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RURAL TRANSPORT SERVICE INDICATORS:
Work in progress paper

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IFRTD

RURAL TRANSPORT SERVICES INDICATORS

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

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Cover photo
Minibus at traffic count on the Kilolo-Iringa road, Tanzania
Cover photo and other photos © Paul Starkey

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.

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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 aims 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 will be achieved using participative methodologies involving local stakeholders and sector experts.

The research team comprises:
Paul Starkey *(Team Leader)*
Peter Njenga *(Project Manager)*
Guy Kemtsop *(Cameroon Researcher)*
Shedrack Willilo *(Tanzania Researcher)*
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The project website is http://www.ruraltransport.info/RTSi.

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Acronyms and abbreviations

4x4	Four-wheel drive vehicle
AFCAP	African Community Access Programme
Aids	Acquired immune deficiency syndrome
eg	for example
Frt	Freight
GIS	Geographical information systems
GPS	Global positioning system
HIV	Human immunodeficiency virus
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
kg	kilogram
km	kilometre
m	metre
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
SSATP	Sub-Saharan Africa Transport Policy Program, World Bank, USA
SUMATRA	Surface and Marine Transport Regulatory Authority, Tanzania
TANROADS	Tanzania National Roads Agency
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

Executive summary

This paper reports the progress of the first two months of Phase 2 of the project to develop indicators to 'measure' the adequacy of rural transport services for meeting the access needs of rural people. The AFCAP-funded project is implemented by an IFRTD team led by Paul Starkey and Peter Njenga. Phase 1 (Apr-Sep 2012) started to develop and test a methodology to acquire the information required to develop indicators. In Phase 2 (Oct-Apr), the methodology for data collection, analysis and reporting is being further developed and tested and key indicator statistics will be identified.

The team held a planning meeting in Kenya and spent time revising the data-entry and analysis software which is designed to automatically create the tables of indicator statistics. The background calculations are complicated by the various ways in which data is disaggregated and tallied. There are four main perspectives (user, operator, regulator and development) and passengers, operators and informants are disaggregated by gender. There are 20 transport types, four road traffic conditions, three-vehicle operating models, and journeys that can be mainly passenger or freight.

The revised survey questions and the data entry and analysis software were tested during a survey of the Kilolo-Iringa road in Tanzania. The RTSi report of this road is attached to this paper. It provides many different statistics including the daily and annual passenger and freight volumes, the fares, frequency and travel times, various operating costs and the safety and security of the various modes of transport. Summaries are provided concerning user satisfaction (disaggregated for gender), regulatory compliance and the development impact of the road. Users were particularly concerned about the relatively high fares charged, but seemed to tolerate the over-crowded conditions on the buses and minibuses.

Four large buses, from different feeding roads pass down the Kilolo-Iringa road each morning in the direction of Iringa and four pass in the opposite direction in the afternoon. Fifteen minibuses operate to Iringa from the Kilolo hub, and a few other services join the road nearer to Iringa. Motorcycles operate from three separate hubs, but do not normally travel long distances. This meant that traffic counts at different points along the road would yield different results. To obtain meaningful statistics, such issues are resolved using the triangulation facility developed within the analysis software. As judgements need to be made about the relative reliability of the different sources of information (operators' and users' estimates and traffic counts), quality control systems are required to verify accuracy.

It has not yet been possible to assess road catchment populations using GIS, but this technique is likely to be possible when higher resolution population datasets become available. The team hope to develop indicators that relate transport services to the catchment population. This may help in planning for transport services to address the unmet latent demand for transport services of remote rural communities. The existing methodology for developing road-based indicators may be useful for developing area-base indicators for transport catchment areas or districts.

The team will initiate discussions about which of the indicator statistics appear to be most relevant to the different stakeholders. Not surprisingly, transport planners seem mainly interested in the data on passenger and freight volumes and vehicle operating costs. Users are mainly concerned with price, frequency and reliability. The increasing use of expensive motorcycle services suggests that timeliness could be a very important indicator.

The team will now carry out two further surveys (in Cameroon and Kenya) in the coming months and obtain new tables of RTSi statistics, with suggestions for the most relevant indicator statistics. The team will also prepare guidelines relating to the survey methodology and analysis software so that the system can be tested by more people. The team will welcome comments on this report and all aspects of this rural transport services indicators project.

1 INTRODUCTION

1.1 Introduction to the purpose of the RTSi project

Rural roads are vital for poverty reduction and economic development in Africa. 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 they so 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 Introduction to RTSi Phase 2

This work-in-progress paper is based upon the first ten weeks of Phase 2 of the RTSi Project to develop indicators to 'measure' the adequacy of rural transport services for meeting the access needs of rural people. This phase started at the end of October 2012 and will run till April 2013.

During the first phase which ran from April to September 2012, the research team worked together to develop a preliminary methodology for obtaining the data that could be used for developing rural transport services indicators. This first phase involved fieldwork in Kenya and Tanzania and detailed discussions between the team and a wide range of stakeholders (transport users, operators, regulators, authorities) and people from organisations that might collect, determine and use the resulting indicator. At the end of the first phase, there was a tested methodology for obtaining and presenting the various data that can be used to determine the characteristics of rural transport services. The work has been described in two previous work-in-progress papers (Starkey, Njenga, Odero, Kemtsop, Willilo and Mbathi, 2012a and 2012b) which are available on the project website, which is: http://www.ruraltransport.info/RTSi

This work-in-progress paper is orientated to people already aware of the work of Phase 1. Any readers who are new to this work are referred to the previous work-in-progress papers. For convenience, an overview of Phase 1 is provided below in Section 1.3. People familiar with Phase 1 can jump to Section 1.4 or Section 2.

A more formal paper, intended for wider readership in a referred journal, will be prepared later in this phase. This will be a more integrated document and will describe the progress that has been achieved in the context of the work of the whole research project.

1.3 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 participative survey methodology.

It was determined that the data needed for indicator development should be specific to a particular road. Researchers should obtain specific information on transport services along that 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 involves information being collected from a range of users with a particular emphasis on gender balance. Elderly and disabled people and those 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 be obtained relating to operating costs and income, 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 is 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) and were willing to travel off the roads. However, they were more prone to accidents.

The key survey information is summarised in eight tables. Four tables summarise most of the statistics considered 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 is complicated because much data is disaggregated for gender, several transport modes and road seasonality (four categories). A provisional analysis framework was developed as an Excel spreadsheet. This incorporated and facilitated seven processes of data triangulation. Data entry at the time of the survey allows discrepancies to be identified, which then allows correction or further research. The surveyor (a transport professional) sees the developing statistics, tables and interview numbers for the different survey categories of users and transport modes. This facilitates survey implementation and reduces the likelihood of incomplete data sets.

1.4 The planned work of Phase 2

It was proposed that the second six-month phase of research should concentrate on consolidating progress by:

- improving the analysis tools
- improving the data collection and in-field triangulation methodologies
- testing rigorously the whole methodology (with in-field data entry and analysis) in Tanzania, resulting in one new RTSi road report
- critically reviewing progress and making improvements as required
- preparing and sharing a work-in-progress paper with a new completed road report
- second cycle of rigorous testing of the methodology and in-field data entry and analysis in Cameroon, resulting in a second RTSi road report
- third cycle of rigorous testing of the methodology and in-field data entry and analysis in Kenya, resulting in a third RTSi road report
- identifying the indicator statistics most relevant and meaningful to the different stakeholders and possible systems of 'weighting' the different statistics
- preparing clear user guidelines for the surveying and analysis tools.
- preparing and sharing a technical paper with the three new RTSi road reports.
- preparing a paper suitable for publishing in a refereed journal.

It was proposed that initial work would concentrate on improving the system used for data entry, analysis and triangulation, using the existing data sets from Phase 1 to obtain indicator statistics. Expert advice would be sought on how to resolve problematic issues. The updated survey and analysis methodologies would then be tested on one new road in Tanzania. During the survey, various stakeholders (users, operators, regulators and development personnel) would be asked which of the emerging indicator statistics appeared relevant and meaningful to them. A work-in-progress paper (this present document) with one new RTSi road report would be circulated after ten weeks. This would be the output describing the first milestone of Phase 2, which was the validation of the RTSi methodology and analysis software.

