxis only started about six years ago. However, for the moment, the authorities in most southern African countries are extremely negative about the possibility that motorcycle operators could start motorcycle taxis services. The transport regulators are reluctant to even contemplate their operation in their countries. For them, motorcycle taxis cannot be considered a legitimate form of transport. Similar points of view may be expressed by transport planners and regulators in China, Nepal and many other countries around the world. In Colombia, where motorcycle taxis are common and there is a high level of regulation, there have been several attempts to ban them.

When contemplating international indicators and standards, there is no consensus on whether motorcycle taxis should be considered a ‘legitimate’ public transport service. In some countries they are an anathema. Even in countries where they are commonly used, there is debate as to whether or not they are appropriate. They cannot be considered to provide the same quality of transport services as buses or minibuses.

It is clear from their great importance in some countries that motorcycle taxis must be included in indicator statistics. It is also apparent from the attitude of certain countries that they should not be aggregated automatically with buses and minibuses in composite indicators. It therefore seems there should be one ‘indicator’ (or a series of indicator statistics) for ‘conventional’ public transport (buses, minibuses, rural taxis) and a separate one for intermediate means of transport. The intermediate means of transport would include motorcycle taxis and motor tricycles (which are increasing in some countries). This category could also include animal drawn transport and bicycle taxis, where these are important.

The methodology for collecting and analysing the data should remain disaggregated for all important rural transport services (formal or informal, authorised or non-authorised). In presenting the indicators, motorcycle taxis should remain as a disaggregated category, allowing planning authorities and others to view them as they see fit. Such disaggregation makes sense as the services provided by motorcycle taxis are very different from those provided by buses and minibuses, in terms of journey type, cost, comfort and safety. It is possible that ‘passenger trucks’ (another common but often

unauthorised means of rural transport), should also remain disaggregated in the presentation of the indicator data.

5.3 Methodology for determining the indicators

Initially, the proposed indicators will all be generated using the recommended RTSi survey methodology and its associated survey questions and spreadsheet for data entry and triangulation. Once the data has been entered and the required triangulations have been made, the eight RTSi Road Report summary tables are generated automatically by the spreadsheet. The eight tables of RTSi indicator statistics will form the basis of the RTSi Road Reports and they will be presented together with explanatory text, illustrative maps, GPS tracks and photos. While the survey methodology and spreadsheet will require further testing and modifications (some of the issues that must be addressed are noted below), it does provide the basis for an effective, rapid and remarkably comprehensive appraisal of the transport services situation on any rural road. The RTSi Road Reports and their indicator statistics will remain disaggregated for transport type (all key statistics) and for gender (user-based opinions and satisfaction).

While the RTSi methodology will remain the basis of the majority of the indicators and the RTSi Road Reports, some simpler 'headline' indicators will be suggested that will not necessarily require the implementation of the full methodology. These simpler 'headline' indicators will be separated into two (or three) classes, one for 'conventional' public service vehicles and another for motorcycles and other intermediate means of transport. A possible third class would be other 'unconventional' transport types where these exist but are not recognised as authorised public transport vehicles. A much quicker and simpler survey methodology will be developed for these 'headline' indicators. This will allow the headline indicators to be obtained for many more roads (possibly all rural roads). This will lead to a wide and shallow data set that can complement the deeper and more comprehensive data sets obtained from the RTSi Road Reports. The combination of these complementary data sets should become extremely useful in the planning, appraisal and evaluation of rural roads and rural transport services.

6 CRITICAL ASSESSMENTS OF THE MAIN INDICATOR OPTIONS

6.1 Fares and travel costs

From the outset, the cost of travel was thought to be a key indicator. All stakeholders have agreed with this. One of the key assumptions in the appraisal and evaluation of roads is that travel costs decrease with road improvements. At present, this is estimated using theoretical vehicle operating costs rather the prices rural people pay for transport services.

Fare price per passenger kilometre is a valuable statistic that can be calculated easily from data that is simple to collect. It is relevant, valid, reliable, sensitive, measurable, ethical, appropriate, transparent, interpretable, actionable and based on cost-effective data. This indicator does vary within a reasonably narrow range (generally within one order of magnitude, or less than a tenfold difference) and is responsive to road improvements and to transport competition. It allows comparisons over time and space, within localities, countries and regions.

The data should be collected from user surveys, asking typical journeys and fares and computing the statistics using distances obtained during the survey (GPS, maps or stakeholder reporting). Some people have questioned why fare data should not be obtained from the operators, as this would be simpler. Firstly, some fares are regulated and operators might feel obliged to give the official fares, when they actually charge more. Users are more likely to give accurate information about what they are expected to pay. Secondly, this research has shown that fares for long journeys tend to be cheaper (per passenger kilometre) but not all rural users make such long journeys. By asking users about typical journeys they make, a more realistic estimate is provided about actual fares paid by rural people in their normal travel patterns.

As noted, the fare data for motorcycles (and other intermediate means of transport) should not be aggregated but should be presented separately.

Data from different 'conventional' modes can be aggregated to make this indicator simpler. The aggregation should not be a simple average of transport modes but should be related to their contribution to transport services along the road. With the existing data collection it would be possible to base this on the annual passenger kilometres travelled in the various modes. This will take account of passenger capacity and journeys per day and per year (allowing for disruption).

Some passenger fares rise around special holidays, but in the indicator calculations such short-term fluctuations may be ignored. However, if passenger fares routinely increase significantly during the rainy season, this should be taken into account. The 'indicator' fare would be the average fare, based on the number of days at each fare level. The average fare indicator would be higher than a dry season indicator, but it would be sensitive and actionable (through road improvements to reduce the need for a rainy season premium).

6.2 Freight costs

The cost of transporting small freight is important in rural areas. Small-scale farmers (women and men) may take small loads to markets and they may buy farm inputs (such as sacks of fertiliser). People often wish to buy shopping and household goods in towns, and need to transport them back to the villages. Domestic construction materials, including iron sheets and cement, may also be purchased from urban suppliers.

While rural passenger services have been found to be complex, rural freight services are even more variable. Some freight is carried by private individuals and companies for their own businesses. There are traders who buy or sell produce or products and include their transport costs in their traded prices. There are freight contractors who rent out their whole vehicle and others who take mixed loads, allowing people to travel with small loads or to consign small loads to particular

destinations. Then there are passenger transport services that in rural areas generally carry significant quantities of freight. Most freight in passenger transport services is accompanied, but some services carry consigned freight as well.

This research focussed on two types of load: accompanied freight of up to 50 kg (eg, one 50 kg sack) and 200 kg of consigned freight (eg, four 50 kg sacks). On the whole, it was easy to ask questions about these two scenarios and obtain what appeared to be reliable and consistent data for these costs for different transport modes and distances.

It was known from the outset that freight costs are much more variable than passenger fares. Freight charges may vary by two orders of magnitude (a one-hundred-fold difference). This is due to different pricing systems, different distances and different vehicles, which in combination can cause huge variations in the cost per tonne-kilometre. Most freight operators consider both volume and weight when they charge. A light bulky package (eg, a rolled roofing sheet) may cost the same as a small, dense package (eg, a sack of cement), but the cost per tonne-kilometre may differ by a factor of five. It is not uncommon for operators to charge a flat rate per loaded item, irrespective of the destination along that particular route. This makes the cost per tonne-kilometre of a journey of 5 km, ten times more expensive than a 50 km trip. The operators of smaller vehicles generally charge more: one sack is significant for a small vehicle, but negligible for larger ones. Differences due to vehicle type can be five-fold or more. Finally, there is a great deal of flexibility and discretion in charging for freight, particularly when operators make most of their money from passenger fares. Some loads are carried free-of-charge, and the charges for others may depend on the driver's mood and social factors, such as status, relationships and even ethnicity. Combining all these factors can lead to huge differences in freight costs, when expressed as standardised units.

