



ReCAP
Research for Community Access Partnership



Consolidation, Revision and Pilot Application of the Rural Access Index (RAI)

Workshop Report
October 2019



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Abstract

A key part of the RAI project is to present the findings of the TG2 phase of the project, and propose recommendations for TG3, at a stakeholder workshop. The RAI team agreed with ReCAP that the workshop should be split into two separate events in order to maximise the dissemination and feedback on the RAI guidelines and recommendations for the forthcoming phase of the RAI project.

This report contains two separate reviews of the two workshops. The first workshop was held in Malawi in August 2019 and included representatives from all stakeholder groups in Malawi, as well as representatives from Ghana. The coordination and measurement processes for RAI were explored, as well as the data availability and quality, and useful lessons were learned.

The second workshop was held at the PIARC World Road Congress in Abu Dhabi in October 2019 and included representatives from most ReCAP countries, as well as from key agencies such as the World Bank, UK's Department for International Development, the Asian Development Bank and the African Development Bank. Lively debate was held in both sessions of the workshop and valuable feedback was received. This will be used to inform the next phase of the project.

Overall the importance of RAI as a rural accessibility indicator was recognised and feedback on the work done by the team was positive. There was also good reaction to the recommendations made for the next phase of the RAI project. The final project report will include these recommendations in more detail.

Key words

Rural, Roads, Access, Poverty, Index, SDG, Methodology, Geospatial

Research for Community Access Partnership (ReCAP)

Safe and sustainable transport for rural communities

ReCAP is a research programme, funded by UK Aid, with the aim of promoting safe and sustainable transport for rural communities in Africa and Asia. ReCAP comprises the Africa Community Access Partnership (AfCAP) and the Asia Community Access Partnership (AsCAP). These partnerships support knowledge sharing between participating countries in order to enhance the uptake of low cost, proven solutions for rural access that maximise the use of local resources. The ReCAP programme is managed by Cardno Emerging Markets (UK) Ltd.

www.research4cap.org

Acronyms, Units and Currencies

ADB	Asian Development Bank
AfCAP	Africa Community Access Partnership
AfDB	African Development Bank
AsCAP	Asia Community Access Partnership
DESA	Department of Economic and Social Affairs
DFID	Department for International Development
DoLI	Department of Local Infrastructure
DoS	Department of Surveys
DTM	Digital Terrain Model
GBP	British Pounds
GIS	Geographical Information System
GPS	Global Positioning System
GRIP	Global Roads Inventory Project
HDI	Human Development Index
HDM-4	Highways Development and Maintenance (management system)
IAEG-SDGs	Inter-agency and Expert Group on SDG Indicators
IMT	Intermediate Means of Transport
IRF	International Road Federation
IRI	International Roughness Index
JOSM	Open Street Map for Java
ISDB	Islamic Development Bank
LSMS	Living Standards Measurement Study
MASAF	Malawi Social Action Fund
MASDAP	Malawi Spatial Data Platform
MDA	Ministries, Departments and Agencies
ML	Machine Learning
MOLGRD	Ministry of Local Government and Rural Development
MOTPI	Ministry of Transport and Public Works
MRA	Malawi Roads Authority
MRFA	Malawi Roads Fund Administration
NSO	National Statistical Office
NSS	National Statistical System
ONS	Office for National Statistics
OSM	Open Street Map
PIARC	World Road Federation
PMU	Programme Management Unit
RAI	Rural Access Index
ReCAP	Research for Community Access Partnership
SDG	Sustainable Development Goal
SuM4All	Sustainable Mobility for All
TG1	Task Group 1
TG2	Task Group 2
TG3	Task Group 3
TRL	Transport Research Laboratory
UK	United Kingdom (of Great Britain and Northern Ireland)
UKAid	United Kingdom Aid (Department for International Development, UK)
UN	United Nations
UNDP	United Nations Development Programme
UNGP	UN Global Platform
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
US	United States
WRC	World Roads Congress

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1 Executive Summary

The Rural Access Index (RAI) team agreed with ReCAP that the requirement for a stakeholder workshop under the Task Group 2 (TG2) phase of the project would be most effectively implemented as two separate workshops. The team proposed that firstly a practitioner workshop should be held in Malawi, with counterparts from Ghana also taking part to share experiences and learn about the RAI process being developed. Secondly the main stakeholder workshop should be held at the PIARC World Roads Congress in order to maximise the concentration of stakeholders in one place. This was agreed with PIARC several months in advance of the conference. The overall provisional sum for the stakeholder workshop in TG2 was not exceeded.

The key focus of the Malawi workshop was to assemble all the necessary government stakeholders for RAI in one place, so that coordination and the process of RAI measurement could be disseminated and discussed. The workshop was held over the course of two days, with the first day being a formal workshop event and the second day being a field trip to verify the status of various classifications of roads and how they are represented in the Roads Authority database. Three of the RAI team travelled to Malawi to facilitate the workshop and presented on a range of issues around the collection of RAI data and its use to measure RAI.

The main aim of the PIARC workshop was to present the findings of the TG2 work to stakeholders, and to present the initial recommendations for Task Group 3 (TG3), which is due to start in 2020 and is scheduled to last for 6 months. The workshop was well attended by many interested agencies, including the World Bank, DFID, ADB, AfDB, ISDB, IRF and country practitioners. The format of the workshop was to have an expert panel from the agencies shown above, and ask them to comment on the presentations, as well as summarising the overall discussions during the plenary sessions.

There were two sessions to the workshop over the course of 3½ hours. The first session dealt with the history of the RAI and its relationship to Sustainable Development Goal (SDG) 9.1.1, the issues encountered in data collection and processing for RAI, and the coordination and processes that need to be implemented to measure it. Counterparts from Malawi and Nepal also presented their experiences and challenges with measuring RAI. A lively debate was initiated and some useful feedback was received.

The second session explained the recommendations and options for TG3. The core recommendations focused on dissemination, uptake and embedment of RAI by producing documents and online resources to assist countries in regular RAI measurement. The team noted that funding needs to be sought for TG3 to support data collection and processing in country, so some additional recommendations were proposed that would be possible if additional funding is found. Some future possibilities for measuring RAI were also presented, including the use of satellite imagery and mobile phone data.

In summary the participation in the workshop was very good, and there was a high level of recognition of the importance of RAI as a rural accessibility indicator for SDG 9.1.1. Some useful feedback was received which will be fed into the planning of TG3 and used to inform future measurement of the RAI.

2 Introduction

The RAI project included provision for a stakeholder workshop to disseminate the results of Task Group 2 (TG2) and present the recommendations for Task Group 3 (TG3). It was agreed with ReCAP PMU that this input would be split. An initial workshop was held in Malawi in August 2019 to explore the processes necessary to measure RAI and to include all local stakeholders, and the final stakeholder workshop was held as part of the PIARC World Roads Congress (WRC) conference held

in Abu Dhabi in October 2019. The overall cost of these two events did not exceed the provisional sum allowed in the contract.

3 Malawi Workshop

Since the Inception period a number of activities have been undertaken and good progress has been made towards the project goal. These activities have been summarised in the following sections.

3.1 Presenters and Attendees

The workshop was attended by representatives from Malawi and Ghana.

Presenters from TRL:

Robin Workman (RW)
Kevin McPherson (KM)
Justin Saunders (consultant) (JS)

Representatives from Malawi Government:

Malawi Roads Authority (MRA)
National Statistical Office of Malawi (NSO)
Ministry of Local Government and Rural Development (MOLGRD)
Ministry of Transport and Public Works (MOTPI)
Malawi Roads Fund Administration (MRFA)
Malawi Department of Surveys (DoS)

Representatives from Government of Ghana:

Ministry of Feeder Roads

A full list of participants can be seen in Annex A.

3.2 Proceedings

The following are notes on the workshop proceedings:

1. TRL conducted welcome and introductions, gave a brief overview of the Rural Access Index (RAI), and distributed sets of draft Supplemental Guidelines for collection and publication of RAI. These Supplemental Guidelines are to be finalised under this project.

Road Network Data

2. TRL explained that the value of the RAI calculation is highly dependent on the methodology, and on which roads are determined to be “all-season”.
3. In 2006, a RAI value of 38% was calculated for Malawi based on household survey data. In 2016, however, RAI was recalculated at 23% based on new web technologies (using data obtained by GPS survey of the road network and online data sources such as WorldPop).
4. The official MRA (Malawi Roads Authority) statistics indicate 15,541 km of road network, of which approximately 4,400 km are paved. Based on TRL analysis to date:

- a. If only classified paved roads are taken into consideration, then the value of RAI will be calculated at around 23% (as per the 2016 calculation).
 - b. If classified paved and unpaved roads are taken into consideration and are determined to be “all-season”, then the value of RAI will be calculated at around 60%.
 - c. The 2006 Road Network Reclassification Study recommended that an additional 9,500 km of (mainly unpaved) roads be classified. If these additional roads are determined to be “all-season”, then the value of RAI could well be around 80%.
5. A field trip took place on 22nd August 2019 with representatives from the workshop to gain a better understanding of the road network. Summaries of the workshop and field trip recommendations are given below.