In the second half of Phase 2, the survey and analysis methodologies will be reviewed and modified in the light of experiences. The revised methodology will be tested again on a new road in West Africa (Cameroon). A new road report will be produced with tables summarising the key statistics. Stakeholders will again be consulted about which indicator statistics appear to be most relevant or useful to them. The methodology will be adjusted as appropriate. The newly revised methodology will be tested again on a new road in Kenya. This will be implemented by someone who is not familiar with this research, supported by members of the research team. A new road report will be produced with tables summarising the key statistics. Stakeholders will again be consulted about which indicator statistics appear to be the most relevant to them.

Progress towards the identification of the key indicator statistics will be reported in another (final for this phase) ‘work-in-progress’ paper. The team will prepare clear guidelines relating to the survey and analysis methodologies so that other people and organisations will be able to test and use the systems developed. These outputs, together will a technical paper and final report, will be submitted at the end of phase, and will mark the final milestone of Phase 2.

2 PROGRESS AND ACHIEVEMENTS IN RTSi PHASE 2

2.1 Team and team meeting

Five members of the team continue from Phase 1. These are: Paul Starkey (Team Leader), Peter Njenga (Project Manager), Guy Kemtsop (Cameroon Researcher), Shedrack Willilo (Tanzania

Researcher) and Krishan Jayatunge (Website and design). These are joined by Romanus Opiyo (Kenya Researcher) and John Hine (Technical Adviser). John Hine is a very experienced transport economist and a member of this project's consultative group and AFCAP's Steering Group. He has agreed to work for a small number of days to advise particularly on the use of the spread sheet software to determine vehicle operating costs. However, his experience will also be valuable in relation to selecting those indicator statistics likely to be most acceptable to transport planning authorities and donor agencies.

The team met in Karen, Kenya, from 27-31 October 2012 to plan the work of the phase. The team reviewed the questionnaires, the key statistics and the data analysis software. Various statistics relating to vehicle operating costs were updated, and some new statistics were added to the summary tables. Examples of the updated summary tables, based on data from Tanzania, are provided at the end of this document.

2.2 Analysis software

The team put a great deal of time into developing the analysis software (based on Microsoft Excel). The aim is to develop software that is very user friendly and that automatically computes the key statistics and generates tables from the survey data entered. The problem is that in order to develop a relatively simple system, very many background computations have to be put in place. This is because most data is disaggregated for gender, transport type (now 20 types of transport), road conditions (normal, busy, disrupted and cut off), passenger and freight journeys and different systems of transport operation (owner drivers, leasing operators, employing enterprises).

When the software is finalised, it should be possible for one person to enter the data on data-entry sheets in a portable computer while undertaking the survey. This person, or a supervisor, should check all figures to ensure that they are realistic and of appropriate order of magnitude. Unusual statistics can generally be traced back to errors in data entry. Once the data is entered, the surveyor has to make 20 formal triangulated decisions for each mode of transport (see below). Once this is done, all the tables of statistics and stakeholder opinions should be automatically generated and available for copying into a Word document for the RTSi road report.

This was finally the case for the RTSi road report from Kilolo, Tanzania, annexed to this report. However, it did take far longer than expected to reach this stage of automatic generation due to problems of data entry and errors in the various equations required to tally and analyse the data. The system is not yet perfect, and further work needs to be done to test and verify the various statistics being generated. Nevertheless, the team remains optimistic that the software will work correctly on the surveys to be undertaken in Cameroon and Kenya.

2.3 Triangulations

Following data entry, the researcher has to undertake a series of 'triangulations' which are contained in the 'Intermediate Tables' worksheet. There are 20 separate data triangulations 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 has to decide on the value to be 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. Therefore, 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 the triangulated figures that are taken forward into the final indicator statistics.

2.4 Road survey in Tanzania

The road chosen for survey was the 36 km Kilolo-Iringa road in Iringa Region. The RTSi report is attached at the end of this paper, and provides details of the road and the transport situation.

This road is actually a regional road, joining the rapidly-growing Kilolo town (headquarters of a newly-created district) to the regional town of Iringa. This road was chosen because there had been previous studies on the road, it connects a rural area with a town and also has a diversity of transport services. It is not an inter-urban road, as Kilolo is still a small rural community. A small minority of the passengers travelling on the road would actually live in Kilolo: most would be from the surrounding areas. However, because of the transport demand and the all-weather gravel road, there are a range of transport services, including large buses, a midi-bus, minibuses and motorcycle taxis (operating from a small number of hubs, including Kilolo itself). There are also a range of private and official vehicles and freight trucks. This has provided an opportunity to test the data-entry and analysis software with several different traffic types. On the district roads in the area, there are generally only one or two modes of transport services (eg, bus and motorcycle, minibus and motorcycle, rural taxi and motorcycle or motorcycle only). A 4x4 rural taxi, a motorised three-wheeler and a power-tiller with trailer also operate on parts of the road, but only provide localised services.

It was relatively straightforward to undertake the survey and traffic count. The revised questionnaires appeared to be satisfactory. Users and operators provided useful qualitative and quantitative information. Perspectives relating to the development impact and to regulation were also collected.

Several interesting points emerged. Traffic volumes were higher than on other roads studied in Tanzania. This was because it was an all-weather, gravel regional road with a large and productive catchment area. More private and official vehicles were recorded. Kilolo is being established as a district headquarters, but there are not yet adequate houses and offices for all senior staff of governmental, non-governmental and commercial organisations. As it is only one hour away from Iringa, some people live in Iringa and travel to Kilolo for their work.

A study of the road had been carried out in 2005 (Awadh, 2007). Table 1 compares the traffic flows in 2012 and 2015 to illustrate some of the changes that have taken place in terms of traffic and transport services. The 2005 traffic count was carried out slightly closer to Iringa than the 2012 count (so will have slightly more traffic feeding in) and also closer to some villages (so higher levels of pedestrians and bicyclists at 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 has dropped slightly (from 10 to 8). Minibuses have increased and have replaced the rural taxis, providing both more vehicles and greater carrying capacity. Private and official cars and pickups have increased greatly, which is probably related to the development of the new district headquarters at Kilolo. All types of trucks have increased, providing significantly greater overall carrying capacity. In 2005, only five motorcycles were recorded, but now motorcycles are the commonest vehicle type (as on many other roads in Tanzania and other countries). The numbers of bicycles and pedestrians have decreased. This may be partly due to the different location of the traffic count, but it may also be due to greater access to motorcycles and to the better transport services provided by the midi- and minibuses.

The motorcycle taxis have only recently started to operate at Kilolo and other small hubs. Their numbers are likely to grow quite rapidly in the coming years. They charge high fares and generally provide relatively short distance transport, particularly to villages not on the main road. Unlike the roads studied in Bagamoyo, many of the motorcycles are not operated as taxis, but are used by individuals for their livelihoods. This may again be related to the establishment of the new district and the proximity to Iringa town. While it was acknowledged that the motorcycles did not generally comply with financial and technical regulations, their level of loading appeared to be modest compared with the other roads surveyed in Tanzania and Kenya. 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. This is particularly true of the early services, with minibuses in the middle of the day being less crowded. One 65-seat bus had 100 passengers, the midi-bus had 49 passengers and one minibus had 30 passengers. These figures are in addition to luggage, particularly for the large buses. The transport operators try to maximise their income and profit per trip. This is a common practice, but it leads to poor quality of transport service in terms of space, comfort and frequency.

Despite the high loading levels, the fares are quite high and there is major dissatisfaction with them. Surprisingly, there is only minor dissatisfaction with comfort (seating , space available) except there is major dissatisfaction with the travelling environment (heat, fumes, dust, etc). Safety and security were not of particular concern to users, although the reported accident rate for motorcycles was high. Motorcycles were considered by users to be less safe than buses and minibuses.