The cost per tonne-kilometre of small freight and medium freight are important statistics relating to rural transport services and could be a useful for planning, appraisal and evaluation purposes. As indictors they would be relevant, valid, measurable, ethical, appropriate, transparent, interpretable, actionable and based on cost-effective data. The key problem with this indicator is that it is very variable, depending on local practices, and this makes comparisons between roads particularly difficult. The present survey methodology generates statistics for small freight (50 kg) and medium freight (200 kg), with prices per tonne-kilometre in USD cents (or in local currency, if preferred). These two statistics are different, with the medium freight generally cheaper, per tonne-kilometre. Although the small freight (up to 50 kg) costs are more variable, this statistic is the more relevant to most users of rural transport services. If only one of these two indicator statistics is used, it should be the small freight one.

6.3 Transport frequency and travel opportunities

For rural women and men, transport frequency is one of the most important features of rural transport services. In RTSi Road Report Table 3, this is expressed as the number of travel opportunities per day in the direction of the main hub (town, market and/or services centre).

The travel opportunities a day may be similar to the total number of services a day, but if two (or more) services go at about the same time, this counts as only one travel opportunity. For example, on the Pitoa Road surveyed in Cameroon, on market day, three passenger trucks left Djallou in convoy. This did not represent three travel opportunities a day, but just one single opportunity. And on normal days, there were no passenger trucks, and so no travel opportunities.

If there are motorcycle taxis (or other taxis) waiting at known points and/or if they can be easily ordered by mobile phone, these 'on demand' services need to be quantified in an appropriate way. If they are 'on demand' throughout the day, this can be considered as 50 opportunities a day (equivalent to about one opportunity every 15 minutes during a twelve hour day).

Transport frequency on normal days is recommended as a key 'headline' indicator. This is expressed as the number of opportunities per day to travel towards the main hub. In the survey methodology, this statistic comes from user questionnaires, triangulated with information from operators and the traffic count data. The 'conventional' rural transport services could be combined for this indicator, but, as noted above, the motorcycle taxis (intermediate means of transport) should be a separate indicator statistic.

The suggested indicator is for 'normal days' as for many travel purposes, particularly those to do with health, rural women and men may have to travel on any day of the week. Included in the complete set of indicator statistics is the complementary indicator relating to market days. In many parts of the world, there are surges of people travelling to periodic markets, and the transport services often respond to this with extra services on market days. This is particularly apparent in some West African countries (including Cameroon and Burkina Faso) where the transport on market days is many times more than that on normal days. On the road surveyed in Northern Cameroon, there were no conventional services on 'normal days' but several passenger trucks and a minibus operated on market days.

Transport frequency on market days could be used as an additional 'headline' indicator. This would allow the large differences in transport services on some roads in West Africa to be clearly highlighted. However, adding this would reduce the simplicity and clarity of the indicator. Creating an 'average daily frequency' indicator could be misleading. The average for the larger transport services vehicles on the Pitoa surveyed road in Cameroon would be about one service a day. Such an average might seem reasonable for the needs of maternal health transport. However, the reality is that all the services travel within a short period of time on market day only, and there are no 'conventional' transport services six days in the week.

There are several complications of including transport frequency on market days:

- On some roads there are markets at different locations on different days
- Some markets are not weekly but every 5 days or every 10 days
- Rural roads going to larger towns with daily markets do not have clear 'market days'
- Some rural roads have busy days for transport services at weekends or other days.

Therefore the transport frequency on market days is not recommended as a headline indicator. It will be retained within the tables of indicator statistics in the RTSi Road Reports.

6.4 Journey times and waiting times

Travel times, including actual journey times and required waiting times are clearly very important to rural transport users. Various indicator options were considered. One problem was that people undertake various journeys, with different distances. The typical journey distances on one road may be very different from other roads. One option was to standardise on a theoretical 20 km journey. However, it was thought better to compare journey times by expressing them as average speed. This could be calculated easily from the user data (journey distance divided by the reported time for that journey). With multiple journeys reported by most users the dataset size for this statistic was relatively large.

As an indicator, this statistic was not found to be very satisfactory. There was little 'average speed' difference between vehicle types and between the roads. The indicator was not very interpretable, as it was not a journey time. It was a speed, but it did not relate directly to the physical speed of the vehicle (it was an average travel time, including stops). It did not include waiting time, which can be an important component of travel time (typical waiting time was recorded in the context of increased waiting time due to disruptions). Typical journey time (or average speed) once in a vehicle is closely related to road conditions. Waiting time is more of a function of the quantity and predictability of transport service operators.

The team do not feel that the journey time/average speed indicator is particularly useful and so it is not recommended as a separate indicator. However, it will remain as component of RTSi Road Report Table 3.

6.5 Safety and security

In the RTSi Road Report Table 3, statistics are presented relating to safety and security, disaggregated for vehicle type. The safety figures are derived from the average of user recollections of any accidents (involving damage to vehicles and/or injuries to drivers, passengers or other road users) in the past year. The security figure is derived in a similar way, but relates to assaults or robberies happening to passengers using transport services or waiting for them. In both cases the figures are adjusted to take into account the frequency of transport movements and to allow them to be presented as easily comparable numbers (as opposed to small figures with many decimal places that people find difficult to interpret). The statistics are expressed as accidents or security incidents accidents per 100,000 vehicle trips. Most calculated accident statistics have been in the range from zero to 200, with motorcycles having highest number of accidents (even after adjusting for their many trips). Recalled security incidents have been few, on most of the roads surveyed.

The figures obtained provide some idea of the *perception* of safety and security risks. They provide interesting comparisons between vehicle types. The actual figures cannot be relied on to be accurate, as most are based on responses such as 'hardly ever, perhaps one a year' and 'quite a lot, maybe two or three every month'. Depending on the length of the road, and the location of the respondents, the incidents referred to may be the same as those reported by others, or in addition to them. The team had considered trying to obtain data from police records and/or hospital records, but no data were obtained that could be linked to specific roads. Therefore these statistics based on respondent recall, and presumably influenced by respondent perceptions, appear to be the best estimates available using the existing survey methodology.

As potential indicators they are seem to be relevant, valid, ethical, appropriate, transparent, interpretable, actionable and based on cost-effective data. There is some uncertainty as to their reliability, sensitivity and measurability. Further discussion with stakeholders (including other researchers working on similar issues) is required before they can be recommended for immediate use. Therefore, it is recommended that these indicator statistics be retained in the RTSi Road Report tables and considered with a raft of other statistics for possible use in the development of simple indicators. These statistics must remain disaggregated between motorcycles and conventional public transport vehicles. While the statistics for the larger vehicles could be combined to make a simpler 'headline' indicator, they should remain disaggregated in the RTSi Road Report Table 3, so that any differences in perceptions between the safety and security of different transport types can be highlighted.

6.6 Disruption and reliability

Bad weather and poor roads can disrupt transport services severely. An indicator that measures this could be useful for the purposes of road planning, appraisal and evaluation and of understanding access problems of rural people. The indicator the team developed to measure this was based on the percentage of the year that the road was impassable, the percentage of the year when the services were possible but disrupted, the percentage increase in waiting time on disrupted days and the percentage increase in journey time on disrupted days. The information comes from surveys of users and transport operators (to allow triangulation).

In order to keep the consistent and intuitive convention that 100% is good, and 1% is bad, the disruption factor was converted to a reliability factor. This worked provided the journey or waiting times did not double. If times increased by over 100%, negative figures were generated which were

difficult to interpret. In calculating this indicator, the four types of disruption were ascribed equal 'weight'. There was no logical reason for this, but also there were no reasons to apply different weightings. This issue could be addressed in a follow-up initiative.