SDGs in Malawi

6. RAI is indicator 9.1.1 of the SDGs. It was promoted from Tier 3 to Tier 2 status at the end of 2018.
7. Deputy Commissioner of NSO discussed the status of the SDGs in Malawi at present. A baseline report was prepared in 2015 by the NSO, which documented the indicators that Malawi intended to collect, and set baseline figures for those indicators. RAI was not one of the indicators included in that list; NSO had concentrated on indicators for which there was an approved methodology at that time, and which were in Tier 1.
8. The Malawi Government through the Department of Economic Planning and Development compiles and submits the biannual Malawi SDGs Report to the UN, with the next submission due in September 2019. NSO works closely with them, but does not have the responsibility of releasing the Report. RAI is not included in that report, and there is insufficient time to include it in the September 2019 report at this point.
9. There is an SDG Steering Committee chaired by NSO, of which Ministry of Transport (which oversees MRA) is a member. MRA should continue to liaise with NSO and others to ensure that NSO is included in future.
10. NSO stressed that all data for inclusion in the SDGs (and other national statistics) be based on “official data”, i.e. that has been verified and approved by the appropriate government agency. The Ghanaian Feeder Roads participants were not very familiar with the general status of SDG reporting in Ghana.

Open Street Map

11. TRL discussed Open Street Map (OSM), emphasising that it was an important mechanism to share road network data among government agencies, NGOs, and development agencies.
12. TRL highlighted that the road network data in OSM at present did not match exactly the official set of data from MRA, however some preliminary work had been undertaken to identify the changes needed to OSM, and to prepare for upload of corrected data so that OSM would match that of MRA.
13. For the purposes of RAI, TRL is recommending verification of the location (geometry) of the roads in OSM (and update as necessary), plus update of road classification and surface type

- attributes to match MRA data, to enable OSM to be cited as the official source of road network data.
14. NSO indicated that if MRA updates OSM, and takes responsibility for keeping it up-to-date in future, then OSM could be used as the official source of road network data, and can be used for RAI calculation.
 15. TRL consultant presented an Open Street Map tool for Java (JOSM) that can be used to update OSM. He has previously worked with staff from Department of Surveys to review data in OSM and determine the best way of updating it. Department for Surveys has also published other geographical data to the Malawi Spatial Data Platform (MASDAP) on the web. Department of Surveys can provide assistance and advice to MRA, as necessary, on publication of data and update to OSM.
 16. It was also noted that NSO had digitised roads from satellite imagery around 2016 for purposes of census planning. That digitised data and/or imagery should be reviewed against OSM to identify any gaps in OSM.
 17. Ghana participants noted that the road network data was regarded as sensitive data in Ghana, so it would be difficult to reconcile with OSM officially. Recommendations for review and update of OSM are given at end of this note.

Population Data

18. NSO in 2018 completed its latest national population census and has published its main report on its website.
19. The main report is presented in spreadsheet tables. NSO does not typically publish census data in geographical format, and the highest granularity of population data found on the website is published at district level. The national census was georeferenced, however, and is available from NSO at the level of enumeration area, upon request.
20. TRL discussed the potential benefits of WorldPop as a source of data for RAI and for other indicators. WorldPop is a service which provides population at 100m squares for all countries in the world, derived from official national census data and compared with satellite imagery, aerial photography and ground truthing. Its spatial granularity makes it ideal for calculation of RAI.
21. Data downloaded from the WorldPop website is typically based on the last national population census available. Typically, that data is reconciled at the national level. However, WorldPop has the capability to reconcile their data to the highest level of granularity published by the NSO.
22. NSO indicated that they would be happy to liaise with WorldPop to reconcile latest 2018 census at the level of the enumeration area; and that if such reconciliation was found to accurately reflect population at the enumeration area, that NSO would endorse WorldPop as a source of data for purposes of RAI.
23. TRL have introduced WorldPop to NSO in order to facilitate endorsement of WorldPop as a source of population data for Malawi.

Urban / Rural Boundaries

24. NSO agreed that the boundaries previously provided by Department of Surveys (including 4 cities, and 26 towns) represent the official definition of “urban areas”, and that all areas outside those should be considered rural.
25. NSO agreed that these boundaries should be published as geographical boundaries. Ghana noted that it has not yet been possible to obtain boundary data from the Ghana Statistical Service, but urban areas are considered as having 5,000 people or more.
26. NSO indicated that there is an official process for changing these boundaries; they do not change frequently. Any changes in future should be published in geographical format by Department of Surveys.
27. These boundaries are now available for download on the MASDAP geospatial portal on the web. (<http://www.masdap.mw>).

Accessibility Factors

28. The Supplemental Guidelines introduce the concept of Accessibility Factors for use in countries where condition data is not regularly collected. MRA does not collect or hold condition data on its unpaved network.
29. Accessibility Factors are intended not to require onerous data collection and are not expected to change frequently.
30. Accessibility Factors based on Surface Type, Terrain and Climate were considered for Malawi. Koppen climate maps and DTM (digital terrain models) were reviewed in the workshop as potential sources of climate and terrain data.
31. It was determined that the southern districts of Malawi were candidates for defining Accessibility Factors. Unpaved roads in those districts have been susceptible to flooding in the past, and some roads on those districts were considered by those in the workshop to be not “all-season” using the expanded definition that *“A road that is impassable for more than 7 days per year (measured cumulatively, i.e. it is not necessary for the 7 days to be consecutive) is not regarded as all-season”*.
32. It was agreed that MRA would consult with District Engineers in the 4 Districts identified to prepare Accessibility Factors for use in RAI calculation. These factors would be defined by District because the District Engineers in those areas would be the ones most familiar with their roads. Ghanaian participants agreed that this would also be possible in Ghana.

Secondary Indicators

33. TRL presented proposals on Secondary Indicators, for motorcycles and waterways.
34. For motorcycles, TRL is recommending inclusion of other sub-categories of roads in OSM that are currently categorised as “tracks” or “paths”. Ground-truthing would be needed to assess those, and some assessment of quality and coverage of such data in OSM would also be required (it was noted, for example, that paths and tracks in OSM in Malawi had been identified in some areas but not others). It was discussed that the principle is sound, but would likely require significant data collection across the country to provide comprehensive

coverage. Such data might be available for digitisation from satellite data. Based on the data currently in OSM, and based on observations in the field trip (below), then this secondary indicator with inclusion of tracks and paths would be near 100%.

35. For waterways, TRL is recommending inclusion of jetties or docks in OSM, and to include rural population living within 2 km of a jetty or dock as a secondary indicator for RAI. This is not considered to be a major factor in Malawi or Ghana, but could be significant in other countries.

UN Global Platform

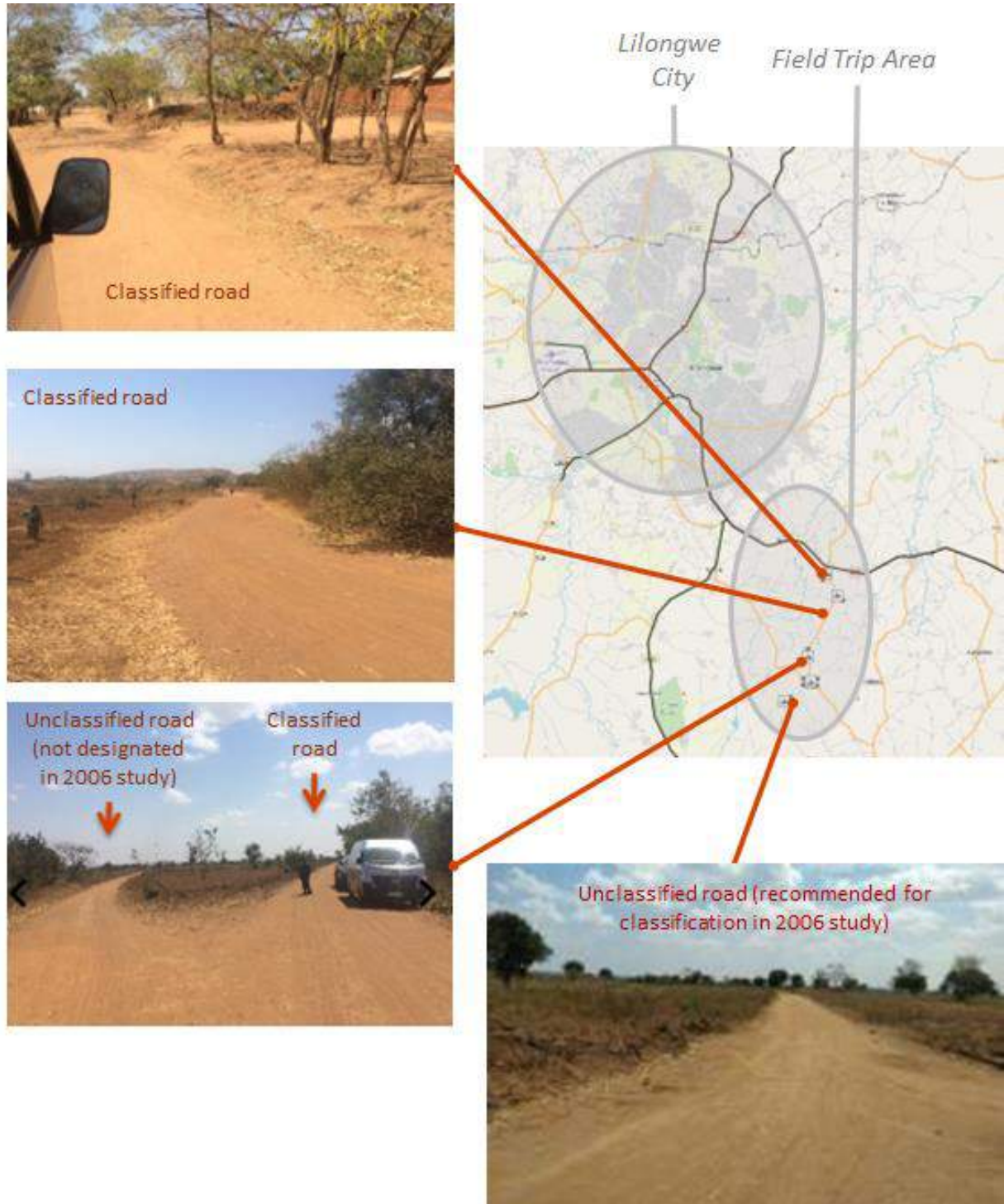
36. TRL discussed the UN Global Platform (UNGP), as a potential set of tools, data and services with which to calculate indicators and statistics. The UNGP will eventually include imagery, mobile phone network data, and social media data, along with a set of tools with which to use it.
37. TRL is also working with Azavea to produce a web app which will have the functionality to calculate RAI for all countries.
38. TRL emphasised that the exercises gone through in this workshop, including identification of the road network, identification of urban/rural boundaries, identification of accessibility factors etc. are still fundamental to calculating a true value of RAI, and that the long-term intention was that NSOs would work to provide official endorsement of the tools and methods in the UNGP.