2.5 Preparations for road surveys in Cameroon and Kenya

The team has been preparing to survey a road in northern Cameroon in January. It is anticipated that Guy Kemtsop will carry out the survey in collaboration with Paul Starkey. This will be in a Francophone environment in the Sahel, and so will be a very different socio-political and ecological environment.

Plans for the third survey in Kenya have had to be brought forward due to the forthcoming elections. Traffic counts have already been undertaken and the survey will be completed in early February, to avoid potential risks.

3 LESSONS AND ISSUES TO DATE FROM RTSI PHASE 2

3.1 Surveying complex transport patterns

The survey methodology has been trying to define and quantify the rural transport services on particular roads. The more the actual transport services are studied and understood, the greater becomes the complexity of the emerging picture. On each road that has been studied, it is clear that the rural transport services are not uniform along the road. They vary with both space and time.

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 link roads, the transport services (rural taxis, buses and minibuses) 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), 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.

Some of the complexity issues were discussed in Phase 1 (Starkey et al, 2012a, 2012b). Each day is different on a road. Traffic varies with the seasons and a wide range of issues to do with road condition, markets, vehicles, festivals, owners, the situation on other roads and the particular circumstances of a wide range of stakeholders. The methodology aims to capture the main fluctuations in space and time, and the key issues for stakeholders.

3.2 Importance of traffic count location and timing

As has been noted above, on many rural roads there will be a gradient of transport services, with least traffic near the remote end, and greatest traffic towards the hub end (which may be a junction with the main road or a town with markets and services). 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 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.

On the Kilolo-Iringa road in Tanzania, the traffic count location was on a central part of the road, and was not close to a minor hub. This was considered accurate for assessing the traffic and transport services travelling along the length of the road. However, this resulted in quite low counts for pedestrians, bicyclists and motorcyclists. These use the road, but for relatively short distances. Siting the traffic count location nearer to Iringa (regional hub) would have increased levels of minibuses (additional services joining from feeding roads). If sited within 5 km of Iringa, there would have been much higher levels of the small traffic types (including pedestrians and bicycles) as this would be within easy commuting distance of Iringa town. However the number of big buses would have been the same. Siting the traffic count location nearer to Kilolo (small district hub) would have greatly increased the numbers of motorcycles, pedestrians and bicycles, but the numbers of buses and minibuses would have been the same.

The Tanzanian (Kilolo-Iringa) traffic count provided a good estimate of the long-distance transport along the road. That was the main objective of the traffic count. However, this result did under-estimate the real importance of motorcycles, bicycles and pedestrians on other sections of the road. It would be possible to do counts on several sections of the road, to capture the different traffic patterns along the road. This would provide quantitative data and allow greater understanding about how the various transport modes contribute in their different ways. However, it might be difficult to combine these different counts into one meaningful ‘average’ figure for the road.

To overcome this problem of over-stating or understating the importance of intermediate means of transport, the RTSi software provides an opportunity to ‘triangulate’ the information from the traffic

count. For all transport modes, the researcher enters a triangulated figure based on the traffic count and the information from operators, users and observations. For large public transport modes such as buses and minibuses, there would only be adjustments if the traffic count days were considered exceptional (disrupted by rain or an unusual breakdown of a bus). For motorcycles, it would be appropriate to enter a figure that would be between the low level of a remote traffic count and the higher figure that would be obtained close to a hub. This intermediate figure could be considered to be representative of the road as a whole, although clearly the benefits of motorcycle transport would not be uniform along the road.

The methodology suggests that traffic counts are taken on two days at the same place: one count on a normal day and one count on a 'busy' day. The 'busy' day will normally be the day of a regular market. It would be good to have a traffic count on a typically disrupted day, but traffic flows on disrupted days can be estimated from the data provided by the operators and users. Again, all figures are triangulated, to allow the final figures to be as close to the true situation as practicable.

3.3 Catchment populations for transport services

Another key issue in the development of indicators is the relationship between transport services and the catchment population. Although the team has included 'catchment population' in the indicator summary Table 1, it has not yet found satisfactory ways of defining this statistic. In Phase 1 it had been hoped to do this using GIS technologies, but it appeared that suitable datasets did not exist for the roads being studied. 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, 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 team would like to develop statistics that relate the transport services 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 being studied that this is not always the case. There is latent demand that can be transformed into economic demand if appropriate transport services are in place. 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 and Kenya illustrates how creating a new supply can meet part of the latent transport demand. It would have been difficult to predict how rural people could afford such relatively expensive services.

The concept of catchment population can also be linked to more than one road. The Kilolo-Iringa road studied in Tanzania has several feeding roads, each with different transport services characteristics. Together, these could be seen as one transport catchment area, with several, bifurcating routes. One of the ideas suggested for future research was the development rural transport services indicators for geographical areas, such as districts. One of the challenges would be how to develop area-wide indicators, when the transport services along the various roads were not the same. However, this challenge is already being faced for the roads being studied. Transport

services vary along rural roads. The Kilolo-Iringa road demonstrated this. The existing road-based indicators already have had to cope with such variations.

Within-road variations in transport services are much smaller than the variations between roads. Taking the example of the catchment area of the Kilolo-Iringa road system, including its feeding roads, some of the feeding roads have very poor transport. Access for the people living on these feeding road corridors is very inferior to that of the main Kilolo-Iringa road, for which indicator datasets have been collected. Nevertheless, if the transport authorities were to develop a planning framework for transport services on the Kilolo-Iringa road, it would make sense to have a plan for the whole road catchment area and its entire catchment population.

The study of the Kilolo-Iringa has illustrated how this RTSi methodology could be used in the future, not only to 'measure' the adequacy of transport services along one road, but they could also provide a basis for planning improved transport services for wider, catchment populations.

3.4 Potential for improving economic models

The research has already shown that many of the quantitative and qualitative assumptions made in transport planning are unrealistic. The RED (Roads Economic Decision) model is used by development banks and some donors to assess the internal rate of return (IRR) for planned rural road projects and for the economic impact of constructed or rehabilitated roads. The RED model involves many assumptions relating to reducing the operating costs of vehicles.

The conventional RED model assumes that operators buy new vehicles. The RTSi surveys have shown that the only new RTS vehicles are motorcycles (not included in conventional RED analyses). The public transport and freight vehicles on the Kilolo Road in Tanzania were about 20 years old, and had been bought as old vehicles from operators on less-challenging routes. There is a stratification, with new vehicles often spending their first ten years in Japan, moving to urban or inter-urban routes in Tanzania and finally (at the age of 15+ years) being bought by rural transport services.

In the medium term, it may be possible to use statistics from the RTSi surveys to improve the assumptions in the RED models.

3.5 Looking towards indicators

The work so far in this phase has continued to concentrate on collection and analysis of reliable datasets. It is envisaged that such datasets will become useful for planning and evaluation purposes. However, the aim of the project is to use these to develop simple, clear and meaningful indicators. With several data sets available is now possible to start to compare the different roads and to see which statistics change.

The team has started to ask stakeholders which indicator statistics are the most meaningful to them. Planners and regulators (roads and transport agencies) tend to be interested in the statistics relating to overall passenger and freight volumes, and also the various statistics relating to vehicle operating costs. Naturally they tend so see rural transport from a 'roads' perspective rather than a user perspective.

For users, price is clearly a major indicator, and the data sets have price per kilometre for each means of transport. Also available is the price of transporting small-to-medium loads of freight. User opinions on prices are generally strong. Frequency is another key indicator for the users, and the data sets include this as the number of travel opportunities per day.

One issue to be resolved is how to produce road-based indicators when the various transport types have very different characteristics. Cheap but infrequent buses, slightly more expensive but more frequent minibuses and very expensive but readily available motorcycle taxis. These often have similar satisfaction ratings, even for price, perhaps because users offset convenience and price.

The team developed a provisional disruption index, based on the percentage of days with disrupted services and/or no services and the increases in waiting and journey times on disrupted days. To keep things consistent with the rest of the survey (where higher values indicate better performance), this was converted into a reliability index. This seemed to provide a good indicator of reliability (low levels of disruption). However, if disrupted journey times and waiting times are more than double the normal times, the indicator gives a negative value which appears confusing. The team is therefore discussing with specialists about alternative equations or algorithms for computing this indicator statistic.