Different forms of public transport are affected in different ways by poor weather and difficult roads. Large buses can sometimes operate on roads where minibuses with low clearance cannot. However, large buses find slippery conditions very difficult. Jeeps and other 4x4s may keep operating as long as the road is not physically cut off by a flood or a landslide. When a landslide does block a road, pedestrians and motorcycle taxis may be able to travel over the obstruction. In other words, although the disruption is related to the road, it is also dependent upon the transport types that operate along the road. This may be an indicator that should remain disaggregated for all vehicle types.

This indicator is essentially an indicator of disruption that has been presented as a reliability indicator to allow an intuitive low-to-high performance scale. However, this indicator does not measure daily reliability on 'normal' days. The reliability and predictability of regular services are key concerns of users and are significant gender issues (women, in particular, may travel less on unreliable and unpredictable services). There is therefore a case for developing a different reliability indictor that measures reliability and predictability. For this reason, it may not be appropriate to promote the existing disruption indicator as a reliability indicator. Perhaps it should be a clearly-defined disruption indicator, where 100% means total disruption.

Indicators that measure disruption and/or reliability can be obtained from the survey data. Further work is needed to develop these in ways that transport planners and other stakeholders can find meaningful. The data on which they are based is quite straightforward to collect, and the resulting indicators should be relevant, valid, measurable, ethical, appropriate and actionable and based on cost-effective data. The existing draft indicators are not yet sufficiently transparent and interpretable.

For a reliability indicator, one suggestion is that the indicator should be based on the probability of being able to get on a vehicle within (say) fifteen minutes of an anticipated departure time, travel to the local market/administrative hub and return the same day. With good transport services, the probability would be almost 100%. With very unreliable services, it might be almost 0% and so there would be a good range of possible indicator levels and scope for improvements. As noted, one reason for this suggestion is that the predictability and reliability of return trips to markets and services are a key gender issue, greatly influencing women's active participation in markets and even attendance at health facilities.

6.7 Vehicle operating costs (VOCs)

The problems relating to accuracy and small interview numbers have already been discussed. While vehicle operating costs (VOCs) are crucial, the existing questions, methodology and spreadsheet have not been able to produce reliable, repeatable and robust VOC statistics. Related to this is the fact that VOCs are specific to vehicle types and to methods of operation, and, as has been noted, on rural roads there is a great diversity of transport modes and operational business models. Therefore, none of the vehicle operating cost statistics developed is recommended for inclusion as a 'headline' indicator.

Despite the problems with the VOC statistics, the information gathered could be valuable for understanding the impact of road improvements. During discussions in several countries, it appears that existing road assessment models (HDM4 and RED) are using VOC figures that have not been generated in consultation with local rural transport operators. Whatever the imperfections of the questions and responses of this survey methodology, they may be getting nearer to the 'truth' than those assumptions hidden within the existing transport planning tools.

The methodology developed is therefore commended for use in in-depth surveys conducted by professional officers. It is not recommended for use in enumerator-conducted surveys. The data generated are not considered sufficiently repeatable, robust or reliable for use in the development of indicators.

If the present questionnaires and spreadsheet are to be used to obtain reliable VOC data, it is recommended that interview numbers are increased. This is partly due to the lack of records relating to costs and to the uncertainties of many of the estimates of expenditure made by the operators. It is suggested that at least ten operators are interviewed per transport mode, which for many roads would mean that there would be insufficient operators on the road to maintain the direct link between that road and the vehicle operating cost statistics generated. If the interview numbers did need to be increased to include operators on other roads, then these should be selected from operators on comparable roads in the area. This might result in 'district-level' VOCs for rural roads. There would be no point in combining data from operators on rural roads, with operators of inter-urban transport services (that probably have very different travel patterns, road conditions and VOCs).

There are two further suggestions for people wishing to use this survey technique to generate more accurate VOC data sets. One would be to systematically reject the 'outside' extreme values as potentially spurious. The second would be to calculate median averages, as these statistics are less influenced by spurious data than the mean averages used in the current spreadsheet.

6.8 User perspectives

The researchers developed a questionnaire through which different transport users provided information on the various means of public transport they used, including their travel costs, their estimates of transport frequency and other relevant operational issues. They were also asked to rate their satisfaction (on a simple, five-point scale) concerning 22 features of the rural transport services, including issues relating to fares, times, frequencies, predictability, comfort, security and transporting small amounts of freight. All but three of the satisfaction questions are specific to particular transport types.

The suggested minimum number of respondents was 30. This should comprise at least 15 men and 15 women with at least two people who were farmers, traders, people with disability, older persons, students and people travelling for reasons to do with health, maternal health, employment, financial services and socio-cultural reasons. As noted above, not all people use all forms of public transport, and the numbers of respondents contributing to information on some forms of transport have been low. While supplementary interviews could be conducted to avoid tiny 'sample sizes', some categories of users (eg, women using uncommon transport types) are likely to remain quite small.

The information provided on fares and operational features contribute to several indicator statistics provided in RTSi Road Report Table 3 including transport costs (passenger fares and freight), travel times and transport disruption. The satisfaction ratings, disaggregated for gender, are provided in two tables. RTSi Table 4 summarises the information by aggregating groups of questions (eg, those relating to comfort and travelling conditions). The full results are presented in RTSi Table 5.

During the initial planning for a four-phase project, it was envisaged that the team would develop a weighting system to allow the development of a composite user-satisfaction indicator. This would have been done in Phase 3, in consultation with other stakeholders. There was not time to do this in this two-phase project, but this could still be done in the context of a follow-up initiative, if the relevant stakeholders felt it would create a useful indicator.

The information collected is not yet in a form that could be used as a simple, 'headline' rural transport services indicator. The information makes sense when it is in tables, disaggregated for transport type. Compiling the data into a composite indicator may or may not be appropriate.

Determining this would take more time, and detailed discussions with the various stakeholders to see if such an indicator would be found valuable and meaningful.

At this stage, the team feel that the user satisfaction tables should be retained in the survey methodology and the resulting RTSi Road Reports. They provide useful information on user concerns. The gender disaggregation provides some insights into possible gender issues that could be further investigated. It should not be a cause for concern if clear gender differences are not apparent, any more than if little difference is seen in satisfaction between two transport types. The survey provides an opportunity to identify important gender issues (and differences in transport types), but with the current interview numbers, gender-related concerns may not be apparent if the differences are relatively minor.

6.9 Operator perspective

In addition to questions relating to vehicle operating costs, the operators were asked nine questions relating to their satisfaction with issues such as road condition, availability of working capital/credit and the regulatory environment. These are presented in RTSi Road Report Table 6. The information is disaggregated for vehicle type. Maintaining such disaggregation makes sense, as the regulatory environment, the work of transport operator associations and road conditions affect operators in different ways.

The team feels there is valuable information obtained from these survey questions that should influence transport planning. The summary tables should certainly be included in RTSi Road Reports. However, no clear way has yet been identified in which such information could contribute to simple indicators. With further work with interested stakeholders, it might be possible to provide a simple 'operator perspective' indicator based on the data collected. Until that time, the information is best presented in table form in the RTSi Road Reports, with explanatory discussion in the report text of the issues of particular concern for the operators of the different transport types.

6.10 Regulator perspective

In the RTSi survey, the regulator's perspective is provided by people who know the road and have a reasonable understanding of the various regulatory requirements relating to vehicle technical condition, insurance, operators' fiscal requirements and operational, safety and environmental regulations. Questions are also asked about the safety of the road and any planning framework for transport services. If an officer from the ministry or agency responsible for transport services is available, and they know the road in question, they would be asked these questions. Other possible informants for this part of the survey would be local police officers and village leaders.

In the reports, the views of informants are summarised in RTSi Road Report Table 7. In addition, an overall regulatory compliance score is included in RTSi Table 3 and the safety assessment is included as part of the road overview in RTSi Table 1. The presented data are disaggregated for vehicle type. It is particularly important to report the compliance of motorcycles separately from other vehicles as, on the roads surveyed, the compliance assessment of these vehicles was particularly low. Other vehicles tended to have similar levels of regulatory compliance, although the larger passenger vehicles (buses and midi-buses) generally had the highest overall average scores. No weighting system has been employed, and so the various questions have equal influence on the final average score.

