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

TG3 Final Report

Robin Workman
Kevin McPherson

TRL Ltd

ReCAP Reference Number: GEN2033D

July 2020

Preferred citation: Workman, R. & McPherson, K., TRL (2020). Consolidation, Revision and Pilot Application of the Rural Access Index (RAI): TG3 Final Report. ReCAP GEN2033D. London: ReCAP for DFID.

For further information, please contact:
Robin Workman, Principal International Consultant, TRL: rworkman@trl.co.uk
TRL, Crowthorne House, Nine Mile Ride, Wokingham RG40 3GA, UK

ReCAP Project Management Unit
Cardno Emerging Market (UK) Ltd
Level 5, Clarendon Business Centre, 42 Upper Berkeley Street,
London, W1H 5PW United Kingdom

Cover photo: Robin Workman-Zambia (satellite image), Robin Workman-Nepal, Andrew Otto- Kenya

Quality assurance and review table

Version	Author(s)	Reviewer(s)	Date
1	Robin Workman, Kevin McPherson	Martin Greene (TRL) Annabel Bradbury (ReCAP PMU) Joseph Haule (ReCAP PMU) Nite Tanzarn (Technical Panel) Dang Thi Kim (Technical Panel)	30/06/2020
2	Robin Workman, Kevin McPherson	Annabel Bradbury (ReCAP PMU)	30/07/2020

ReCAP Database Details: Consolidation, Revision and Pilot Application of the Rural Access Index (RAI)

Reference No:	GEN2033D	Location	Asia and Africa
Source of Proposal	TRL	Procurement Method	Open Tender
Theme	Infrastructure	Sub-Theme	Rural Access Index
Lead Implementation Organisation	TRL Ltd	Partner Organisation	N/A
Total Approved Budget	£148,575	Total Used Budget	£148,575
Start Date	01/02/2020	End Date	30/06/2020
Report Due Date	30/06/2020	Date Received	30/06/2020

Contents

Abstract

The Rural Access Index (RAI) is an indicator that was first developed by World Bank in 2006 to measure rural accessibility. It was adopted as Sustainable Development Goal (SDG) indicator 9.1.1 in 2016 with the same definition as the RAI: 'Proportion of the rural population that live within 2 km of an all-season road'. A geospatial methodology was adopted in 2016 by the World Bank, who are the custodian of SDG indicator 9.1.1, but results between 2006 and 2016 were inconsistent so the present project was established. The overall aims of this project were to develop a harmonised approach to measurement of the RAI that is relevant, consistent and sustainable, and which facilitates the implementation of RAI across United Nations (UN) member countries. The project has consolidated existing and proposed approaches to data collection and measurement in collaboration with the World Bank and other stakeholders and presents a refined measurement process designed to minimise inconsistencies in data collection, meet international standards and provide a clear framework for data validation.

This report primarily covers Task Group 3 (TG3) of the project. During this phase, a scientific paper was prepared for publication in a relevant journal, focused on how to motivate countries to measure RAI. A Roadmap and Policy Guide document were also completed. The Policy Guide sets out how to establish RAI in country and donor policy to support its continued measurement, and the Roadmap is designed to support the promotion of SDG 9.1.1 (RAI) to Tier 1 by 2025. Tier 1 is the highest level on the UN's scale of SDGs, characterised by indicators that are conceptually clear, have an internationally established methodology and standards available, and data are regularly produced by at least 50 per cent of countries. The Supplemental Guidelines produced under TG2 have been published on the World Bank Data Catalog, and the SDG 9.1.1 partners are in the process of incorporating the RAI into their long-term policy documents following liaison with the RAI team, including revised metadata for SDG 9.1.1. In addition, a Policy Brief has been produced in the ReCAP format.

Key Words

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

Acknowledgements

This project was undertaken by a team of eight, which included specialists from TRL and independent experts. Throughout the project the team has worked closely with the ReCAP PMU and the World Bank RAI managers, to whom the team are grateful for their feedback, advice and continued support. Perceptions from the authors of the original RAI report were also very useful. During the trials in Ghana, Malawi, Myanmar and Nepal we were hosted enthusiastically and professionally and would like to extend our gratitude to ReCAP country coordinators and counterparts for their cooperation and support. Other partners and stakeholders have also contributed significantly to this project, including ADB, AfDB, WorldPop, PIARC, IRF, UK ONS, representatives for the UN Global Platform, and Azavea.