4 CONCLUSIONS

The team has made some good progress in the first part of Phase 2. Refining the software has been complex, challenging and time consuming and work remains to be done. The end result must be a methodology with analytical software that other people can use to create meaningful statistics.

The study of a regional road in Tanzania has provided another opportunity to gather datasets from which transport services indicator statistics can be developed. This road had a good range of transport services, and access to a previous study showed how these had changed over the past five years. The study showed that the transport services were not constant throughout the road, but varied due to the effects of feeding roads and the small transport hubs along the road. This provided valuable lessons in relation to the location of traffic counts and developing reasonable statistics from variable data. The process of systematic triangulation is very useful, but does require rigorous quality control to prevent inaccuracies being taken forward into the tables of final statistics.

The attached report of the Kilolo-Iringa road contains a unique set of interesting statistics. In addition to their role in developing transport services indicators for the road, it is anticipated these could be of value to planners in various ways, including improving road planning models and developing a framework for planning appropriate transport services for the catchment population.

The team have been starting to gauge opinions about which of the statistics being collected are of greatest interest to the different stakeholders. So far, transport planners favour the statistics on overall passenger and freight movements. Users seem mainly concerned with fares, frequency and predictability. More extensive and detailed stakeholder discussions will take place during the coming surveys in Cameroon and Kenya. This paper will be used to solicit ideas concerning the indicator statistics from the project's consultative group and other members of the rural transport 'community of practice'. Feedback on this report and the rural transport services indicator initiative will be welcomed, and the relevant email addresses and website address are provided at the front of this report.

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Awadh A, 2007. A rapid assessment of rural transport services in Iringa Region, Tanzania. SSATP Working Paper No. 87E Sub-Saharan Africa Transport Policy Program (SSATP), World Bank, Washington DC, USA. Available at: http://www.ruraltransport.info/RTSi/resources/resource_documents.php

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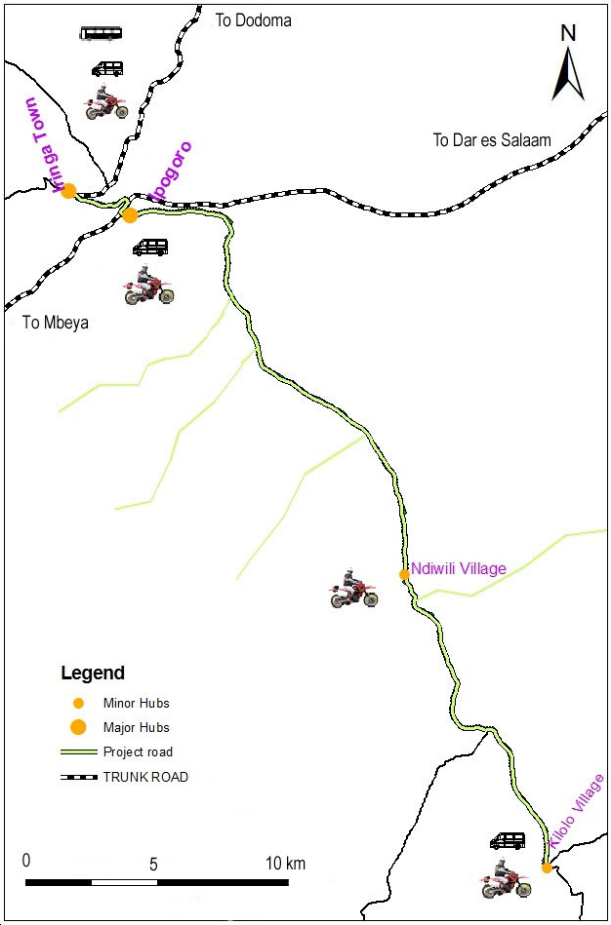
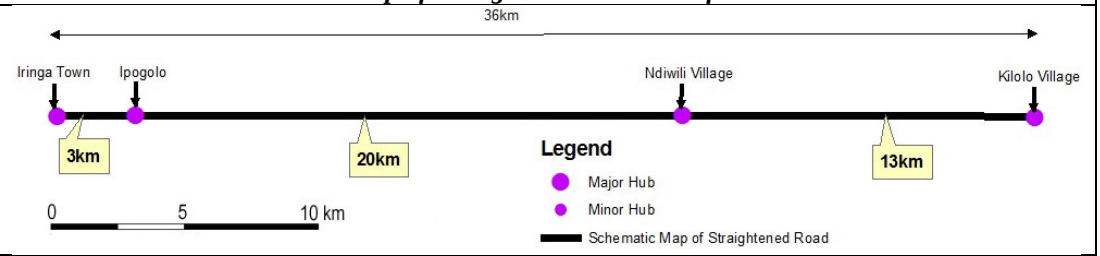
Rural Transport Service Indicators
Summary Tables and Report

Report of: Iringa-Kilolo Road, Iringa Region, Tanzania

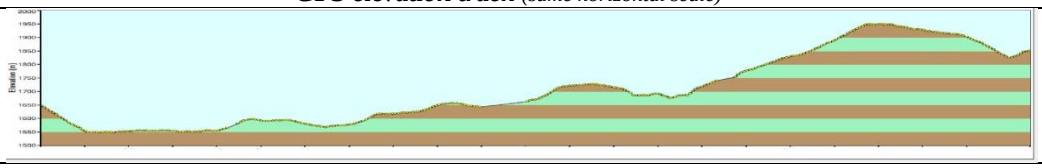
Prepared by: Shedrack Willilo Date: 04 January 2013

Table 1. Road information			
Road name:Iringa – Kilolo			
District, Region and Country:Urban & Rural Iringa, and Kilolo, Iringa, Tanzania			
Road type: Regional road	*Responsible authority: TANROADS*		
Road start location:Iringa Town	*GIS:*		
Road finish location:Kilolo	*GIS:*		
Road length:35km	*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 Ipogoro junction on the TanZam highway. From Ipogoro 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.			
Maps of road, with context and hub and spoke connections			
		

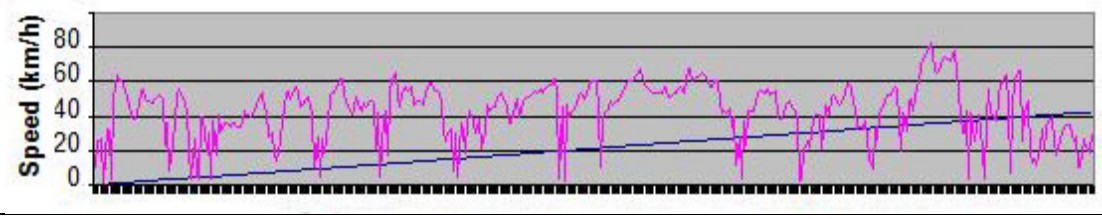
Schematic map of 'straightened' road with features



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. The minibuses and one midi-bus provide quite frequent services between the Kilolo hub and Ipogoro, 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 Ipogoro. Several small district and village roads feed into the road, so that traffic levels nearer to Ipogoro/Iringa are higher than those near the Kilolo end of the road.