3.3 Field Visit

A field visit to rural areas around Lilongwe was made on 22nd August to verify the status of the rural roads:

1. Selected participants from the workshop visited some unpaved roads south of Lilongwe (Mwalaulomwe, around 8 km south of the Lilongwe Ring Road on the M1).
2. The main objective of the field trip was to view a variety of unpaved roads that were a) currently classified, b) currently unclassified but recommended for classification in the 2006 Reclassification Study; and c) unclassified and not identified in the 2006 Reclassification Study.
3. It became apparent (see photographs below) that there was little to distinguish physically from these three different types of unpaved road, and that if the current classified unpaved network was regarded as “all-season”, then those roads recommended for inclusion in the 2006 Reclassification Study, and other unpaved roads, might also be regarded as “all-season”.
4. The Regional Engineer from MRA indicated that all roads driven on this trip would be regarded as “all-season” (i.e. would not likely become impassable during the rainy season, and would be motorable by non 4-wheel drive vehicles).
5. He also highlighted that some of the roads being driven on were probably maintained by NGOs (possibly Malawi Social Action Fund (MASAF) or Food for Works). Typically, such NGOs provide money to local people in return for those people maintaining the rural roads. A rate of around £1.20 per day for maintenance of 2 metres of road was indicated. Some NGOs may also provide equipment or machinery for this purpose.

- 6. MRA may also provide localised maintenance of some roads at the request of local communities.
- 7. It is believed that some NGOs have lists of roads under their programmes, although it is not known whether any have mapping data for those roads.



3.4 Summary actions and recommendations

Road Network

- A. The question of the extent of road network to include in the calculation of RAI is fundamental. TRL recommends that most of the unpaved network can be considered “all-season” (subject to accessibility factors), especially given that it is maintained either by MRA (the “classified network”), or by NGOs (the “unclassified network”).
- B. However, the true extent of the unclassified network is uncertain. The additional 9,478 km identified under the 2006 Road Network Reclassification Study is out-of-date (e.g. it includes the Lilongwe Ring Road opened in 2015, it seems to overlap in parts with the existing classified network, and was based on incomplete GPS surveys circa 2005). It is also clear that there are many other unpaved roads in Malawi that are of similar standard to those identified in the 2006 study but which were not recommended for inclusion in the classified network at that time. We therefore recommend that the Malawi Government conduct a new Road Reclassification Study. TRL will prepare a brief Concept Note on this subject for MRA, since it is likely that some consultancy effort would be required in this area. However, MRA / Roads Fund Administration should start making some immediate preparations as follows:
 - a. The Roads Fund Administration should liaise with all NGOs involved with road construction and/or maintenance, and collate lists and mapping of roads under the various NGO programmes.
 - b. Based on the above, the Roads Fund Administration, in conjunction with MRA and Department of Surveys, should prepare a definitive road map of all roads in the country, using Open Street Map as a repository.
 - c. Official statistics on the classified network of 15,451 km have not been updated for several years. The Lilongwe Ring Road, for example, which was opened in 2015, does not appear in MRA statistics or mapping. MRA should conduct a review of all roads recently constructed and look to include these in the official statistics. Until such times as the official statistics are updated, MRA should identify those in OSM as “not gazetted”.
 - d. MRA / Road Fund Administration should liaise with all relevant NGOs and produce guidelines and requirements for future collection and handover of mapping and inventory data for all roads under their programmes.
 - e. Satellite imagery may be useful in determining the nature and status of rural roads, as researched under the ReCAP GEN2070A project (Workman, 2018). The image below shows the same two roads in ‘Field Trip, bullet 7’ above (on the right hand side of the Figure). One is classified and the other unclassified, but under the methodology developed in GEN2070A both would likely be assigned the same condition value based on the satellite imagery features:



Source: Google Earth, imagery date 14/9/2017

WorldPop

- C. TRL to provide WorldPop contact details to NSO and make an introduction; NSO to work with WorldPop to update WorldPop data based on the 2018 census reconciled to the level of the enumeration area, with a view to NSO endorsing WorldPop as a source of 2018 population data for Malawi RAI and other indicators and planning purposes.

RAI for Malawi

- D. Given the uncertainties discussed above, and the fact that many of the actions would likely take several months to complete, TRL recommends that, for current purposes in the initial version of the Azavea tool, that RAI is based on:
- The current classified network of 15,541 km (shapefiles to be provided by MRA)
 - WorldPop data as currently on WorldPop website (based on 2008 census projected to 2018, and reconciled at national level)
 - Urban boundaries as provided by Department of Surveys on the MASDAP website
 - In the absence of condition data for unpaved roads, accessibility factors to be devised by MRWA in consultation with their District offices
- E. This will likely generate a RAI for Malawi in the order of 60-65%. However, the true value of RAI in Malawi (including all all-season roads) is likely to be in the order of 80%. Comparing the OSM unclassified network in Malawi against satellite imagery, there are other features that appear to be roads in satellite imagery that have not yet been identified in OSM (shown as yellow lines in the sample below) and which would require ground-truthing.



- F. A concerted effort between the participants mentioned, and with relevant NGOs, is required to deliver the actions identified. Some consultancy inputs are likely to be required to provide direction, coordination and some technical assistance.
- G. The above efforts on road classification are fundamental not only for RAI, but for development planning in Malawi in general, and to provide a sound statistical basis for calculation of other service-based indicators.

- H. Calculation of secondary rural access indicators to include motorcycles in Malawi would require significant ground-truthing against OSM “paths” and “tracks”, and update of “paths” and “tracks” in parts of the country where coverage appears incomplete. Given that the true value of RAI based on “all-season” roads is likely to be ~80%, then the value of any secondary indicator to include “paths” and “tracks” would likely be 90% or higher (see sample imagery above – even if these features are not motorable roads, then almost certainly they would be passable by motorcycle). We would recommend that any efforts should concentrate on the unpaved motorable road network as described above.
- I. Calculation of secondary rural access indicators to include waterways is not relevant to Malawi at this time.

3.5 Photographs

Photographs from the workshop and field trip can be seen in Annex J.

3.6 Workshop evaluation

The participants were asked to complete feedback forms at the workshop. The results of these forms are shown below.

The form consisted of 12 questions, with a combination of written responses and graded rating in a table, from Very Good to Very Poor.

3.6.1 RAI Workshop assessment form

- 1 Please list 3 things that you have learned from this workshop:

1 -----

2 -----

3 -----

		Ratings				
		Very Good	Good	Fair	Poor	Very Poor
No.	Questions	☺	☺	☹	☹	☹
2	How useful was the workshop?					
3	To what extent did the workshop meet your expectations?					
4	Were you able to contribute to the workshop?					
5	How do you rate the workshop schedule?					
6	How were the logistics and management of the workshop?					
7	How do you rate the workshop presentations?					
8	How do you rate the workshop discussion and feedback?					
9	How do you rate the workshop overall?					

10: What were the two best aspects of the workshop?

11: How could the workshop have been improved?

12: Do you have any other comments or suggestions?

Thank you!