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
ATO	Asian Transport Outlook
AU	African Union
DEGURBA	Degree of Urbanisation
DFID	Department for International Development
FAO	Food and Agriculture Organization of the United Nations
FAQ	Frequently Asked Questions
GAUL	Global Administrative Unit Layers
GDPR	General Data Protection Regulations
GIS	Geographical Information System
GRA	SuM4All Global Roadmap of Action towards Sustainable Development
GRID3	Geo-Referenced Infrastructure and Demographic Data for Development
GRUMP	Global Rural Urban Mapping Project
GTF	Global Tracking Framework
HDI	Human Development Index
HDM-4	Highway Development and Management tool (version 4)
HLPF	High Level Political Forum
IADB	Inter-American Development Bank
IAEG-SDGs	Inter-agency and Expert Group on SDG Indicators
IDA	International Development Association
IRF	International Road Federation
ISDB	Islamic Development Bank
LGED	Local Government Engineering Department
LIC	Low Income Country
MDB	Multilateral Development Bank
MIC	Middle Income Country
NSO	National Statistical Office
NSS	National Statistical System
PIARC	World Road Federation
PIDA	Programme for Infrastructure Development in Africa
PMU	Programme Management Unit
RAI	Rural Access Index
ReCAP	Research for Community Access Partnership
SDG	Sustainable Development Goal
SSATP	Africa Transport Policy Programme
SuM4All	Sustainable Mobility for All
TG1	Task Group 1
TG2	Task Group 2
TG3	Task Group 3
TOR	Terms of Reference
TRL	Transport Research Laboratory
UK	United Kingdom (of Great Britain and Northern Ireland)
UKAid	United Kingdom Aid (Department for International Development, UK)
UKONS	UK Office of National Statistics
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNGP	United Nations Global Platform
UNSC	United Nations Security Council
UNSD	United Nations Statistics Division
US	United States
WESR	World Environment Situation Room
WRC	World Road Congress

Executive Summary

The 'Consolidation, Revision and Pilot Application of the Rural Access Index (RAI)' project started in September 2018, with the aim to develop a harmonised approach to data collection and measurement of the RAI that is relevant, consistent and sustainable. The RAI was adopted as Sustainable Development Goal (SDG) 9.1.1 in 2016. This project has worked closely with the World Bank as custodian of SDG 9.1.1 plus other partners, development banks and regional organisations.

The current methodology for calculation of RAI was published by the World Bank in 2016. The project has developed Supplemental Guidelines to that methodology which follow the key tenets of the 2016 methodology, while emphasising the involvement of National Statistical Offices (NSOs) and government agencies in the process, and providing transparency and consistency in how the RAI is calculated. They also provide an alternative approach to the 'all-season' aspect of RAI by focusing on the intended purpose of the road network and the changing risks of accessibility to that network, rather than relying on physical measurements of road condition. Importantly, they encourage NSOs to engage with new online tools and platforms such as WorldPop, OpenStreetMap and others to improve the accuracy and accessibility of data and statistics for RAI. They also provide step-by-step procedures for calculating RAI, and for documenting the exact datasets and methodology used.

The project has trialled the Supplemental Guidelines in four countries: Ghana, Malawi, Myanmar and Nepal. Several visits were made to these countries to collect, check and process data, facilitate coordination between key stakeholders, and consolidate the RAI process through training and capacity building.

Further measurement of RAI in other countries has also been supported, motivated through an online survey of selected countries to which 14 responded fully. Many other countries were also contacted through the Custodian, other partners and the Transport Research Laboratory (TRL) projects. From these countries a shortlist of three were selected; Costa Rica, Namibia and Ireland, and TRL engaged with them to measure RAI. It should be noted that no ReCAP countries were at the stage whereby their data was ready, in terms of quality and completeness, to measure RAI within the timescale provided, but TRL worked with Bangladesh and Uganda to review their data, following the Webinars for those countries. The other respondents have also been encouraged to continue with RAI data preparation and measurement, and TRL has provided advice and support where possible.

The Supplemental Guidelines produced under TG2 have been published on the World Bank Data Catalog, and the partners are in the process of incorporating the RAI into their long-term policy documents following liaison with the RAI team. The RAI will also be included in the World Environment Situation Room of the United Nations Environment Programme (UNEP).

The World Bank RAI team have requested the United Nations (UN) Inter Agency Expert Group on SDGs to include RAI in the UN e-Handbook and the UN SDG Metadata web page. the United Nations Economic Commission for Europe (UNECE) has also added RAI data and links on its 'wikistats' page. The SuM4All online tool also records RAI measurements, and this needs to be updated by official data from the custodian.