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

'Feeding' [7]	*User satisfaction* [8]	★★★★☆	*Development impact* [9]	★★★★☆
'Lnking' [10]	*User satisfaction* [11]	★★★★★	*Development impact* [12]	★★★★★

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 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	8	85	2,150	680	17,200	379	5,440	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	3515	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	124	200	60	3	97	1	8	124	4,133	40	383	+
Bicycle	54	100	40	5	27							
Pedestrian	24	80	20	10	12							
Totals	**376**	**586**	**248**	**18**	**161**	**151**	**2,520**	**1,494**	**36,313**	**954**	**54,806**	

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	44	46	41	602
Cost of 200 kg consigned freight in USDc per tonne-km	38	21	45	n/a
Safety: Recalled no. of accidents per 100,000 vehicle trip	198	0	165	3,831
Security: Recalled no. of incidents per 100,000 vehicle trip	0	0	3	66
Typical age of vehicle	23	17	19	1
Typical fuel consumption of vehicles (litres per 100 km)	15	19	17	1
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	4
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

Table 4. User satisfaction with main RTS modes (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	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆
The more stars the better. ★☆☆☆☆*= Very dissatisfied.* ★★☆☆☆*= Dissatisfied.* ★★★☆☆*= Medium.* ★★★★☆*= Satisfied.* ★★★★★*= Very satisfied*								

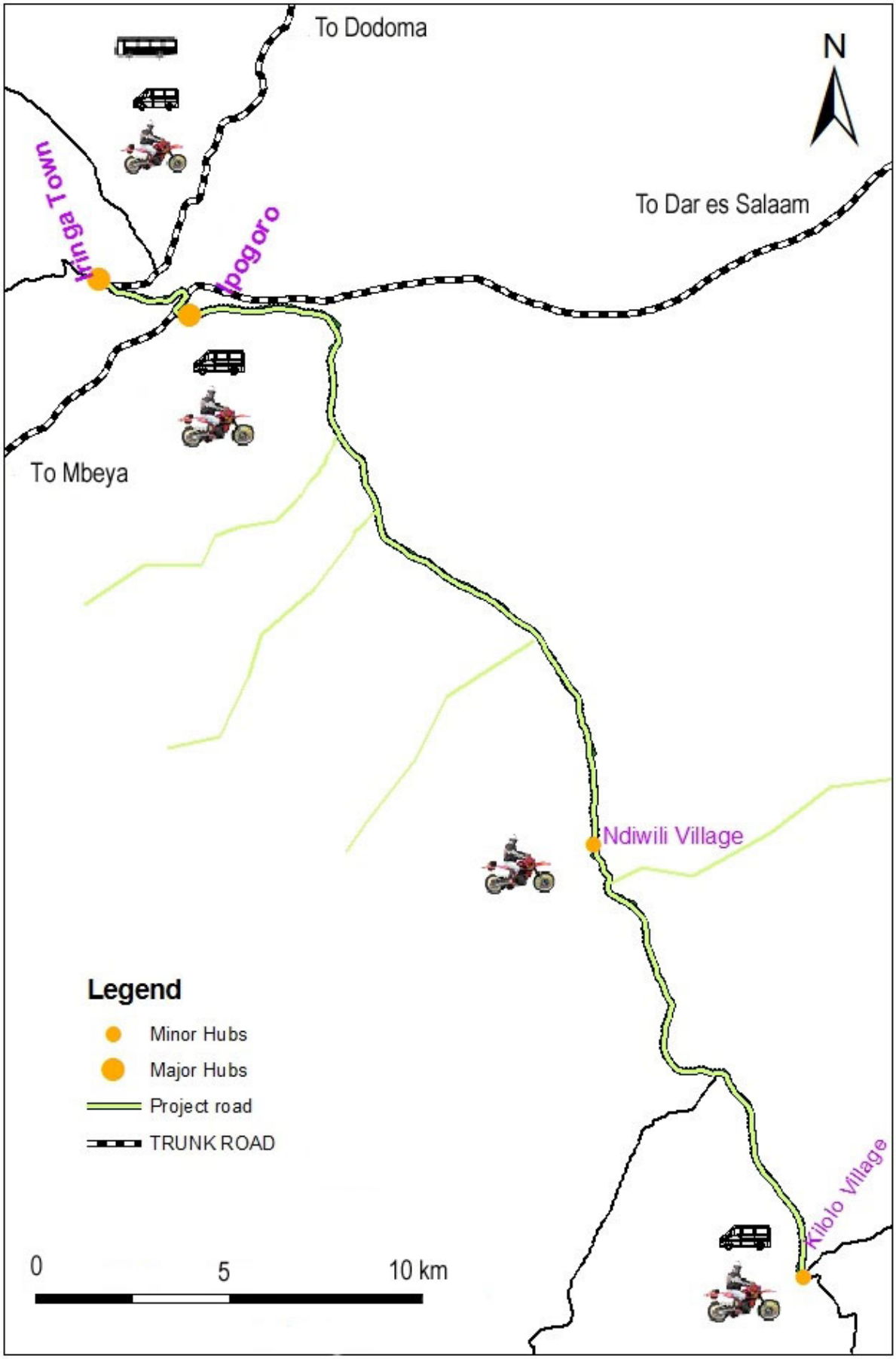


Fig. 1: Iringa - Kilolo Road Context Map

Overview of transport services situation and issues

The Iringa–Kilolo road is all weather motorable road with one section at Tagamenda village with drift curvet which gets disrupted for few hours during heavy rainfall. The major economic activities along the survey road are agriculture and livestock keeping. Crops grown include maize, sunflowers, beans, peas, vegetables and tomatoes.

Fig. 2: Cars waiting for rain water to drain at the drift curvet so they can cross

Typical transport services along Iringa-Kilolo road include motorcycles, minibuses and large buses. Bicycles are also important transport services but are not commercially used. Trucks are also widely used especially for freight transport. Based on a one day traffic count at Kitayawa sub-village, the daily transport services along the road in the direction of main hub (Iringa) comprised 27 bicycles, 97 motorcycles, 15 minibuses, 1 midi-bus and 4 large buses. There were also 2 pickups and 23 trucks of which 8 were light trucks, 10 medium trucks and 5 large trucks. Various cars (saloons, estates and 4x4s) are also widely using the road and 43 cars were recorded of which 28 cars were private vehicles and 15 were official government vehicles. The bus services have formal timetables, but users say they are nonetheless unpredictable.

Disruption to services along this road section is minimal. Generally, there is no single day in which there are no transport services along the Iringa–Kilolo road. Based on the surveys, the overall annual passenger volumes were 107,848, 508,400, 27,000 and 209,780 for motorcycles, minibuses, midi-bus and buses respectively (Table 2 above). The maximum carrying capacity is 2, 20, 45 and 85 passengers for motorcycles, minibuses, midi-bus and large buses respectively. The minibuses and a midi-bus normally make one return trip a day, while buses make a single one-way trip a day. This is due to the fact that, the buses are more disrupted than minibuses as buses start their routes before Kilolo on more difficult roads. The market share of these modes therefore is 13%, 60%, 3% and 25% for motorcycles, minibuses, midi-bus and buses respectively.

User perspectives

A total of 63 users of motorcycles, minibuses, midi-bus and buses were interviewed in relation to the Iringa-Kilolo road. Out of these, 36 (57%) were male and 27 (43%) were female. The youngest respondent was a student of 16 years while the oldest was a 72-year-old farmer. The user category interviewed above included farmers, traders, disabled, elderly, students, health users, maternal health care, disabled and those using transport for employment, financial services and/or for socio-cultural or religious reasons.

Summary of user satisfaction

Women and men were asked about their satisfaction with the different means of transport. For the motorcycle transport service, 9 (82%) men and 2 (18%) women were interviewed. In the case of minibuses, 21 users responded to the question of which 11 (52%) were men and 10 (48%) were women. In the case of the midi-bus, 7 (54%) men and 6 (46%) women were interviewed. Likewise 18 bus users responded to the questions of which 9 (50%) were men

and 9 (50%) were women. The Figure 3 below presents satisfaction levels, disaggregated for gender, relating to passenger fares, journey times, service frequency and service predictability. Higher scores (and taller bars) represent greater satisfaction.