3.6.2 Analysis of Workshop assessment responses

The following responses were received for Question 1:

Question 1; 'Please list 3 things that you have learned from this workshop':

- RAI is an effective indicator for SDGs
- Workshop achieved interdepartmental participation
- Ways for identifying / classifying roads and condition
- Methodology to determine and calculate RAI in GIS
- WorldPop
- Open Street Map
- Accessibility factors and how to calculate them
- Challenges in determining RAI
- Definition of all-season roads
- Metadata validation
- Role of NSO in determining RAI

Questions 2 to 9; responses:

No.	Questions	Ratings:	Number of responses					Total responses	Weighted average (out of 10)
			Very Good	Good	Fair	Poor	Very Poor		
2	How useful was the workshop?		10	1	-	-	-	11	9.8
3	To what extent did the workshop meet your expectations?		3	6	1	-	-	10	8.3
4	Were you able to contribute to the workshop?		3	6	2	-	-	11	8.0
5	How do you rate the workshop schedule?		6	4	1	-	-	11	8.8
6	How were the logistics and management of the workshop?		2	5	2	1	-	10	7.3
7	How do you rate the workshop presentations?		8	3	-	-	-	11	9.5
8	How do you rate the workshop discussion and feedback?		5	5	1	-	-	11	8.6
9	How do you rate the workshop overall?		6	5	-	-	-	11	9.1

Question 10; 'What were the two best aspects of the workshop?' responses:

- Participatory, chance to discuss the issues
- Facts were well articulated
- Good time for discussions with presenters
- Presentations were brief and clear
- Discussions on urban boundaries
- OSM and WorldPop
- Practical feel of the GIS process
- Practical demonstrations of RAI and calculation

Question 11; 'How could the workshop have improved?' responses:

- Could have been longer (4 responses)
- Could have used a full day to practice the RAI calculation process in GIS
- Hands on training in use of GIS, WorldPop and OSM
- More working examples
- Invite other stakeholder countries
- Presentation by females

Question 12; 'Do you have any other comments or suggestions?' responses:

- So far so good, nice workshop
- Good and eye-opening workshop
- Good, should be organised often and include other countries to share their experiences in calculating or implementing RAI
- Provide/send presentations before workshop so that participants can prepare in advance
- Provide more time, say 1 day

From the responses above it can be concluded that the participants appreciated the workshop and were able to learn a lot about the process for measuring RAI. There were no real negatives about the workshop, with only one rating below 'Fair' on the scale. It is the facilitator's opinion that all those present participated fully and benefited greatly from their active involvement.

4 PIARC Workshop

The workshop at PIARC was held on Tuesday 8th October 2019 in the afternoon. The full programme can be seen in Annex B. It was estimated that up to 60 people attended the workshop.

4.1 Presenters and panel members

The following presenters and panel members were present at the workshop:

Chairperson: Magda Leisten Johansson (MLJ) DFID

Moderator: Annabel Bradbury (AB) RECAP PMU

Speakers: Robin Workman (RW) TRL
Kevin McPherson (KM) TRL
Annabel Bradbury (AB) RECAP PMU
Chisomo “Dan” Kauma (CK) Malawi Roads Authority (MRA), Malawi
Mahesh Chandra Neupane (MCN) Department of Local Infrastructure (DoLI), Nepal

Panellists: Guangzhe Chen (GC) World Bank
Ashok Kumar (AK) World Bank
James Leather (JL) Asian Development Bank
Joseph Haule (JH) ReCAP PMU
Nazir Ali (NA) ReCAP Steering Committee

Other notable contributions:

Paul Starkey (PS) University of Reading / TRL Team

4.2 Session 1: 14:00 – 15:30:

Session 1 was conducted as follows:

Magda Leisten Johansson:

The session was opened by MLJ as chairperson. She represented DFID and set the scene for the workshop.

Guangzhe Chen:

Introductory remarks were made by GC from World Bank, who are the custodian of the RAI/SDG 9.1.1.: GC noted the importance of access to rural communities and the work that WB have done in recent years to support this.

Annabel Bradbury:

Presentation 1: An introduction to ReCAP and the RAI – AB

AB presented ReCAP and the RAI context and moderated both sessions. A copy of this presentation can be seen in Annex C.

Presentation 2: Introduction to the RAI/SDG 9.1.1. – RW

RW commenced the presentations by introducing the RAI and how it relates to SDG 9.1.1. He covered the aims and objectives of the project and reflected on the previous attempts to measure RAI in 2006 (Roberts, 2006), 2016 (Iimi, 2015) and 2018, which led to the development of the current project, which was scoped in 2018 (Vincent, 2018). RW highlighted the key aspects of the data required to measure RAI and also summarised the potential to include a secondary indicator that would include motorcycle access and navigable waterways.

The presentation can be seen in Annex D.

Presentation 3: Measurement process, data collection and analysis – KM

KM presented the sources of data required to measure RAI geospatially, and some of the issues that were encountered in this process.

- Population: KM provided an overview of WorldPop and why it is an appropriate source of data for RAI.
- Urban/Rural boundaries are also essential to measure RAI, these are defined by the country itself as there is no standard definition of urban and rural worldwide. However, there are sources that can be used in the absence of other information, such as the GRUMP database.
- In terms of mapping, the country mapping should be the default. However other resources such as Open Street Map are improving continually and the team have recommended that countries work with OSM to provide consolidated and accurate maps of the road network.
- Road condition has been used in the past to define 'all-season' status, but this is seldom collected for rural unpaved roads, which have the highest impact on RAI. An alternative has been developed using Accessibility Factors which forego the need to collect condition data and therefore avoid imposing a high data collection burden on countries.

This presentation can be seen in Annex E.

Presentation 4: Country experience from Malawi - CK

CK presented his experience of measuring RAI in Malawi:

- Background information of Malawi, incl. high percentage of rural population (84%)
- Provided information on population, road mapping and condition.
- Most roads are all-season, with exceptions in the south which is subject to higher levels of rainfall.
- An example of accessibility factors was provided.
- The specific challenges of RAI measurement for Malawi were presented.

This presentation is provided in Annex F.

Presentation 5: Country experience from Nepal - MCN

MCN presented his experience of measuring RAI in Nepal:

- Background information of Nepal, incl. high percentage of rural population (81%)
- Provided information on population, road mapping and condition.
- Few roads are all-season, with monsoon rains, few river crossings and frequent landslides in mountainous areas.
- Accessibility was reviewed, and MCN commented that walking time would be more appropriate for Nepal to measure the RAI than distance, because of the mountainous terrain.
- Lack of capacity was seen as a key challenge to Nepal in RAI measurement.

This presentation is provided in Annex G.

Discussions:

Panel Comments:

JL: Rural access is part of a multi-criteria analysis, and it is important to understand what the priorities are. Inequalities are developing for rural communities, there is a danger that rural population will be left behind. Urban/rural divide is growing, and so RAI is becoming more important. Boundary changes could be important as urban migration expands cities.

NA: There is a danger we take roads for granted. We expect them to be provided, but the agricultural sector can be neglected, for example farm roads. We need to focus on the problem. Appropriate design is important, for example causeways instead of culverts, to reach the last mile for accessibility. Accessibility to services is also important.

GC: It is necessary to fill the gap by raising awareness of rural accessibility. The index needs to be simple, and rural access needs to be defined by the mode of access, i.e. motorcycles. Based on session 1 there seems to be little consensus on how to move forwards, need to bridge the gap to include service type indicators. It needs to be a simple process to measure RAI universally. (Session 1 only presented the project progress and issues encountered; solutions were presented in Session 2).

Plenary comments:

- **Various:** RAI is a fundamental indicator and the only one for rural accessibility, therefore it should be pushed. It was mentioned in an earlier Keynote Speech of NA that RAI is among the most important global indicators for measuring rural transport accessibility. Also earlier keynote speech of GC highlighted it as an important indicator.
- **JL:** Rural access and rural development are reciprocal. RAI should be packaged / marketed as a rural development indicator to help gain support and update / embedment.
- **Adam Andreski:** What about situations like Liberia where half of the country is inaccessible for 6 months of the year, mainly due to the main roads being not all-season, even though some of the rural roads would be! RW – Accessibility factors would take this into account, backed up by ground truthing.

- **Ok Namkung:** What about other questions in the household surveys, were they related to the RAI in 2006 study? AB – The LSMS study was used to collect data, and although this data is available the methodology used to measure RAI was not fully recorded, so it is assumed that no other data was taken into account.
- **Deputy Minister, Myanmar:** Rural and Urban in Myanmar is defined and clear, but problem is road classification.
- **JH:** If there is need for in-country support for RAI, in-country Road Funds Administrations may be able to assist, and should be consulted.
- **PS:** Suggested calculating and publishing RAI in conjunction with “RAI + motorcycles” so that the parallel indicator can show progress in opening up rural areas for communities.

4.3 Session 2: 16:00 – 17:30:

Session 2 was conducted as follows:

Presentation 6: Introduction to the RAI/SDG 9.1.1. – KM

KM talked about proposals for RAI accuracy, reliability and sustainability:

- Accessibility factors have been developed as an easy and sustainable way to measure the all-season status of a road.
- Recording metadata for RAI is very important, so that the process can be checked and investigated if necessary.
- The role of the different government agencies was explored and the importance of embedding the RAI in the National Statistical System of a country.
- An insight was given to the development of an automatic calculation tool to be established on the UN Global Platform. The importance of country endorsement was also highlighted.
- For embedment it was recommended that the RAI be part of the planning, monitoring and evaluation process in a country, which requires coordination, documentation and quality assessment, leading to publication of both the RAI and its metadata.

This presentation is provided in Annex H.

Presentation 7: Introduction to the RAI/SDG 9.1.1. – RW

RW first presented the recommendations for uptake and embedment in Phase 3:

- Produce documentation to support the use of open source GIS data.
- Promote RAI at high profile events.
- Produce online resources to help with the measurement of RAI.
- It was noted that additional funds are required to support country measurement of RAI in phase 3, which included the full development of the calculation tool.

RW then presented options for future measurement of the RAI, which included:

- Using satellite imagery to identify roads and their all-season status.