The regulator's perspective questions were answered by only a small number of people (generally three), but the opinions expressed did appear to provide reasonable assessments, with which the team members concurred. There were clear differences in assessments for the compliance of different vehicle types (with motorcycles rated particularly low). There were also clear differences in the different types of compliance (insurance being quite high, technical compliance lower and

environmental compliance often very low). The RTSi Regulator Perspective Table 7 is therefore regarded as providing a meaningful contribution to the RTSi Road Report.

The average figures of regulatory assessment could make valid indicators, provided they were disaggregated for intermediate means of transport (motorcycles). They could be fully disaggregated for vehicle type or separated into two classes, 'conventional' public service vehicles and intermediate means of transport. Such indicators should be relevant, valid, sensitive, ethical, appropriate, transparent, interpretable and actionable and based on cost-effective data. Due to the small number of assessments, there could be questions about their reliability (although the team did not find this an issue). If such indicators were to be adopted, their 'measurability' could be improved by providing some assessment guidelines, such as the percentage level of compliance to be associated with 'medium compliance'.

The team does not think that a regulator perspective 'headline' indicator should be recommended for immediate adoption. Rather it should be considered and discussed as part of a raft of indicators that can help to measure and assess the quality and appropriateness of rural transport services. The regulator perspective survey should remain a part of the overall RTSi methodology and the RTSi Regulator Perspective Table 7 should continue to be a component of in-depth assessments of transport services on specific roads.

6.11 Development perspective

The RTSi survey to obtain a 'development perspective' was an innovative attempt to assess how the rural transport services were influencing twelve issues related to development. These included agriculture, enterprises and trade, medical and educational services and the empowering of women, minority groups, people with disability and young people. Questions were also asked about mobile phones and information technologies and the impact of transport services on cultural heritage, the environment and HIV/AIDS. There were also questions relating to the integration of transport services and the adequacy of road maintenance. The people selected to make such assessments included village officials, staff of NGOs working along that road and staff of local schools and clinics. The assessments made were summarised in RTSi Road Report Table 8. The responses were disaggregated for vehicle type, apart from those relating to the integration of services and road maintenance. The average assessments were also summarised in RTSi Table 3, with the assessments of road quality and transport integration also included in RTSi Table 1.

In general, the team felt the various judgements made by the people assessing the development impact were well-measured and reasonable. There was appropriate variation based on the local situation between the different development issues and also between the various transport types, indicating thoughtful responses. For example, on all roads, motorcycle taxis were rated particularly highly for their empowerment of young people. Motorcycles were also rated highly for their role in agriculture, for along the surveyed roads they were a major means to take produce to market and to carry fertilisers to the farms. The respondents on the roads surveyed in Tanzania, Kenya and Cameroon did not feel that there were any obvious marginalised ethnic groups, and so they could not answer questions relating to the empowerment of ethnic minorities though transport services.

Three development responses appeared to go in a 'perverse' ways (the better the transport service, the worse the outcome). These related to impact of transport services on the cultural heritage, impact on HIV/AIDS and impact on the environment. It is easy to understand how, as number and type of transport services vehicles increase, there may be negative impacts on these issues. Due to the 'perverse' tendencies, these questions were presented separately in RTSi Development Perspective Table 8 and their average scores were also kept separate.

No weighting has been applied to the different development impacts. While there is no logical reason why they should have equal weight, it would be difficult to develop a meaningful weighting

system. The issue of weighting could be reviewed during any follow-up indicator testing and development initiatives.

The RTSi Development Perspective Table 8 summarises the assessments of the development impacts of the various transport services. However, the really interesting and valuable information is actually the logic behind each assessment. For example, in Cameroon, motorcycle taxis were given a surprisingly high assessment for maternal health: the logic was that they could be called by mobile phone at any time, and so (unlike all other vehicles) they were always there for urgent transport for mothers and babies. The same respondent gave motorcycles a very low assessment for environmental impact. One issue was the excessive dust clouds throughout the long, dry season caused by the many motorcycles. Larger transport services also produced dust clouds, but they were only present one day a week and so their impact was smaller.

There is no way that any indicator derived from the development perspective survey could adequately capture or represent the many development lessons obtained from the survey. It would be difficult for a composite development indicator to fulfil all the requirements of being relevant, valid, reliable, sensitive, measurable, ethical, appropriate, transparent, interpretable, actionable and based on cost-effective data. To make it more repeatable and measurable, it would be possible to develop a checklist of possible criteria, each of which might be separately assessed: for example environmental impact could include (among other issues) dust pollution, emission pollution and deforestation. This would increase the complexity of the survey, but it would still be a cost-effective method of data collection.

The team is convinced there is value in including the ‘development perspective’ in the RTSi surveys and RTSi Road Reports. The team does not recommend the immediate adoption at any composite indicator based on the development assessment scores. However, the ‘development perspective’ approach to rural transport services should be certainly be discussed further, and followed up.

7 PROPOSED HEADLINE INDICATORS AND INDICATOR STATISTICS

7.1 Suggested key indicator statistics

Based on the previous analysis, two relatively simple, reliable, robust and actionable 'headline' indicators are proposed that can be used immediately for rural passenger transport services comparisons over time and space.

- RTSi: Fare price per passenger kilometre
- RTSi: Transport frequency on normal days

Two indicators for rural small and medium freight services could also be used, but these are known to be less 'measurable' and much more variable

- RTSi: The costs per tonne-kilometre of accompanied small freight (50 kg loads)
- RTSi: The costs per tonne-kilometre of consigned medium freight (200 kg loads)

Two further indicators are not ready for immediate use, but could be developed and tested quite quickly.

- RTSi: Reliability and predictability index for return trips to the market/services hub
- RTSi: Disruption index

There are also four more complex sets of indicators relating to the key stakeholders:

- User satisfaction
- Regulator perspective
- Operator perspective
- Development perspective

For the moment, it is recommended that these are displayed as RTSi Tables, disaggregated for vehicle type and for gender (in the case of user satisfaction). They are best presented, and interpreted, in the context of the RTSi Road Reports.

The RTSi Surveys and Road Reports are recommended for all serious road-related studies, including appraisals and evaluations. Further work is required to improve the methodology and the spreadsheet. In doing so, the advantages of reducing, rather than increasing, their complexity should always be considered.

Simpler and much quicker surveys can be designed and undertaken to obtain estimates of the proposed 'headline' indicators. This would make it feasible to have headline indicators available for most, or all, rural roads.

7.2 Headline indicators defined

The headline indicators ready for immediate use are presented and defined in Table 9 (passenger transport) and Table 10 (small and medium freight). These statistics are generated automatically by the RTSi spreadsheet, following data entry and triangulation. However all these statistics could be also be generated by using a much shorter and simpler questionnaire and analysis spreadsheet.