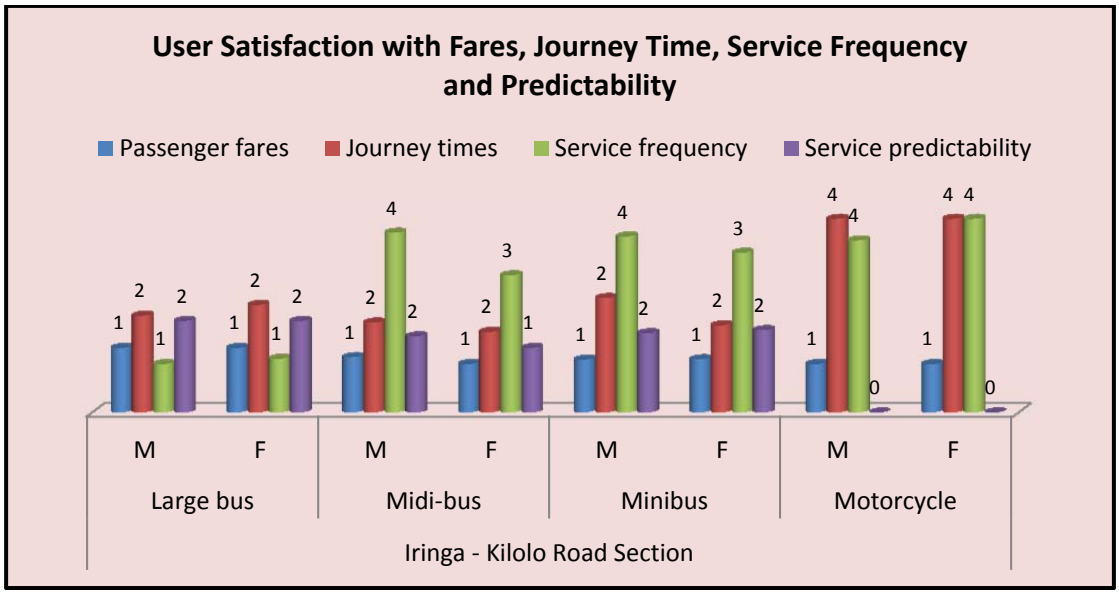


Fig. 3: User satisfaction with fares, journey time, service frequency and predictability

The survey results show that users were very dissatisfied with passenger fares for all modes of transport. Similarly, users were dissatisfied with journey times and predictability of services for minibuses, midi-bus and buses. On the other hand, users were happy with the service frequency for motorcycles, minibuses and midi-buses. This could be explained by the fact although the minibuses and midi-bus make one return trip a day, there are about 15 vehicles a day operating on the road. They queue up to leave quite regularly from the hubs at Kilolo and Ipogoro. The satisfaction with fares, journey time, frequency and predictability did not demonstrate any clear gender differences.

In terms of freight characteristics, both men and women were medium satisfied with availability of minibuses, midi-bus and buses to carry small freight (20–50kg) and satisfied with the motorcycles for this purpose. RTS users were dissatisfied with the availability of minibuses, midi-bus and motorcycles to carry medium freight (200 kg) but were medium satisfied with the availability of large buses to carry such loads. This could be due to limited capacity to handle large freight on minibuses and midi-buses. The medium satisfaction with freight on the large bus may be due to the fact that, the large buses start before Kilolo and leave fully loaded, so that it is not always possible to carry additional freight. With regard to freight charges, both men and women were very dissatisfied with the freight charges for medium freight (100–200kg) and dissatisfied with the same for small freight. On the other hand, both men and women were satisfied with the handling of small and medium freight. User satisfaction with freight transport is illustrated in Figure 6.

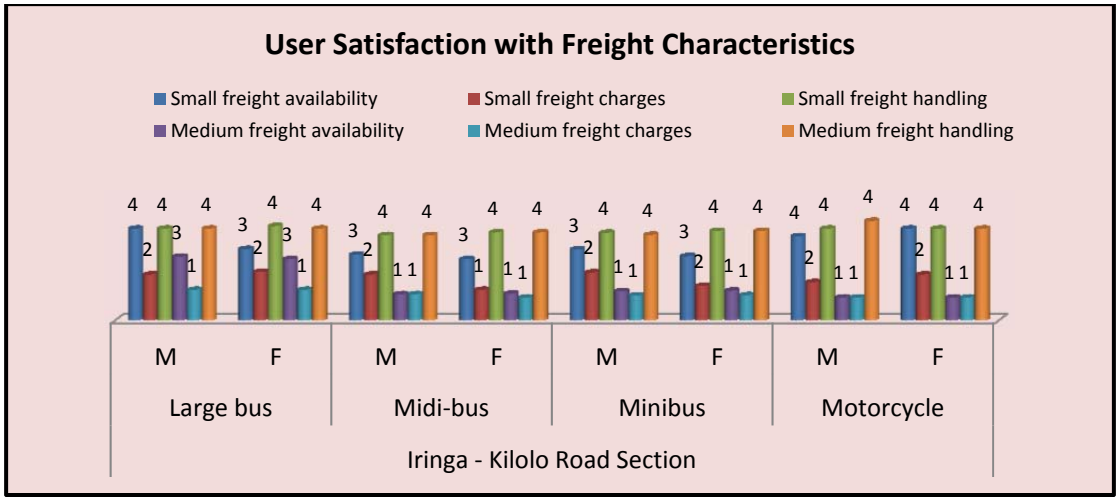


Fig. 6: User Satisfaction to Freight Characteristics

The survey results indicated that both men and women were dissatisfied with the safety risk across all modes with motorcycle being perceived as the most risky mode. On the security aspect, users were generally satisfied with the security risks (theft, assault, harassment), across the modes with women being medium satisfied with the security of minibuses and midi-buses. RTS users were medium satisfied with the comfort in terms of seat condition of minibuses, midi-bus and buses but satisfied with the same for motorcycles. On the other hand, both men and women complained about poor access for vulnerable people (elderly or physically challenged people) for all the modes. Comfort in terms of the environment (noise levels/dust/heat) was also a serious challenge across all modes. The user satisfaction in relation comfort and security is illustrated in Figure 7.

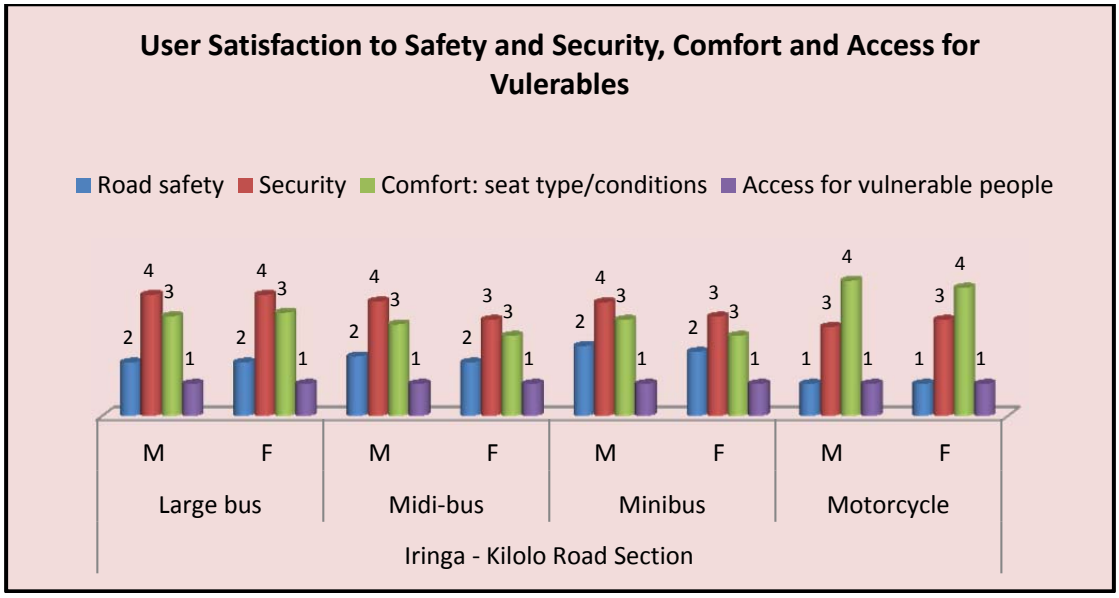


Fig. 7: User satisfaction to safety and security, comfort and access for vulnerable people

Across the modes, all RTS users interviewed indicated that they were dissatisfied with the roadside waiting facilities, which was understandable as such facilities do not exist. In terms of intermodal connectivity, RTS users were satisfied with the feeding and linking intermodal connectivity. This suggests the role of motorcycle in facilitating the movement of people and goods to and from the road as well as minibuses, midi-buses and buses in facilitating timely links to higher level transport types to major hubs.