- Using mobile phone data to track vehicle movements and thus define all-season roads.
- Using other technologies such as social media, data scraping, big data and data science.
- Machine learning was seen as something that could be applied to other technologies in order to assist with measurement and make the process faster and easier.

This presentation is provided in Annex I.

Discussion:

Panel Comments:

JH: There can be issues with NSO's in Africa, they are generally not involved in roads data. They are a statistics agency and roads are not usually 'official' data, i.e. not published in the government gazette. Awareness is necessary, need to engage with NSOs. Generally they are under-resourced. It could be possible for Road Funds to provide funding, for example in Tanzania this should be possible.

AK: In India, most statistics offices do not get involved with transport data or indicators. They concentrate on censuses and do not often include the Transport ministries. Their scope is restricted. Automation of the indicator would be very beneficial, even if it is only 70% accurate. Needs to be easy and quick to measure.

JL: Automation would be good; if data is wrong would be necessary to know how wrong it could be. Important to include with other indicators to get full picture. ADB's vision of a prosperous, inclusive, resilient, and sustainable Asia and the Pacific ([Strategy 2030](#)) is aligned with the SDGs and the 2030 Agenda for Development. Accessibility is an integral part of this. Need more policy/sector support, and data allows us to see what is happening.

Plenary comments:

AB: AB opened the second discussion session.

- **Various:** On the automation tool. Data will never be 100% complete or accurate, so it is suggested to calculate based on Open Source Data, then contact the individual countries and say "this is the default data for RAI 9.1.1, if there is better data available then let us know so that RAI can be recalculated"
- **Ernest Obeng, Ghana Research Centre:** Problem in Ghana is that NSOs have no funds for the transport sector, and would rely on roads authorities to provide the data. All agreed that in general NSOs have limited funds and human resources for SDG data collection.
- **Girma Bezabeh (AfDB):** NSO does not have a mandate for transport, SDG 9.1.1 should be with the Ministry of Transport who are well positioned to collect and compute this data. Travel time would be better than distance, for the reasons highlighted in the presentations.
- **Patrick Bekoe, Ghana Department of Feeder Roads:** Classified network should be used as roads authorities will have this data. Country ownership of RAI is essential.

Panel Conclusions:

- **JL:** Future technologies. It was noted that Malaysia already has a national dataset based on mobile phone network data for transport planning. May provide opportunities for looking at

rural access. Need to think how we sell RAI in order to get it measured, maybe need different approaches to different people/countries. Important to understand how we sell it.

- **AK:** AK reflected on his career since 1977. RAI has had some resistance but is a good opportunity. Rural access and development are reciprocal, but asked what to do after measuring RAI. What accuracy measures are in place. Automation would provide a quick answer. Options would be to link it to a full asset management system, and to create incentives to measure RAI. Institutionalisation and ownership are key. Need to look at the short and long terms, include it in government objectives. If it can be used to demonstrate support for improved health, education etc. then government will support.
- **JH:** Need to raise the profile of RAI at a high level within each country. Define who takes charge (NSO or roads authority) and link to SuM4All. There are four groups in SuM4All. Need to consider community movement (first mile), motorcycle tracks, etc. Would be valuable to have an automated way to detect all-season roads.

Sum up:

AB: AB summed up the workshop. She highlighted the interdependency between rural and urban areas and the constantly changing dynamic. Also the importance of the calculation tool on the UN Global Platform to the future sustainability of RAI.

She thanked all of the panel members for their support and encouraged participants to send further comments by email.

4.4 Photographs

Photographs from the workshop can be seen in Annex J.

4.5 Related events at WRC 2019

In addition to the workshop in Abu Dhabi a presentation on RAI was made at the UK Pavilion stand on Monday 7th October 2019, and an RAI poster session was held in the afternoon of Wednesday 9th October 2019. Photographs from these events can be seen in Annex J.

5 Conclusions

In conclusion it was a good decision to split the stakeholder workshop part of this project into two separate events. This has undoubtedly provided a broader range of feedback and learning for the project and has covered the areas of RAI data collection, analysis and measurement in more detail than would have been possible in one event. This has to some extent compensated for the lack of feedback on the RAI guideline, despite it being presented at an event in TRL and at an RAI working group event, and several rounds of circulation by email.

The Malawi workshop gave practitioners the opportunity to explore the RAI process in more detail, and the fact that all of the key stakeholders in Malawi were present was an important test of how RAI can be managed by the responsible authority in each country. Feedback on the workshop was very good and the participants appreciated the opportunity to learn more about the RAI and discuss

how it should be measured in Malawi and Ghana. This was an important learning process for the final guideline and for recommendations to be made in the final report. This workshop has provided learnings that have been built into the Supplemental Guidelines, such as how the different agencies should work together to measure RAI, and how mapping can be reconciled with WorldPop. The Ghanaian participants agreed that it was a useful experience for them to help them with coordination between key stakeholders and measurement of the RAI in Ghana.

The stakeholder workshop at PIARC was also very good for raising awareness and dissemination of the work carried out so far. A wide range of stakeholders was present and the feedback received will be useful to develop the tasks in TG3 and further refine the way forwards for RAI. It was very beneficial that a senior person from the custodian and co-partner were there and sat on the panel, which added substance to the proceedings. The workshop has also provided valuable support towards uptake and embedment of the project outcomes, with a view towards consolidating the RAI in years to come as an essential SDG indicator for rural accessibility.

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Annex A: Malawi workshop participants

No.	Name	Organisation	Designation
1	Robin Workman	TRL	Principal International Consultant
2	Kevin McPherson	TRL	Asset Management Consultant
3	Justin Saunders	Africa Bees	GIS Expert
4	Francis Dimu	Malawi Roads Authority	Director of Planning and Design (ReCAP coordinator)
5	Dr. Patrick Amoah Bekoe	Department of Feeder Roads, Ghana	Principal Engineer (ReCAP coordinator)
6	Chisomo Dan Kauma	Malawi Roads Authority	Senior Engineer, Roads Data Management
7	Hankey Pangani	Department of Surveys	GIS Technician
8	Silence Chirwa	Department of Surveys	GIS Officer
9	Joel Kossam	Ministry of Transport	Statistician
10	Newton Burami	Malawi Roads Authority	Maintenance Engineer
11	Sharmey Banda	Malawi Roads Authority	Senior Engineer, Materials
12	Harris Kumwenda	Ministry of Local Government	Civil Servant - Engineer
13	Richmond Ankrah	Department of Feeder Roads, Ghana	IT/GIS expert
14	Joseph Mawusi	Department of Feeder Roads, Ghana	Engineer
15	Charles Makoza	Ministry of Transport: Roads Department	Senior Civil Engineer
16	Simon Divala	Ministry of Transport	Senior Civil Engineer
17	Jameson Ndawala	National Statistical Office	Deputy Commissioner
18	Lameck Million	National Statistical Office	Senior Statistician
19	Sangwani Gondwe	Roads Fund Administration	Technical Auditor

Signed permission forms were obtained for all participants which confirmed that they were happy for their names, organisation and designation to be used in this report.

Annex B: PIARC Workshop Programme

Time	Topic/Presentation title	Speaker (title, role/position, organisation, location, if applicable include PIARC Technical committee)
14:00 – 14:05	Introduction to workshop	Magda Leisten Johannson , DFID (Workshop Chairperson)
14:05 – 14:10	Comments from World Bank	Guangzhe Chen , World Bank (RAI Custodian)
14:10 – 14:15	Introduction to the RAI project	Annabel Bradbury , ReCAP (Workshop moderator)
14:15 – 14:20	Introduction to the RAI	Robin Workman , TRL
14:20 – 14:40	RAI Measurement Process, Data Collection and Analysis	Kevin McPherson , TRL
14:40 – 14:45	Country experience of RAI measurement – Malawi	Chisomo Kauma , Roads Authority, Malawi
14:45 – 14:50	Country experience of RAI measurement – Nepal	Mahesh Chandra Neupane , Department of Local Infrastructure, Nepal
14:50 – 15:30	Questions and Panel Discussion	Representatives from World Bank, ADB, ReCAP
15:30 – 16:00	<i>Coffee break</i>	
16:00 – 16:10	Proposals for RAI accuracy, reliability and sustainability	Kevin McPherson
16:10 – 16:20	Potential for future technological options for RAI measurement	Robin Workman
16:20 – 17:00	Audience interaction, group work, plenary discussions	Workshop, managed by TRL
17:00 – 17.30	Panel discussion Request for countries interested to measure RAI in Phase 3	Representatives from World Bank, ADB, ReCAP


Annex C: Presentation 1






Research for Community Access Partnership (ReCAP)

Dr Annabel Bradbury
Deputy Team Leader - Transport Services

Introduction to ReCAP

- Applied research to improve the evidence base on Low Volume Rural Roads (LVRRs) and the transport services that use them
- Funded by the UK government through DFID
- 6 year programme (2014-2020)
- £24m research budget
- Managed by Cardno Emerging Markets (UK) Limited





AfCAP Partner Countries

- DRC
- Ethiopia
- Ghana
- Kenya
- Liberia
- Malawi
- Mozambique
- Sierra Leone
- South Sudan
- Tanzania
- Uganda
- Zambia



AsCAP Partner Countries

- Myanmar (Burma)
- Bangladesh
- Nepal
- Pakistan
- Afghanistan





ReCAP Research Themes

Research themes are:

- Provision of access
- Preservation of access
- Effective use of rural access (transport services)
- Cross-cutting issues:
 - Gender mainstreaming
 - Road safety
 - Capacity building and knowledge management



Regional Projects



- Asset management
- Back analysis
- Climate adaptation
- Leadership development
- Materials database
- Motorcycle safety
- Rural Access Index
- Interactions: Maintenance-Provision of Access for Rural Transport Services
- Satellite imagery
- First mile research
- Gender mainstreaming cluster



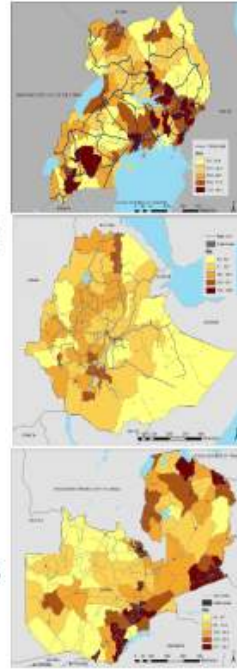
Rural Access Index (RAI)

'Percentage of rural people who live within 2 km of an all season road as a proportion of the total rural population' (SDG 9.1.1)

Task Group 1: Status Review

Task Group 2: Consolidation and Revision

Task Group 3: Application in ReCAP countries



Thank you for your attention

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Annex D: Presentation 2

CONNECTING CULTURES
ENABLING ECONOMIES
6th to 10th October 2019

RAI (SDG 9.1.1) INTRODUCTION

RAISING THE PROFILE OF THE RURAL ACCESS INDEX AS A VITAL SDG INDICATOR FOR MEASURING RURAL DEVELOPMENT AND CONNECTIVITY

ROBIN WORKMAN
PRINCIPAL INTERNATIONAL CONSULTANT

TRL THE FUTURE OF TRANSPORT

RAI

DEFINITION

'the proportion of the rural population living within two kilometres of an all-season road'.

TRANSPORT ROUTE

20 to 30 minutes walk = approx 2km

- All-season = "a road that is motorable all year round by the prevailing means of rural transport (often a pick-up or a truck which does not have four-wheel-drive), with some predictable interruptions of short duration during inclement weather (e.g. heavy rainfall) allowed."

Also incorporated as SDG 9.1.1 (Tier II)

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RAI

SUSTAINABLE DEVELOPMENT GOALS (17 GOALS, 232 INDICATORS)

Inter-Agency and Expert Group (IAEG), composed of Member States and including regional and international agencies as observers, Tiers:

- Tier I : Conceptually clear, methodology, Min. 50% of countries
- Tier II : Conceptually clear, methodology, data not regularly produced
- Tier III : No methodology, but being developed

RAI – SDG 9.1.1 – only rural access indicator



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RAI

AIMS AND OBJECTIVES

Aim is to develop, propose and obtain agreement on a harmonised approach to data collection and measurement of the Rural Access Index that is relevant, consistent and sustainable .

Objective is to scale up implementation of the RAI across UN member countries in order to advance the status of SDG Indicator 9.1.1 to Tier II and eventually Tier I in the tier classification of the SDGs.

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BACKGROUND

PREVIOUS WORK

- 2006 Household surveys, modelling, etc.
- 2016 Geospatial methods (8 countries)
- 2017/18 Extension (15 countries)
- Others: UK, USA, etc.

Country	RAI 2006	RAI 2016
Bangladesh	37	87
Nepal	17	54
Ethiopia	32	22
Kenya	44	56
Mozambique	27	20
Tanzania	38	25
Uganda	27	53
Zambia	64	17

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RAI

GIS LAYERS

RAI (SDG 9.1.1) – proportion of the rural population who live within 2 km of an all-season road

- Where do people live?
- Where do roads exist?
- All-season access?

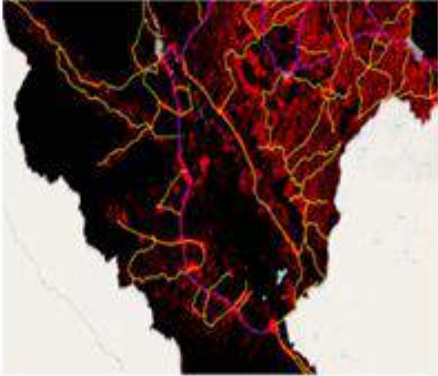
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RAI


POPULATION

The RAI is defined as **'the proportion of the rural population living within two kilometres of an all-season road'**.

- Identify the 'rural' population
- Identify where it lives
- Produce a GIS rural population layer



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RAI


NETWORK

The RAI is defined as **'the proportion of the rural population living within two kilometres of an all-season road'**.

- Identify where the roads are
- Identify best source of mapping
- Produce a GIS map layer



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RAI

ALL-SEASON STATUS

The RAI is defined as 'the proportion of the rural population living within two kilometres of an all-season road'.

- Identify road condition
- Interpret data to identify 'all-season' roads
- Possibility to use accessibility factors or mobile phone data
- Produce a GIS 'all-season' layer



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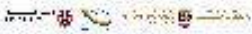


RAI TRIALS

- Engage with NSO and roads organisations
- Review data for completeness and quality
- Analyse data in GIS format to produce a measurement of RAI
- Support local partners to measure RAI

Country	RAI history			Data			Other		
	2006	2016	2018	Cov'ge	Mgmt.	Quality	Issues	Envir'mnt	Mapping
Ghana	✓			G	G/F	G/F	Y	Tropical	G/F
Malawi	✓		✓	G	G/F	G	Y	Savanna	G
Nepal	✓	✓		G/F	G/F	G/F	Y	Mountain	G/F
Myanmar				U	U	U	Y	Monsoon	U

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RAI

SECONDARY INDICATOR

Motorcycle access




Secondary RAI inclusion
The population of village & are included as they live within 2 km of an all-season road

The population of village & are also included as they live within 2 km of a motorcycle trail

Navigable Waterways




Secondary RAI inclusion
Houses within 2 km of an all-season road are included and ...

The people living in houses within 2 km of a jetty (or within 2 km of the navigable waterway if there are many jetties) are also included

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Annex E: Presentation 3

CONNECTING CULTURES
ENABLING ECONOMIES
6th to 10th October 2019

RAI (SDG 9.1.1) EMBEDMENT

RAISING THE PROFILE OF THE RURAL ACCESS INDEX AS A VITAL SDG INDICATOR FOR MEASURING RURAL DEVELOPMENT AND CONNECTIVITY

KEVIN McPHERSON
ASSET MANAGEMENT CONSULTANT
TRL

TRL THE FUTURE OF TRANSPORT

RURAL ACCESS INDEX

OVERVIEW OF PRESENTATION

- **Measurement Process, Data Collection and Analysis**
 - Data Sources
 - Accessibility Factors
 - Recording the Base Data
- **Accuracy, Reliability and Sustainability**
 - Role of the National Statistical Offices (NSOs)
 - "Auto-calculation" of RAI
 - UN Global Platform
 - Embedment

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1

Logos for the Ministry of Transport, PIARC, and the Ministry of Planning are visible at the bottom right.

RAI
DATA SOURCES: WORLDPop


ABOUT NEWS DATA CONTACT

POPULATION
URBS
MIGRANCES
URBAN CHANGE
AGE AND SEX STRUCTURES
DEVELOPMENT INDICATORS
DEPENDENCY RATES
INTERNAL MIGRATION
DYNAMIC MAPPING
GLOBAL LIGHT DATA
COMPARISONS
GLOBAL SETTLEMENT GROWTH
GRID-CELL SUPPORT AREAS
ADMINISTRATIVE AREAS

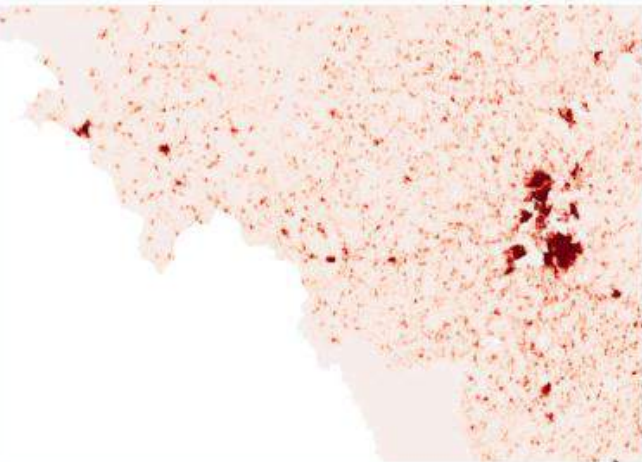
Mapping population distributions
Calculating every person's footprint

Mapping populations
Spatial demographics
Mapping development indicators
Maternal and newborn health
Population dynamics

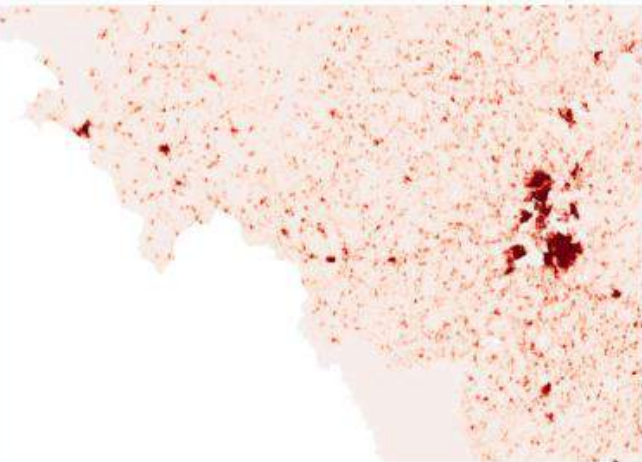
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RAI
DATA SOURCES: WORLDPop