Table 9: Suggested headline indicators for passenger transport

Indicator statistic	Public transport vehicles [1]	Intermediate means of transport [2]	Other informal sector vehicles [3]
Fare price per passenger kilometre [4] *(Local currency / USD cents)*	/	/	/
Travel opportunities on 'normal' days [5]			

Notes and definitions:

1) *Public transport vehicles (if any operate on that road). Licensed public transport vehicles, such as buses and minibuses.*
2) *Transport services (if any operate on that road) provided by motorcycle taxis, motor tricycles or other intermediate means of transport such as bicycle taxis, animal-drawn carts or pack animals.*
3) *Other informal transport operations (if any operate on that road) using vehicles with more than three wheels that are not licensed as public transport vehicles, such as 'rural taxis', minivans and mixed passenger/freight trucks.*
4) *The average fare price per kilometre paid by an adult passenger on a 'normal' day. Expressed in local currency and USD cents. Data were obtained from rapid surveys in which a range of users provide examples of their typical journeys for the different types of transport services that they use on that road (for example, going to a market, hospital, clinic or administrative centre). Fare per kilometre calculated using distance data from GPS, maps or user reports.*
5) *The average number of opportunities per 'normal' day to travel to the local transport hub (normally an administrative town with market, shops, health centre and other services, with onward transport connections to other towns and cities). If several services go at about the same time (eg, within 15 minutes of each other followed by a long gap) this counts as one service. If a service is available at any time 'on demand' this is given a notional frequency of 50 (roughly equivalent to one every 15 minutes during a 12-hour day). The data are obtained from discussions with users and transport operators and any traffic count information and is 'triangulated' to provide the best estimate of the actual situation. The statistic refers to a typical 'normal' day and so not a busy market day or a day disrupted by the weather or other events.*

Table 10: Suggested headline indicators for small/medium freight

Indicator statistic	Public transport vehicles [1]	Intermediate means of transport [2]	Other informal sector vehicles [3]
Costs per tonne-kilometre of small freight [4] *(Local currency / USD)*	/	/	/
Costs per tonne-kilometre of medium freight [5] *(Local currency / USD)*	/	/	/

Notes and definitions:

1) *Public transport vehicles (if any operate on that road). Licensed public transport vehicles, such as buses and minibuses.*
2) *Transport services (if any operate on that road) provided by motorcycle taxis, motor tricycles or other intermediate means of transport such as bicycle taxis, animal-drawn carts or pack animals.*
3) *Other informal transport operations (if any operate on that road) using vehicles with more than three wheels that are not licensed as public transport vehicles, such as 'rural taxis', minivans and mixed passenger/freight trucks.*
4) *The statistic derives from the reported average cost (in addition to the passenger fare) of travelling with a load of about 50 kg (if this is allowed). The data are obtained from rapid surveys involving a range of users who can provide examples of the charges they pay when travelling with about 50 kg of goods. The charges are recorded as well as the origin and destination places. The cost per tonne-kilometre is calculated using distance data from GPS, maps or user reports. A '50 kg' load is a significant load that is much more than one shopping bag of goods, one kit-bag or one suitcase (which may be carried free-of-charge). Sometimes goods are charged by weight and sometimes volume. If weight is most important, then it is a load that can be carried by one person, but with some difficulty. It could be a sack of maize, rice, fertiliser or cement weighing 50 kg. If volume is important, it is a big basket that one person can carry, but with some difficulty.*

5) *The statistic derives from the reported average cost of sending a load of about 200 kg (if this is allowed). This may be to or from the market town, or from a road junction to a village (or vice versa). The data are obtained from rapid surveys involving a range of users who can provide examples of charges they pay when sending about 200 kg of goods, such as four 50 kg sacks of grains, fertilizer or cement. The cost per tonne-kilometre is calculated using distance data from GPS, maps or user reports.*

Two further headline indicators that could be developed relatively easily are illustrated in Table 11 (reliability and disruption indexes).

Table 11: Possible headline indicators for rural transport services reliability and disruption

Indicator statistic	Public transport vehicles [1]	Intermediate means of transport [2]	Other informal sector vehicles [3]
Reliability index [4] *(percentage) based on days of normal operation*			
Disruption index [5] *(percentage) based on annual operations*			

Notes and definitions:

1) *Public transport vehicles (if any operate on that road). Licensed public transport vehicles, such as buses and minibuses.*
2) *Transport services (if any operate on that road) provided by motorcycle taxis, motor tricycles or other intermediate means of transport such as bicycle taxis, animal-drawn carts or pack animals.*
3) *Other informal transport operations (if any operate on that road) using vehicles with more than three wheels that are not licensed as public transport vehicles, such as 'rural taxis', minivans and mixed passenger/freight trucks.*
4) *The index statistic derives from questions to transport users and operators on the reliability of transport services on the days they normally operate and the likelihood of being able to get on a vehicle within fifteen minutes of an anticipated departure time, travel to the local market/administrative hub and to return the same day. With good transport services, the probability would be almost 100%. With very unreliable services, it might be almost 0%. This indicator requires further testing and development before it ready to use.*
5) *The composite index statistic is based on the annual disruption patterns and the effects of disruption on waiting and travel time. It derives from questions to transport users and operators concerning the percentage of the year that the road is impassable to that type of transport, the percentage of the year when the services are possible but are disrupted, the percentage increase in waiting time on disrupted days and the percentage increase in journey time on disrupted days. This indicator requires further testing and development before it ready to use.*

7.3 Suggested raft of RTSi Road Report indicators statistics

Most of indicator statistics will be summarised in eight tables in the RTSi Road Reports. Templates of these eight tables are reproduced below. As there are so many statistics, the various definition notes are not reproduced here. These are included in a separate report that provides guidelines for planning, implementing and reporting of the RTSi surveys (Starkey et al, 2013). To illustrate how the full RTSi indicator statistics and explanatory text can be presented, the most three recent RTSi Road Reports are attached as annexes to this Final Report.

RTSi Road Report Table 1. Road information			
Road name:			
Dates of survey:			
District, Region and Country:			
Road type:		*Responsible authority:*	
Road start location:		*Start GPS coordinates:*	
Road finish location:		*Finish GPS coordinates:*	
Road length:		*Catchment population* [1]	
Road quality and condition from different perspectives			
Road authority [2]	*Operators* [3]	*Development* [4]	*Safety* [5]
Summary of road geography and socio-economic situation			
Around 200 words describing the road context, geography and the social and economic context, including factors influencing the need to travel, such as employment or agricultural marketing: see report examples.			
Maps of road showing context (left) and road features (right)			
See guidelines on maps and Table 1 examples			
Schematic map of 'straightened' road with features			
See guidelines on maps and Table 1 examples			
GPS elevation track *(same horizontal scale as 'straightened' road)*			
See guidelines on maps and Table 1 examples			
GPS speed track [6] *(same horizontal scale as 'straightened' road)*			
See guidelines on maps and Table 1 examples			
Description of hub and spoke patterns			
Around 200 words describing the major origins and destinations of the transport services and the main transport hubs beyond the road (can refer to context map). Also any smaller hubs on the road and the pattern of trails and roads feeding into the road (may refer to road features map): see report examples.			
Intermodal connectivity *(one to five stars, the more stars the better)*			
'Feeding' [7] *(getting to the road)*	*User satisfaction* [8]		*Development impact* [9]
'Linking' [10] *(to onward destinations)*	*User satisfaction* [11]		*Development impact* [12]
The more stars (or the higher score) the better. ★☆☆☆☆ *= Very dissatisfied (= 1).* ★★☆☆☆ *= Dissatisfied (= 2).* ★★★☆☆ *= Medium (=3).* ★★★★☆ *= Satisfied (= 4).* ★★★★★ *= Very satisfied (= 5).*			
Notes: The various explanatory notes are available in the RTSi Guidelines (Starkey et al, 2013b)			

RTSi Road Report Table 2. Traffic and transport along road												
Daily traffic flows (in both directions) [1]					**Fleet** [2]	**Passengers and small freight** [3]						
	Normal [4]	*Busy* [5]	*Disrupted* [6]	*Impass-able* [7]	*No of RTS vehicles operating on road* [8]	***Trip transport*** *normal day per vehicle* [9]		***Daily transport*** *normal day all vehicles* [10]		***Annual transport*** *adjusted for traffic fluctuations* [11]		***Change*** *in past year* [12]
						Pax (no) [14]	*Frt (kg)* [15]	*Pax (no)* [16]	*Frt (kg)* [17]	*Pax (000)* [18]	*Frt (t)* [19]	*- - 0 ++*
Large bus												
Midi-bus												
Minibus												
Car (including taxi)												
4x4/pickup												
Pickup/freight												
Light truck												
Medium truck												
Large truck												
Passenger truck												
Motor tricycle												
Motorcycle												
Bicycle												
Transport mode A												
Transport mode B												
Transport mode C												
Transport mode D												
Pedestrians												
Totals												
Notes: The various explanatory notes are available in the RTSi Guidelines (Starkey et al, 2013b)												