Table 5. Summary of user satisfaction responses disaggregated for gender								
Means of transport	**Large bus**		**Midi-bus**		**Minibus**		**Motorcycle**	
Gender of respondent	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
Sample size (N)	*9*	*9*	*7*	*6*	*11*	*10*	*9*	*2*
Passenger fares	1	1	1	1	1	1	1	1
Journey times	2	2	2	2	2	2	4	4
Service frequency	1	1	4	3	4	3	4	4
Service predictability	2	2	2	1	2	2	n/a	n/a
Passenger capacity	2	2	2	2	3	2	4	4
Small freight availability	4	3	3	3	3	3	4	4
Small freight charges	2	2	2	1	2	2	2	2
Small freight handling	4	4	4	4	4	4	4	4
Medium freight availability	3	3	1	1	1	1	1	1
Medium freight charges	1	1	1	1	1	1	1	1
Medium freight handling	4	4	4	4	4	4	4	4
Courier services	3	4	2	2	2	2	1	1
Road safety	2	2	2	2	2	2	1	1
Security	4	4	4	3	4	3	3	3
Comfort: space	4	3	2	2	2	2	n/a	n/a
Comfort: seat type/conditions	3	3	3	3	3	3	4	4
Comfort: surrounding baggage	2	2	2	2	3	3	n/a	n/a
Comfort: environment	1	1	1	1	1	1	1	1
Access for vulnerable people	1	1	1	1	1	1	1	1
Overall un-weighted	2	2	2	2	2	2	3	3
Overall weighted								

Satisfaction for all transport types		
Gender of respondent	**M**	**F**
Facilities at roadside stops	1	1
Feeding intermodal connectivity	4	4
Linking intermodal connectivity	5	5
Overall un-weighted	**3**	**3**
Overall weighted		

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

Operator perspectives

A total of 11 operators were interviewed to provide opinions from the operators' perspective. Out of these one was an owner/operator of a motorcycle and 10 were hired minibus drivers, midi-bus drivers, bus drivers and motorcycle operators. The hired minibus and motorcycle operators paid an average daily rental charge of TZS 35,500 (USD 22) and TZS 9500 (USD 6) to the owners respectively. Minibuses and midi-buses along the surveyed road made one return trip a day while the large buses made a single one-way trip each day. The minibuses provide about 11 travel opportunities a day in the direction of Iringa. They start operations at about 8.30 am after the large buses have passed. Fares per km are similar for minibuses and midi-buses (USDc 5 per kilometre) but cheaper on large buses (USDc 4 per

kilometre). Fares are much higher for motorcycles (averaging USDc 34 per kilometre). There are no formal associations of operators, but the minibuses cooperate in relation to queuing. Figure 8 illustrates the relative fares and frequency of the rural transport services.

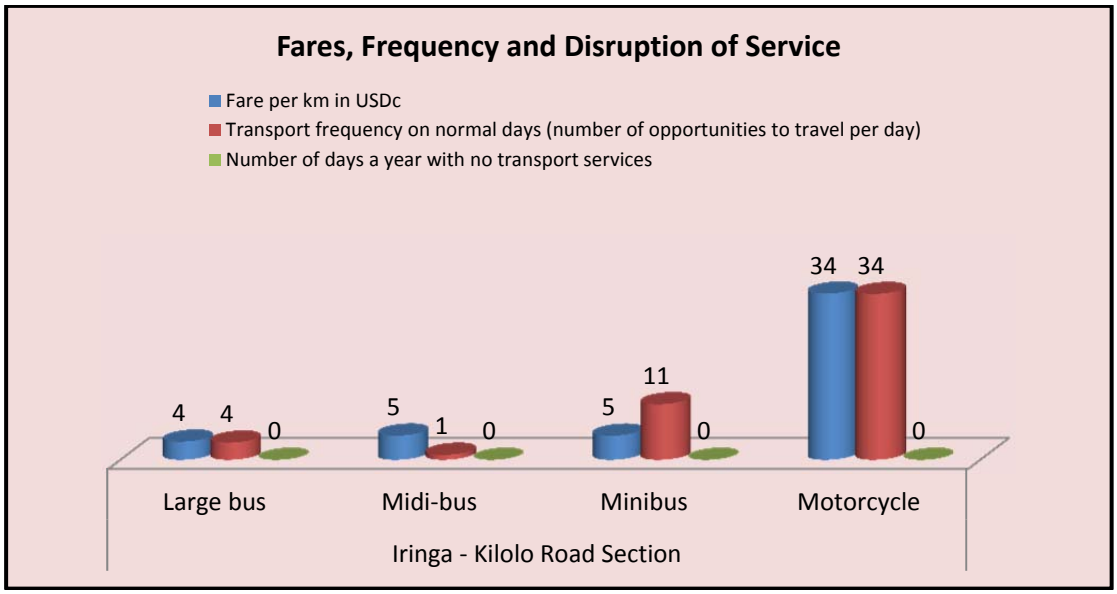


Fig. 8: Fares, service frequency and disruption along the Iringa-Kilolo road

The survey results for operators indicated that poor road condition and access to capital/credit facilities were amongst the key challenges facing the operators. On the other hand, regulatory issues such as check points, barriers, enforced safety regulations relating to loading levels, crash helmets, seat belts and restrictions on operating hours and routes of operation were regarded unimportant disincentives to operators of motorcycles and large buses. These factors were considered medium disincentives for minibuses and strong disincentives for midi-buses and trucks. Conversely subsidies, tax relief, flat rate tax and route allocation were perceived as weak incentives for minibuses, midi-bus and trucks operating along the road but medium incentives to motorcycles and large buses operating along the survey road.

Table 6. Summary of operator perspectives

Means of transport	Large bus	Midi-bus	Minibus	Medium truck	Motorcycle
Sample size (N)	*2*	*1*	*3*	*2*	*3*
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	★★☆☆☆	★☆☆☆☆	★★☆☆☆	★★☆☆☆	★☆☆☆☆
Un-weighted average 2	★★☆☆☆	★☆☆☆☆	★★☆☆☆	★★☆☆☆	★★☆☆☆
Weighted average 3					

The more stars the better. ★☆☆☆☆ *= Very dissatisfied.* ★★☆☆☆ *= Dissatisfied.* ★★★☆☆ *= Medium.* ★★★★☆ *= Satisfied.* ★★★★★ *= Very satisfied*

Regulator perspectives

On the Kilolo-Iringa road people were interviewed to provide their opinions on the regulator's perspective. A Village Chairman (VC), a Village Executive Officer (VEO), a traffic police officer and an officer of SUMATRA (Surface and Marine Transport Regulatory Authority) were interviewed. Traffic police are responsible for enforcing traffic regulations and they know how well operators comply with traffic regulations. SUMATRA is the organisation responsible for route licensing, vehicle technical specifications and timetables. Village leaders are often exposed to traffic regulation issues, in the course of their work and regular travels. Therefor these interviewed people can be assumed to provide authoritative and relevant opinions.

It is clear from Figure 7 and Table 7 that motorcycle taxis generally do not comply with many transport regulations. This may be due to their relatively new appearance in the area, lack of appropriate legislation, lack of enforcement capacity and the fact that the motorcycle taxis (unlike the other modes of transport), generally no not operate near Iringa where they may be checkpoints. Few vehicles comply with vehicle technical regulations (including annual tests) or environmental legislations such as emission and noise controls. The enforcers (traffic police) are not generally concerned with such regulations. Compliance with safety regulations (eg, speeding, overloading, drivers' behaviour, use of safety and crash helmets) and operational regulations (timetables, routes and loading levels) were also very low across all modes. However, with the exception of motorcycles taxis, most operators comply with insurance, tax and financial regulations. This is illustrated in Figure 8 and Table 7.