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RAI

DATA SOURCES: WORLDPOP

- Reconciled to National Census – or to UN Population Estimates
- Georeferencing
- Data disaggregation

NSO Census: GPS-points corresponding to level of household

NSO provide aggregated data of population by enumeration area or other low-level boundary

WorldPop: update and publish population by 100 m square based on interpretation of imagery and other ancillary data, reconciled to boundaries provided by NSO

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4

RAI

DATA SOURCES: URBAN/RURAL BOUNDARIES

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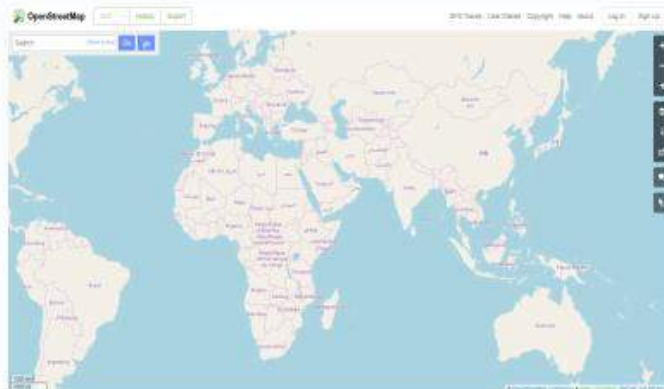
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RAI**DATA SOURCES: URBAN/RURAL BOUNDARIES**

- At present, there is no globally agreed definition of “urban” and “rural”
- UN Statistics Division advises that each country should decide according to its circumstances
- Some countries publish geographical boundaries of their urban extents, however frequently not well-defined and the update procedures are not clear
- UN Expert Group on Statistical Methodology for Delineating Cities and Rural Areas is considering a new approach to instill some consistency (e.g. MODIS 500 m Urban Extent based on the built environment and contiguous patches > 1 km square)

RAI**DATA SOURCES: OPEN STREET MAP**

Open Street Map – almost the *de facto* standard for mapping of road network, buildings, health centres, schools etc.



RAI

DATA SOURCES: OPEN STREET MAP

- Open Street Map – **it is open**
- For some countries, it is more comprehensive and accurate than in-country mapping
- More and more funding from MDBs is going to support OSM mapping initiatives
- It has benefits way beyond the RAI – it is often the go-to source of data for governments at national and local levels, NGOs, commercial operators, and private citizenry
- Many apps that rely on navigation or routing are based on OSM

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RAI

DATA SOURCES: OPEN STREET MAP

- However...
- In many countries, OSM doesn't quite match up with the official national data sets (often because it is more up-to-date!)
- Typically doesn't reflect the official network classification
- Typically doesn't contain surface type information or road condition
- Some analysis and filtering of OSM is necessary to understand the extent of network to use for purposes of RAI

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RAI

ACCESSIBILITY FACTORS

- Accessibility Factors provide an alternative means to road condition data to identify “all-season” roads, if road condition data is not available
- They can be based on variables that determine the all-season nature of a road, such as surface type, climate and terrain
- Represents the likelihood of a road being all-season, and so is closely aligned with the original 2006 study “*may be temporarily unavailable during inclement weather*”
- Can be defined in a workshop with local engineers and/or transport operators, without onerous data collection

RAI

ACCESSIBILITY FACTORS

- **Surface Type:** unpaved roads are more vulnerable than paved roads to being impassable
- **Climate:** Significant wet season, intense precipitation can cause significant flooding and risk of landslides that can cause road closures for long periods of time
- **Terrain:** Hilly or mountainous terrain, unstable or slippery materials, can give high risk of landslides; also could include low-lying areas near the sea if large areas such as a district or county are affected

RAI
ACCESSIBILITY FACTORS

Typical set of factors

		Terrain				Terrain	
		Low Risk (e.g. Flat, Rolling)	High Risk (e.g. Mountainous)			Low Risk (e.g. Flat, Rolling)	High Risk (e.g. Mountainous)
Climate	Low Risk (e.g. Dry Season)	1	1	Climate	Low Risk (e.g. Dry Season)	1	0.9
	High Risk (e.g. Wet Season)	1	0.9		High Risk (e.g. Wet Season)	0.9	0.8

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RAI
RECORDING THE BASE DATA

- Very important that the method of recording for any country is documented
- At least 25 countries have already calculated and published RAI, however the base data and assumptions used in the calculations are often not recorded
- The calculated value of RAI depends very much on the input data used – e.g. if paved roads only, then RAI will be low, but if unpaved roads are included then RAI will be higher
- Similarly, the urban/rural boundaries will make a significant difference to the result
- Consistency within a country over time is key

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Annex F: Presentation 4

CONNECTING CULTURES
ENABLING ECONOMIES
6th to 10th October 2019

RAI EXPERIENCE FROM MALAWI

RAISING THE PROFILE OF THE RURAL ACCESS INDEX AS A VITAL SDG INDICATOR FOR MEASURING RURAL DEVELOPMENT AND CONNECTIVITY

ENG. CHISOMO DAN KAUMA

SENIOR ENGINEER- ROAD DATA MANAGEMENT

ROADS AUTHORITY, MALAWI

TRL THE FUTURE OF TRANSPORT

INTRODUCTION

MALAWI

- Malawi is a landlocked country in southeast Africa
- Total population 17,563,749
- Capital city is Lilongwe with total population of 989,318
- 84 % of the population is classed as Rural

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POPULATION

POPULATION CENSUS

- Population and Housing Census undertaken by National Statistical Office (NSO)

Year	Population	Average Annual/ Intercensal Growth Rate
1998	9,933,868	2.0 %
2008	13,077,160	2.8 %
2018	17,563,749	2.9 %

NSO is mapping with WorldPop to reconcile 2018 census at the level of the enumeration area, with a view to endorsing WorldPop as a source of data for purposes of RAI and other indicators



MAPPING

MALAWI ROADS AUTHORITY MAPPING

- Total road network of 24,929 km
- Only 15,451Km are gazetted
- Currently finalizing GIS Mapping with comprehensive attribute data
- Planning to update Open Street Map (OSM) to include official gazetted data

Road Classification	Length (km)
M (Main Road)	3,357
S (Secondary Road)	3,125
T (Tertiary Road)	4,121
D (District Road)	3,500
U (Urban Road)	1,348
Undesignated Community Roads	9,478
Total (km)	24, 929

ROAD CONDITION

MALAWI ROAD CONDITION

- Around 4,000km of roads are paved, the rest is unpaved
- Paved condition surveys conducted annually by consultant, using visual methods & ROMDAS
- Visual road condition data collected on rural roads every 5 years
- All-season status is not measured
- The unpaved network is generally passable all-year round



ROAD CONDITION

MALAWI ROAD CONDITION

- However in some southern region districts, some roads are susceptible to flooding and can be considered "not all-season"
- This may be due to a combination of different factors including climate, terrain, local soils, unstable materials, road design, shape, lack of adequate drainage etc.



ROAD CONDITION

ACCESSIBILITY FACTORS

- Any roads identified by District Engineer on a simple map as "not passable for more than 7 days per year" were highlighted, and accessibility factors were estimated for the unpaved roads in that district based on local engineering input
- As seen in map opposite, only certain unpaved roads in that district are regarded as not all-season, in this case because they are susceptible to flooding



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ROAD CONDITION

CHALLENGES IN CALCULATING AND PUBLISHING RAI

- Agreeing which parts of the road network should be included in the RAI calculation (e.g. unpaved roads, undesignated roads)
- Agreeing simple method to identify which roads should be considered "all-season" without requiring onerous data collection
- Common agreement on "urban" versus "rural"
- Defining roles and responsibilities to calculate and publish RAI as part of the SDGs across multiple agencies

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Annex G: Presentation 5


**CONNECTING CULTURES
ENABLING ECONOMIES**
 26th Abu Dhabi World Road Congress 2019
 6th to 10th October 2019





RAI EXPERIENCE FROM NEPAL

**RAISING THE PROFILE OF THE RURAL ACCESS INDEX AS A VITAL SDG INDICATOR
FOR MEASURING RURAL DEVELOPMENT AND CONNECTIVITY**


MAHESH CHANDRA NEUPANE
 SDE, PLANNING SECTION
 DEPARTMENT OF LOCAL INFRASTRUCTURE (DOLI), NEPAL


TIRL THE FUTURE OF TRANSPORT




INTRODUCTION

NEPAL

- Nepal - a landlocked country in South Asia
- Bordered by China in the north, 3 sides by India
- Total population - 26.4 million (Census 2011)
- Capital city - Kathmandu - population 1 million
- Combines extreme mountain terrain and lowland plains
- Population density high in valleys, but low above 2,000 m, and very low above 2,500 m



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POPULATION

POPULATION DATA

- Population and Housing Census undertaken by Central Bureau of Statistics
- Last census conducted in 2011, not yet in GIS
- Population projected for 2019 – 29.218 million
- next census planned for 2021
- WorldPop is a new concept for us
- Nepal is one of the **10 least urbanized** countries in the world – 81% of the population is classed as rural
- Nepal is also one of the **10 fastest urbanizing**
- Rural/Urban boundaries in shapefiles; (Department of Survey)