(Note the order of Table 3 and Table 4 have been intentionally re-ordered here to save a report page)

RTSi Road Report Table 4. User satisfaction with main RTS modes (disaggregated for gender) [1]								
	Transport Mode 1		**Transport Mode 3**		**Transport Mode 3**		**Transport Mode 4**	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
'Sample size' (N) [2]								
Fares								
Journey time								
Operational features [3]								
Freight [4]								
Safety and security [5]								
Comfort [6]								
Universal access [7]								
Overall satisfaction [8]								
The more stars (or the higher score) the better. ★☆☆☆☆= Very dissatisfied (= 1). ★★☆☆☆= Dissatisfied (= 2). ★★★☆☆= Medium (=3). ★★★★☆= Satisfied (= 4). ★★★★★= Very satisfied (= 5).								
Notes: The various explanatory notes are available in the RTSi Guidelines (Starkey et al, 2013)								

RTSi Table 3. Rural transport services key operational statistics* for major transport modes [1]				
	Transport Mode 1	**Transport Mode 3**	**Transport Mode 3**	**Transport Mode 4**
	Photo of mode 1	*Photo of mode 2*	*Photo of mode 3*	*Photo of mode 4*
Contribution to annual passenger transport (% of market) [2]				
Contribution to annual small freight transport (% of market) [3]				
Fare per km in USDc [4]				
Journey time (average speed on normal days) in km/hr [5]				
Transport frequency on normal days (number of opportunities to travel per day) [6]				
Number of days a year with 'normal service' [7]				
Number of busy days a year [7]				
Number of days a year with disrupted service [7]				
Number of days a year with no transport services [7]				
Reliability factor(s) (%) [8]				
Men as % of passengers/day (busy days) [9]				
Women as % of passengers/day (busy days) [9]				
Children as % of passengers/day (busy days) [9]				
Cost of 50 kg accompanied freight in USDc per tonne-km [10]				
Cost of 200 kg consigned freight in USDc per tonne-km [11]				
Safety: Recalled no. of accidents per 100,000 vehicle trips [12]				
Security: Recalled no. of incidents per 100,000 vehicle trip [13]				
Typical age of vehicle (years) [14]				
Typical fuel consumption of vehicles (litres per 100 km) [15]				
Typical operating distance per year in km [16]				
Daily hire charge for use of vehicle (entrepreneurial mode) (USD) [17]				
Indicative Vehicle Operating Costs per day for entrepreneurial mode (*includes all costs and hire charges but not operational labour/profit)* (USD) [18]				
Daily cost of vehicle ownership/fixed costs (ownership mode) (USD) [19]				
Indicative Vehicle Operating Costs per day for ownership mode *(includes all costs for ownership mode except profit and operational labour)* [20]				
Total revenue per day (USD) [21]				
Total revenue per kilometre (USDc) [22]				
Total revenue per passenger kilometre (USDc) [23]				
Percentage total revenue due to freight (%) [24]				
Regulation compliance (overall assessment) [25]				
Development impact (overall assessment) [26]				
Operator 'sample size' [27]				
User 'sample size' [28]				
Notes: The various explanatory notes are available in the RTSi Guidelines (Starkey et al, 2013)				
***** *The statistics in this table come from many sources. Some statistics derive from user surveys (including fares, freight costs, safety and security), some come from operators (mostly vehicle-related data), some come from traffic counts (gender of passengers) and some are statistics triangulated from multiple sources (frequencies, percentage of market). The regulation compliance derives from the regulators' assessments and the development impact derives from assessments of development-related people.*				

RTSi Road Report Table 5. Summary of user satisfaction responses disaggregated for gender								
Means of transport	**Transport Mode 1**		**Transport Mode 3**		**Transport Mode 3**		**Transport Mode 4**	
Gender of respondent	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
'Sample size' (N)								
Passenger fares								
Journey times								
Service frequency								
Service predictability								
Passenger capacity								
Small freight availability								
Small freight charges								
Small freight handling								
Medium freight availability								
Medium freight charges								
Medium freight handling								
Courier services								
Road safety								
Security								
Comfort: space								
Comfort: seat type/conditions								
Comfort: surrounding baggage								
Comfort: environment								
Access for vulnerable people								
Average								

Satisfaction for all transport types		
Gender of respondent	**M**	**F**
Facilities at roadside stops		
Feeding intermodal connectivity		
Linking intermodal connectivity		
Average		

The more stars (or the higher score) the better. ★☆☆☆☆= Very dissatisfied (= 1). ★★☆☆☆= Dissatisfied (= 2). ★★★☆☆= Medium (=3). ★★★★☆= Satisfied (= 4). ★★★★★= Very satisfied (= 5).

RTSi Road Report Table 6. Summary of operator perspectives				
Means of transport	**Transport Mode 1**	**Transport Mode 3**	**Transport Mode 3**	**Transport Mode 4**
Number of operators interviewed (N)				
Road condition for operations				
Adequacy of working capital				
Facilities for formal credit				
Facilities for informal credit				
Adequacy of technical facilities				
Regulatory disincentives				
Regulatory incentives				
Active associations				
Security risks				
Overall average				

The more stars (or the higher score) the better. ★☆☆☆☆= Very dissatisfied (= 1). ★★☆☆☆= Dissatisfied (= 2). ★★★☆☆= Medium (=3). ★★★★☆= Satisfied (= 4). ★★★★★= Very satisfied (= 5).

RTSi Road Report Table 7. Summary of regulator perspectives				
Means of transport	**Transport Mode 1**	**Transport Mode 3**	**Transport Mode 3**	**Transport Mode 4**
Vehicle technical compliance				
Vehicle fiscal compliance				
Insurance compliance				
Operational compliance				
Safety compliance				
Environmental compliance				
Regulatory planning framework				
Safety of the road				
Overall average				
Number of people interviewed (N)				
The more stars (or the higher score) the better. ★☆☆☆☆= Very dissatisfied (= 1). ★★☆☆☆= Dissatisfied (= 2). ★★★☆☆= Medium (=3). ★★★★☆= Satisfied (= 4). ★★★★★= Very satisfied (= 5).				

RTSi Road Report Table 8. Summary of development perspectives				
Means of transport	**Transport Mode 1**	**Transport Mode 2**	**Transport Mode 3**	**Transport Mode 4**
Agricultural facilitation				
Enterprise/trade facilitation				
Women's empowerment				
Minority group empowerment				
People with disability empowerment				
Young people's empowerment				
Maternal health needs				
Medical service transport				
Education-related transport				
Mobile phone and ICT integration				
Average of the above ten issues				
Cultural impact				
Environment impact				
HIV/AIDS impact				
Average of the above three issues				
Integration with feeder transport				
Integration with external transport				
Road maintenance adequacy				
Number of interviews (people answered questions relevant to their experience)				
The more stars (or the higher score) the better, from the development perspective. For example, the contribution of each mode of transport to the achievement of development goals in that area of concern has been rated by the people interviewed as: ★☆☆☆☆= Very poor (= 1). ★★☆☆☆= Poor (= 2). ★★★☆☆= Medium (= 3). ★★★★☆= Good (= 4). ★★★★★= Very good (= 5)				

8 NEXT STEPS

8.1 Wider debate

The first priority is to stimulate debate about these Rural Transport Services Indicators and their potential value to the various stakeholders. This will involve information dissemination and discussion. The results and ideas generated by this project will have to be made available in various formats and circulated in several forums.