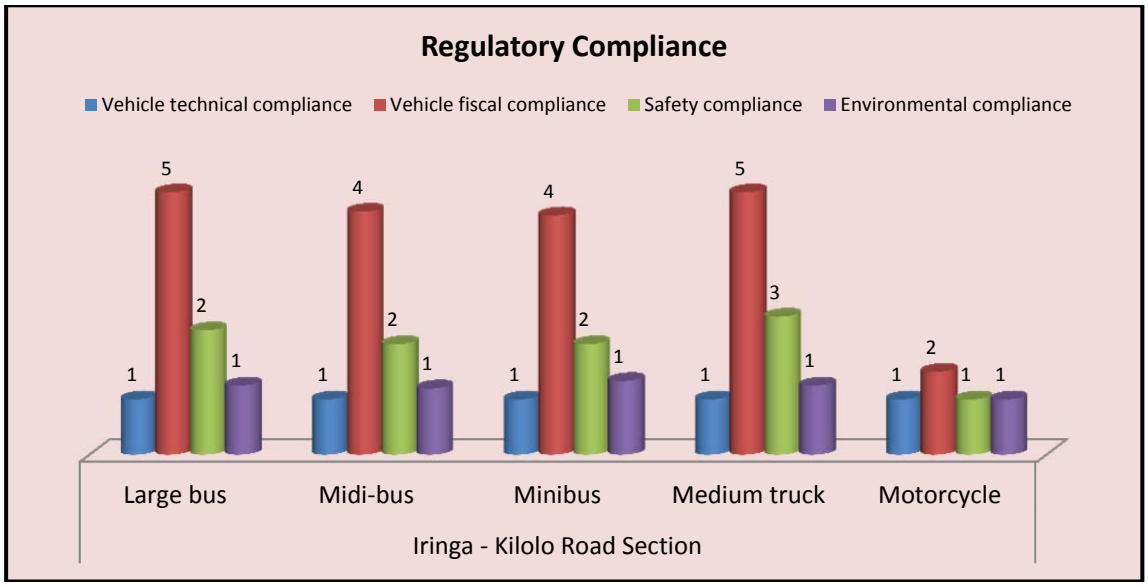


Fig. 7: Compliance levels with technical, fiscal, safety, and environment along Iringa-Kilolo Road

Table 7. Summary of regulator perspectives					
	Large bus	**Midi-bus**	**Minibus**	**Medium truck**	**Motorcycle**
Vehicle technical compliance	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆
Vehicle fiscal compliance	★★★★★	★★★★☆	★★★★☆	★★★★★	★★☆☆☆
Insurance compliance	★★★★★	★★★★★	★★★★★	★★★★★	★★☆☆☆
Operational compliance	★★☆☆☆	★☆☆☆☆	★★☆☆☆	★★☆☆☆	★☆☆☆☆
Safety compliance	★★☆☆☆	★★☆☆☆	★★☆☆☆	★★★☆☆	★☆☆☆☆
Environmental compliance	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆	★☆☆☆☆
Regulatory planning framework	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★☆☆☆
Safety of the road	★★☆☆☆	★★☆☆☆	★★☆☆☆	★☆☆☆☆	★★☆☆☆
Un-weighted average	★★★☆☆	★★☆☆☆	★★★☆☆	★★☆☆☆	★☆☆☆☆
The more stars the better. ★☆☆☆☆ *= Very dissatisfied.* ★★☆☆☆ *= Dissatisfied.* ★★★☆☆ *= Medium.* ★★★★☆ *= Satisfied.* ★★★★★ *= Very satisfied*					

Development perspectives

Four people were interviewed to provide opinions on the development perspective of the road. These were a Village Chairman (VC), two Village Executive Officers (VEO) and a secondary school teacher. Village leaders (VEO, WEO) are regularly involved in discussions with communities to address various development issues including constraints for rural enterprises, agriculture and the medical sector. Teachers have wide exposure and knowledge to address various rural challenges. In this regard, opinions of the consulted people on the development perspectives were considered reasonably authoritative and relevant.

A good mix of RTS is crucial for agricultural and rural enterprises which are the main activities associated with the road. Opinions from the development perspective show that rural transport services play an important role in facilitating agriculture and rural enterprises along the road. Despite RTS being uncomfortable (particularly in relation to medical transport), the transport services are useful for those seeking medical attention along the surveyed road. However, they are not really suitable for pregnant women. The survey suggested that use of mobile phones is very important to help the rural transport operations of motorcycles, but much less so for the larger transport services. Although motorcycles are considered risky in terms of accidents, they are important in supporting young people's advancement through job creation. Motorcycle fares are expensive, compared to other modes, and this means they contribute little to needs of the education sector (students, teachers and school operations). Based on survey opinions and visual observations, the physical road is considered fairly good for operating rural transport services. The various development perspectives are summarised in Table 8.

Table 8. Summary of development perspectives					
Means of transport	**Large bus**	**Midi-bus**	**Minibus**	**Medium truck**	**Motorcycle**
Agricultural facilitation	★★★★★	★★★★☆	★★★☆☆	★★★★☆	★★★★☆
Enterprise/trade facilitation	★★★★☆	★★★★☆	★★★☆☆	★★★★★	★★★★☆
Women's empowerment	★★★★☆	★★★★☆	★★★☆☆	★★★★☆	★★★☆☆
Minority group empowerment	n/a	n/a	n/a	n/a	n/a
Disabled people's empowerment	★★☆☆☆	★★☆☆☆	★★☆☆☆	★☆☆☆☆	★★☆☆☆
Young people's empowerment	★★★☆☆	★★★☆☆	★★★★☆	★★★☆☆	★★★★★
Maternal health needs	★★★☆☆	★★★☆☆	★★★☆☆	★★☆☆☆	★★☆☆☆
Medical service transport	★★★★☆	★★★★☆	★★★★☆	★☆☆☆☆	★★★☆☆
Education-related transport	★★★☆☆	★★★☆☆	★★★☆☆	★☆☆☆☆	★☆☆☆☆
Mobile phone and ICT integration	★★☆☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★★☆
Un-weighted average	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆
Cultural impact	★★★☆☆	★★☆☆☆	★★☆☆☆	★★★☆☆	★★★☆☆
Environment impact	★★★☆☆	★★★☆☆	★★★☆☆	★★☆☆☆	★★★☆☆
HIV/Aids impact	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆	★★★☆☆
Un-weighted average	★★★☆☆	★★★☆☆	★★★☆☆	★★☆☆☆	★★★☆☆
Weighted average					

Overall weighted average	
Integration with feeder transport	★★★★☆
Integration with external transport	★★★★★
Road maintenance adequacy	★★☆☆☆
Final weighted average	

The more stars 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.* ★★☆☆☆ *= Poor.* ★★★☆☆ *= Medium.* ★★★★☆ *= Good.* ★★★★★ *= Very good.*

Conclusions

The survey of the 36 km Iringa-Kilolo road provided an example of ways in which various rural transport services have responded to rural transport demand despite the lack of any planning framework. Transport services along this road respond to the relatively good condition of the road and the interconnectivity of the two major hubs (Iringa and Kilolo). The main transport services operating entirely on the relatively good section are minibuses and a midibus. These do not travel beyond the Kilolo hub, where the condition of the road is not good for rural transport services.

Large buses (65 seats), trucks and motorcycles do operate on the poorer roads beyond Kilolo, but with considerable disruption during the rainy season. The buses, over 20-years old, are heavily loaded with 90 passengers and full roof-racks or luggage holds, and so they can only manage a single journey each day. The trucks operating are mainly used for freight. Bicycles are also widely used for individual mobility and livelihoods but do not normally provide transport services for others.

Several concerns were raised by various stakeholders. Key concerns for the users included the high passenger fares especially for motorcycles and the poor availability and high cost of medium freight services (200 kg). The poor safety of the transport services (particularly motorcycles) and the poor environment of the transport services (noise level/dust/heat) were also issues of concern. Operators were concerned with access to capital/credit facilities to

own and/or operate transport services. Regulators noted very low levels of compliance with safety regulations, operational regulations and environmental legislation. However compliance with insurance was high for all vehicles except motorcycles. People concerned with development were generally positive about the value of rural transport services to facilitate agriculture, enterprises and social welfare. This was related to the relatively good state of the road, and it was felt important that the road continues to be well-maintained in order to continue to have very positive development impacts.