ROAD NETWORK

ROAD NETWORK

- Official statistics from DoR for SRN and from DoLI for LRN
- Mapping data available only for ~58,000 km
- Many parts of LRN have inaccurate geographic representations
- SRN Statistics include roads “planned” and “under construction”
- Some overlaps in mapping between the different agencies

Road Classification	Length (km)
Strategic Road Network (SRN)	14,902
Local Roads Network (LRN)	57,632
District Road Core Network	25,728
Village Roads (VR)	31,904
Total (km)	72,534

ROAD CONDITION

NEPAL ROAD CONDITIONS

- Of the SRN, around 52% paved
- Of the LRN, only around 5% paved
- About 35% of SRN and 74% of LRN are not all-season
- Increasing tendency to construct local roads with little or no planning or design
- Concept of transport planning – relatively new for Provinces and LLs



ROAD CONDITION

NEPAL ROAD CONDITIONS

- Landslides are a common occurrence in the rainy season, and roads can be blocked for many days at a time
- A lot of temporary/no river crossings



ROAD NETWORK

ACCESSIBILITY

- It is well understood in Nepal that walking time is a better measure of accessibility than distance, because of the extreme mountainous terrain. Various walking time maps have been prepared based on terrain models and presence of bridges and river crossings.
- Various measurements of "RAI" exist for Nepal under different studies and for different purposes, e.g. accessibility to the SRN, accessibility to District roads. These are used for transport master plan studies at district and municipal levels.
- "RAI" calculations typically have not taken account of road condition, but are still seen as a useful indicator for prioritisation as part of multi-criteria analysis

CHALLENGES

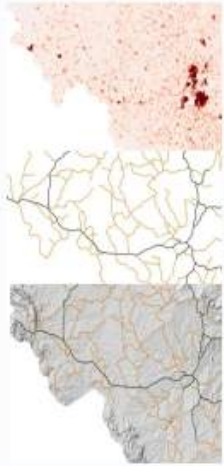
CALCULATING AND PUBLISHING RAI

- Accuracy and coverage of mapping of the road network(s), and reconciliation of different agency's networks
- Nepal should be considered a "special case" for RAI because of extreme terrain, and the need to consider walking time in addition to distance
- Fund and functions (decision making on formulation, execution, maintenance and ownership) for improving accessibility – to Local governments and Provinces
- Very less HRs at Local Levels, vast areas for capacity building


Annex H: Presentation 6

RURAL ACCESS INDEX

- Measurement Process, Data Collection and Analysis
 - Data Sources
 - Accessibility Factors
 - Recording the Base Data
- **Accuracy, Reliability and Sustainability**
 - Role of the National Statistical Offices (NSOs)
 - "Auto-calculation" of RAI
 - UN Global Platform
 - Embedment



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RAI

ROLE OF THE NATIONAL STATISTICAL OFFICES

- They are the custodians of the **National Statistical System**
- They are often (not always) the coordinators for national indicators
- They have a mandate either to report on statistics and indicators, or to work with other government agencies, to ensure that the **fundamental principles of official statistics** are applied
- Their responsibilities include data definitions and quality assurance
- They should **endorse** the use of data sets used for indicators
- They are in a position to minimise duplication of effort across agencies

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RAI

"AUTO-CALCULATION" OF RAI

- Tools are being developed to calculate RAI "automatically" from sources including WorldPop and Open Street Map
- Any RAI calculations will still require endorsement by the responsible agencies and by the NSOs



RAI

UN GLOBAL PLATFORM

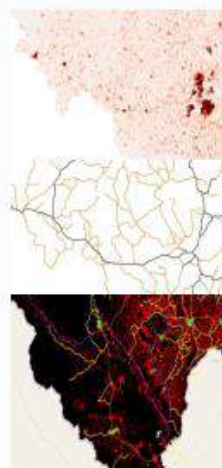
- RAI tools *may* be integrated into the UN Global Platform in future
- UN Global Platform is a digital platform enabling international and regional cooperation for production of statistics and indicators
- Facilitates access to Big Data sources for official statistics
- Including mobile phone data, satellite imagery, scanner data, social media
- UN Global Working Group for Big Data is establishing centers of excellence to provide training on tools, data and services



RAI

EMBEDMENT

- For RAI to be effectively embedded, it should be part of planning, monitoring and evaluation processes
- It should be an integral part of the SDG reporting process
- Requires coordination and agreement among agencies
- Requires involvement of, and endorsement by, the NSO
- Requires clear documentation of the base data used
- Requires a quality assessment and assurance approach
- Coordinated publication of the RAI and metadata



Annex I: Presentation 7

CONNECTING CULTURES
ENABLING ECONOMIES
26th Abu Dhabi World Road Congress
6th to 10th October 2019

PIARC
INTERNATIONAL ASSOCIATION OF ROAD AND TRANSPORT BUILDING OFFICIALS

RAI (SDG 9.1.1): FUTURE MEASUREMENT OF THE RAI
RAISING THE PROFILE OF THE RURAL ACCESS INDEX AS A VITAL SDG INDICATOR
FOR MEASURING RURAL DEVELOPMENT AND CONNECTIVITY

ROBIN WORKMAN
PRINCIPAL INTERNATIONAL CONSULTANT

TRL
THE FUTURE OF TRANSPORT

RAI

UPTAKE AND EMBEDMENT IN PHASE 3

Core tasks:

- Produce notes on WorldPop and OSM engagement and data reconciliation
- Promote RAI measurement at high profile events
- Produce an on-line package of support for RAI measurement:
 - Detailed GIS guide
 - Videos on Guidelines, GIS procedures and Ground Truthing for Accessibility Factors
 - Set of standard F.A.Q.s for the RAI process
 - Recommendations for a Custodian Helpline
- Final report and scientific paper

RAI

UPTAKE AND EMBEDMENT IN PHASE 3

Additional tasks (if extra funding is secured):

- Guide on how to reconcile country mapping with Open Street Map, using Malawi as a test country
- Support RAI measurement in 13 remaining ReCAP countries
- Support RAI measurement in 13 non-ReCAP countries
- Recommendations for future uptake and embedment
- Support development of a calculation tool on the UN Global Platform
- Help to establish a Helpline for the custodian to support RAI measurement in the future

RAI: FUTURE MEASUREMENT

SATELLITE IMAGERY

Define all-season roads

Used to determine road condition:

- Surface Type
- Width and width variation
- Surface texture variation
- Previous research in Africa

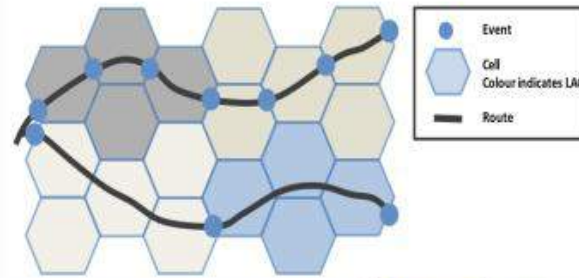


RAI: FUTURE MEASUREMENT

MOBILE PHONE DATA

- Increasingly being used for transport surveys, and to monitor traffic in real time
- Potential for mobile data to indicate whether a road is being used, and how fast the people using the road are travelling

Cell to cell:



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RAI: FUTURE MEASUREMENT

SOCIAL MEDIA

- Expanded coverage of smartphones....
- Broadband....
- Fix my street.....



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RAI: FUTURE MEASUREMENT

DATA SCRAPING

Human-readable data is extracted from a source, which could be a mobile phone, social media, a computer, the internet, a report, online maps, etc.

ieConnect of World Bank are using detailed real-time geo-referenced crash map of Nairobi, “generating high-frequency data on crashes and crash density around urban hotspots and using a real-time verification process to record characteristics related to the crash”

<https://www.worldbank.org/en/research/dime/brief/transport>



RAI: FUTURE MEASUREMENT

INTERNET OF THINGS

A network of physical devices, vehicles, buildings and other items that are embedded with electronics, sensors, software and connectivity to the internet or other networks that enable these objects to collect and exchange data




RAI: FUTURE MEASUREMENT

BIG DATA AND DATA SCIENCE


Big Data: What defines 'Big Data'?

- Volume,
- Speed,
- Diversity,
- Inconsistency,
- Complexity

Data Science: 'Sexiest job of the 21st Century' (Harvard Business Review, Davenport, 2012)




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RAI: FUTURE MEASUREMENT

MACHINE LEARNING / ARTIFICIAL INTELLIGENCE

Can be applied to many datasets to extract the necessary information quickly and accurately



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RAI: FUTURE MEASUREMENT

BEYOND THE HORIZON

- Pollution and air quality monitoring
- Synthetic aperture radar
- Hyperspectral monitoring
- Smart materials
- Pseudo satellites

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RAI: FUTURE MEASUREMENT

CONCLUSIONS

- Potential to measure RAI in the future
- Could be applied to other indicators
- Many options under development and will reach feasibility soon

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Annex J: Workshop Photographs



Malawi workshop



Malawi field trip



RAI presentations at the UK Pavilion



RAI workshop presenters



RAI panellists for Session 1 and Session 2



Workshop participants and questions from the floor



Entrance to workshop venue and RAI poster session