Initially the results are due to be circulated in three forms:

- Project reports and associated pdf outputs on the project website and on the AFCAP, IFRTD and R4D websites
- Paper in a peer-reviewed journal
- Abstract or brief summary for circulation to email lists (eg, IFRTD and AFCAP lists).

There is also a need for an additional information product, in the form of an attractive and concise policy brief that shares the major research findings and recommendations. This could be produced based on the work to date, or could be produced following more interactions with key stakeholders.

It would be good to present the results at various national or international workshops to share the ideas and gain feedback from professional colleagues. Invited presentations and brief workshops at conferences (eg, the two hour sessions in the recent AFCAP and T2 workshops) are a good way to introduce the topic to colleagues. However, such sessions are not sufficient to allow rigorous debate or constructive attention to detailed issues. If possible, there should be a special workshop to debate these indicators or a one-day session tagged onto an appropriate international/regional workshop.

The original four-phase project proposal had planned a sequence of workshops and discussions, involving planning and revision meetings with the research team, planning and review meetings with the research team together with stakeholders from national authorities, national workshops within the countries where surveys had taken place, and small regional workshops bringing together relevant stakeholders interested in using the indicators and survey methodology. As the first phase of AFCAP was due to end, it was not possible to have these wider debates. However, it would still be good to involve more people in detailed discussion about the methodology and the indicators, before they are recommended for adoption by national and international agencies. In particular, it would be good to involve more professionals in the various organisations that could use the indicators. This could be done through a workshop (perhaps 'piggybacked' onto another event) or in the context of some follow-up research initiatives.

A facilitated, email discussion is an option, and this could be arranged in collaboration the communities of practice of AFCAP and/or IFRTD. The advantages of this are mainly speed of organisation and cost of implementation. The disadvantage is that email discussions tend to be easily dominated or skewed, and the rural transport sector does not seem to have made headway yet, using this medium.

8.2 Headline indicators and acquisition methodology

If there are positive responses to the suggested headline indicators, a methodology for acquiring these rapidly should be developed. While this would be conceptually like a very cut-down version of the existing survey, it would actually be better to build this up from first principles. This should ensure it is simple and robust. One questionnaire with a related data-entry spreadsheet could be used to generate all six of the proposed 'headline' indicators.

The questionnaire and spreadsheet would need to be tested on several roads to ensure that the new rapid survey methodology was appropriate and that the indicators were reliable. The four indicators relating to costs and to travel opportunities already appear to be relevant, valid, ethical,

appropriate, sensitive, measurable, transparent, interpretable, actionable and based on cost-effective data. However the more complicated, composite indicators relating to reliability and disruption should be assessed for issues such as transparency and interpretability.

8.3 Revision of RTSi Road Survey questionnaires and software

If the RTSi Road Survey methodology is to be used by other stakeholders, it does need further work relating to the questionnaires and the data entry and analysis spreadsheet. The time and resources available in this project were insufficient to review in depth and address all the issues.

The questionnaires all need to be reviewed again, in terms of:

- their clarity and ease of administration
- the meaning of possible responses and ways these are recorded
- the contribution they make to the data sets and resulting statistics
- whether they could be adjusted or eliminated to reduce overall complexity
- the requirements for the suggested 'headline' indicators.

The spreadsheet will require some editing to take into account any changes following the review of the questions. It will also require changes to produce the new 'headline' indicators, and to modify the presentation tables accordingly.

The spreadsheet also needs to be reviewed for its ease of use and the wording of column and row headings. The existing system for data entry and tallying for the traffic counts needs to be refined. It had initially been designed for simple traffic counts and small traffic volumes. Subsequently, it was used on roads with higher traffic volumes (notably large numbers of motorcycles) with counts in two positions. Work is required to design a better way of entering data, presenting the separate count statistics and integrating these into the final tables.

All the spreadsheet equations and tallying systems need to be checked systematically for appropriateness and correctness. There are tens of thousands of cells and this will be an arduous task, but it should be done prior to any release.

The spreadsheet then needs to be 'finalised' by locking cells to make it impossible for someone doing data entry to modify the analytical framework unless they have 'administrator' access. One of the issues faced by the team that developed it was that it was just an ordinary spreadsheet. Any user could make changes, intentionally or unintentionally. Once these changes had been made, it was very difficult to see them. It is difficult to compare different versions of the spreadsheet. In the future, it might be appropriate to compile the analytical framework into a user-friendly database format. However, for the present it seems appropriate for researchers to continue to develop this in its spreadsheet form.

8.4 Road surveys, appraisals and evaluations

Nine roads were surveyed in Tanzania (4), Kenya (4) and Cameroon (1) during the development of the methodology and the indicators. In each case the researchers implemented the survey in discussion with the local road and transport authorities and the results were shared with these authorities. Two of roads had been selected because of associated infrastructure investments, and it will be interesting to go back to do follow-up studies to see how the road investments have affected the rural transport services.

The road-based studies were specifically intended to be used as tools in appraising and evaluating road investments. Therefore, valuable follow-up activities would be to facilitate some road authorities to use the methodology themselves, particularly in the context of rural road investment appraisals and evaluations. Several roads authorities have expressed interest in this. Follow-up projects could involve joint planning, training and joint assessments, with 'ownership' of the work

embedded in the local road authorities, and technical assistance to help with the planning, capacity building, implementation and assessment components.

There would be great potential for mutual learning and south-south collaboration, if this could involve collaboration between the transport professionals in several countries. It is suggested that a small regional planning and training workshop could be held in one country, in the context of a new road survey in that country. The trained professionals would then be expected to implement road surveys in their own countries. They would reconvene for a further workshop (in another country) to discuss the methodology, the statistics generated and the planning implications for the various roads and transport services authorities. This would provide very valuable learning opportunities about rural transport services, mutual capacity-building and south-south collaboration. It would also result in several RTSi Road Reports that could influence local and national policies relating to transport services.

8.5 Aggregation of statistics and district-level indicators

From the outset of this research, it was proposed that the rural transport service indicators would relate to individual roads. Road-specific transport services were considered appropriate to allow them to be used by those concerned with road management to justify, monitor and evaluate road investment and maintenance. It had also been assumed that road-specific indicators would be relatively easy to develop, as each road was assumed to have unique transport services characteristics. As it transpired, the transport services along a road may not be uniform, so that each road has a range of unique transport services characteristics. Understanding and describing this variation may assist in the development of aggregated indicators for areas such as districts, counties and provinces.

From the outset it had been envisaged that one follow-up of this research would be the development of aggregated indicators for rural transport services. These would be indicators valid for a district (or county, province, state or country) that 'measured' the quantity and quality of rural transport services for that area. As with other indicators, these wider (eg, district-level) indicators would have to be relevant, valid, reliable, sensitive, measurable, ethical, appropriate, transparent, interpretable, actionable and be based on cost-effective data.

A systematic, initial approach to this might be to stratify the roads within a district (or other area relevant to transport planning authorities) by type, isolation and condition and/or other relevant factors such as traffic volumes. A small sample of these roads would be surveyed using the full methodology. A much larger number (possibly all) would be rapidly surveyed to obtain the 'headline' indicators. From these indicators and data sets, it would be possible to see the effects of aggregating the statistics in various ways to produce meaningful district-level indicators that were sensitive, interpretable and actionable.

In the process of the follow-up research, attention should be given to the use and value of the indicators in facilitating pro-poor development interventions. The great danger of aggregated statistics is that they may not highlight the problems of marginalised people, neglected transport routes and deprived areas. Just as aggregating gender within statistics can mask the particular problems faced by women, so aggregating poorly serviced roads with better roads may mask the problems of the poor roads. However, the development of aggregated rural transport services indicators could provide a valuable planning tool that may help to define the rural transport services situation, identify needs and 'benchmark' service standards for quantity and quality.

8.6 Assessing latent demand for transport services in catchment populations

An aspiration of the present research team had been to develop statistics that allowed the transport services to be presented in relation to the catchment population. For example, the fleet operating

on a road could be linked to population through an indicator statistic such as total available rural transport services seats/places per day per 10,000 inhabitants.

One reason for trying to build catchment populations into the indicator statistics is to gain greater understanding about the existing apparent economic demand and the latent socio-economic demand. One of the arguments for laissez-faire policies relating to transport services is that the private sector will automatically meet the existing economic demand for transport. It is clear from the roads that were studied that this was not always the case. There is latent demand that can be transformed into economic demand if appropriate transport services are in place (as has been illustrated by motorcycle taxi service). It may be necessary to 'prime the pump' to start a virtuous spiral of increased transport supply and increased transport services demand. New services may have to be reliable, predictable, affordable and timely, which many existing services are not. The rapid and 'spontaneous' spread of motorcycle taxi services in Tanzania, Kenya and Cameroon illustrates how creating a new supply can meet part of the latent transport demand. It would have been very difficult to predict how much rural people would use such transport services, given they are much more expensive per kilometre than conventional public transport systems.

One aspiration of the present research had been to link the RTSi survey methodology with GIS data, including information relating to populations. However, in the districts surveyed, such data were not yet available in high-resolution GIS form. High resolution spatial data are required to assess the catchment population of a small rural road using GIS. It is necessary to have details of the population living within various distance contours from the road. Existing population statistics are generally grouped by relatively large spatial units such as wards, counties or districts. It is not easy, using current GIS datasets, to attribute such populations to a road that passes through the area. However, in almost all countries, GIS services are rapidly improving their datasets, and it may soon be possible to have appropriate high-resolution population layers that will allow catchment populations to be easily quantified

The concept of catchment population can also be linked to more than one road. Several of the roads studied had feeding roads, each with different transport services characteristics. Together, these could be seen as one transport catchment area, with several, bifurcating routes. Therefore this follow-up could be usefully combined with the proposed work relating to district-level indicators.

9 PROJECT ACHIEVEMENTS, LESSONS AND CONCLUSIONS

The project started by developing a methodology for acquiring the information required to assess the quantity, quality and appropriateness of rural transport services. The methodology was focused on obtaining road-based data that took into account the perspectives of the users, the transport operators, the transport regulators and people involved with social and economic development. The idea was that road-based statistics were directly relevant to the users and they could also be used in the appraisal and evaluation of road investments. The development of wider, district-level, rural transport services indicators could follow. The conceptual framework was based on a rural family that had to walk two kilometres to a rural road (a proximity that was considered as 'access' in the World Bank's Rural Access Index). The Rural Transport Services Indicators (RTSi) were meant to 'measure' the transport services that a rural family would find on that road, in terms of frequency, costs, comfort, safety and the carrying of small freight.

The rapid appraisal survey methodology was intended to be used by transport professionals (not survey enumerators) who would understand, analyse and interpret the emerging issues. The survey could be completed within ten days and would lead to many relevant indicator statistics as well as a descriptive report of the situation presenting an understanding of the underlying issues. During the first phase, pilot surveys were undertaken on three rural roads in Tanzania and three roads in Kenya, and valuable data sets and understanding were obtained.

One key lesson from Tanzania was that most rural roads (village to town, district and community roads) did not have any regular 'conventional' rural transport services, such as buses, minibuses or rural taxis. These operated on the regional and national roads. The only public transport services on most rural roads, in the districts studied, were motorcycle taxis. In less than a decade, motorcycle taxis had become a major (in some cases, the major) form of rural transport in both Tanzania and Kenya. Motorcycle taxis are much more expensive per passenger kilometre than minibuses and buses, and their rapid spread and very positive assessment by passengers illustrates the great importance to rural communities of accessible and reliable transport services. Increasingly, rural families were calling motorcycle taxis by mobile phone. As motorcycles could travel along footpaths, villages two kilometres from the road could now have motorcycle transport services, which complicated the project's initial conceptual framework.

The importance of motorcycle taxis for rural people meant it was important to include them in the rural transport services statistics. However their mode of operation was very different to 'conventional' transport services and their inclusion greatly increased the complexity and variability of the transport services being 'measured'. At the beginning of Phase 2, the research team made various adjustments to the questionnaires and analysis spreadsheet to try to capture the variations in the different types of transport services.

During Phase 2, three more rapid but detailed surveys were undertaken on selected roads in Tanzania, Cameroon and Kenya, each survey taking about ten days in the field. All three highlighted the fact that when motorcycle taxis are included, the transport services along the road are not uniform. Traffic counts on different sections of the road are very different. Problems were experienced tying to record and analyse the complexity of the various transport types and their different systems of management and operation.

When initial research findings were presented to professionals in national agencies and authorities from countries such as Botswana, Lesotho, South Africa, Zimbabwe, Nepal and China, it was clear that in many countries, the antipathy to motorcycle taxis was so great that motorcycle taxis should not be integrated into one unified rural transport services indicator. Therefore it is recommended that the indicator statistics should remain disaggregated for certain transport classes. The 'headline' indicators should be disaggregated for mainstream public transport, intermediate means of transport (including motorcycles taxis) and, where appropriate, informal (perhaps unauthorised) transport types such as mixed passenger/freight trucks. This will allow important data and statistics to be collected and interpreted without compromising the positions of the regulating agencies. It also overcomes the intractable problem of trying to compare or combine the very different prices, frequencies and operational systems of 'conventional' public transport and motorcycle taxis.

Six 'headline' indicator statistics have been proposed as being meaningful, reliable, sensitive and interpretable. All are 'actionable' and could be influenced by policies, regulatory initiatives or development investments. These should be disaggregated for class of service (formal public transport, intermediate means of transport and other informal operations). They are:

- RTSi: Fare price per passenger kilometre
- RTSi: Transport frequency on normal days
- RTSi: The costs per tonne-kilometre of accompanied small freight (50 kg loads)
- RTSi: The costs per tonne-kilometre of consigned medium freight (200 kg loads)
- RTSi: Reliability and predictability index for return trips to the market/services hub
- RTSi: Disruption index (measuring service problems due to weather and road conditions)

Other indicators, including those relating to user satisfaction, regulator perspectives, operator perspectives, development perspectives and vehicle operating costs should be presented within RTSi Road Reports. These should be disaggregated for vehicle type and contain important explanations within the text. User opinions remain disaggregated for gender. The headline indicators could be

obtained using a highly simplified questionnaire and analysis system that would allow all (or most) rural roads to be assessed for these indicators.

With further work, district-level indicators could be developed, using a few stratified RTSi surveys (yielding in-depth road reports) and many simpler surveys to assess the headline indicators. By incorporating population data, it may be able to generate valuable additional indicators that will help to quantify the socially and economically important 'latent' transport demand that is not being met by the existing rural transport services.

This project represented the two initial phases of a multi-phase initiative that should now be followed up. The findings of this research should be well disseminated and discussed in various forums. The methodology and the software for the full RTSi surveys will need to be reviewed, particularly in relation to interview numbers and vehicle operating costs, and adjusted where necessary to allow further testing in different situations. It should be tested by national or local authorities for its application in rural road planning, appraisals and evaluations. A new and simpler system should be created to allow the 'headline' indicators to be acquired rapidly without the need for complete RTSi surveys. Once these 'headline' indicators have been piloted and reviewed, it should be possible to promote their adoption by national and international agencies.

As the results of this research study are disseminated, there should be a greater awareness among national and international agencies of the requirements for good rural transport services and how it is possible 'measure' these using indicator statistics. This should help the relevant authorities and civil society organisation to clearly identify and quantify the existing shortcomings and promote a range of possible initiatives to increase the quantity and/or quality of rural transport services. The proposed indicators will also allow organisations to monitor the progress of initiatives to improve rural transport services. It is envisaged the intended impact will be improved rural transport services that better meet the needs of rural women, men and children in Africa and elsewhere.

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