Webinars have been developed and delivered for Bangladesh and Uganda. These webinars provide details on the RAI and SDG 9.1.1, and how it should be measured. They were recorded in advance, edited to include question and answer sessions, and will be made available by ReCAP as training materials, for publication on ReCAP and TRL websites. A scientific paper focused on motivating countries to measure RAI was prepared and submitted for publication during TG3. A Policy Brief was also developed for ReCAP in the standard format. The team made good progress in motivating partners and key stakeholders to include RAI in their policy documents and websites, particularly with UNECE, UNEP, African Union and Asian Development Bank.

1 Background

The Rural Access Index (RAI) is defined as the "proportion of the rural population who live within 2 km of an all-season road".

The stated aim and objective of the RAI project were:

- **Aim:** 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:** To scale up implementation of the RAI across United Nations (UN) member countries in order to advance the status of Sustainable Development Goal (SDG) Indicator 9.1.1 to Tier 2 and eventually Tier 1 in the tier classification of the SDGs.

Task Group 1 (TG1) was completed in 2018 and included a comprehensive review of the status of the RAI to date (Vincent, 2018). TG2 was formulated on this basis.

The Task Group (TG2) report (Workman, 2020) described how RAI was first measured in 2006 via household surveys, how a geospatial methodology was developed in 2016, and how the project was initiated. TG2 developed a refined methodology, the Supplemental Guidelines, (Workman, 2019) that consolidated existing and proposed approaches to data collection, while aiming to eradicate inconsistencies in data collection, meet international standards and provide a clear framework for data validation. TG2 also conducted trials in four countries (Ghana, Malawi, Myanmar, and Nepal). TG2 worked with the ReCAP SDG 9.1.1 Support project, undertaken by Azavea from July 2019 to November 2019, to produce a web-based RAI Measurement tool that calculates a 'default' RAI for all countries globally, using open source data. The TG2 final report made recommendations for this TG3 phase, which were accepted and formed the basis of TG3.

2 Introduction

The Terms of Reference (ToR) for TG3, the final phase of this project, covered the five areas described below:

A. Policy development

B. Measurement of RAI in more countries

C. A strategic roadmap to achieve Tier 1 status

D. Producing regional webinars that can be used for future training

E. Promoting RAI to a wider audience

TG3 was designed to scale up the RAI methodology trials in a repeatable and sustainable way. The overall objectives were to measure RAI in a further 3-5 countries and engage with as many as possible to start the measurement process, and to produce a roadmap for RAI (SDG 9.1.1) to achieve Tier 1 status by 2025.

Due to the Covid-19 pandemic the scope of the ToR was revised to suit the prevailing conditions. The main tasks and achievements, including for adjustments due to Covid-19, are summarised below:

A. Policy development proceeded almost as planned. The Policy Guide was delivered on schedule in March 2020.

B. Measurement of RAI in more countries. TG3 conducted a survey in January and February 2020 to identify countries that had recently calculated RAI, or who intended to do so in the near future. The intended activity remained largely unchanged, although it became harder to liaise with countries to measure RAI as many staff are working from home and have limited access

to computers and the internet. TG3 did, however, provide support and advice to Ethiopia, Ireland, and Costa Rica on how to measure RAI.

C. The Roadmap was produced on schedule and delivered with the Policy Guide in March 2020. The planned visit to World Bank at the end of the project had to be cancelled and was compensated for in the revised scope through additional liaison with countries interested in measuring RAI, and more extensive work on the webinars.

D. This activity involved holding two regional webinars with countries who intend to measure RAI, as identified in the survey mentioned above. The scope was revised to allow for more preparation and consultation on the webinars, including preparation of videos and circulation of presentations in advance. Separate webinar events were held with representatives from Bangladesh and Uganda in June 2020, during which more time was given for discussion on these countries' plans for calculation of RAI. The webinar videos have been submitted to ReCAP for uploading on the ReCAP YouTube channel, and will be sent to World Bank for uploading to the Data Catalog when approved by ReCAP.

E. Promotion of RAI to a wider audience. Several events had been identified for attendance, including the Geospatial World Forum in Amsterdam in April 2020, and the Second Global Sustainable Transport Conference in Beijing in May 2020. However, all relevant events were cancelled or moved online. These efforts were compensated for in the additional work for webinars as mentioned in 'D' above and also through engagement with United Nations (UN) agencies, and the African Union (AU).

In addition to the adjustments mentioned, it was agreed that the TG2 Supplemental Guidelines be produced in Spanish, due to interest from Latin American countries to measure RAI. Part of the Roadmap to Tier 1 required that the measurement of RAI should be regionally represented, which dictates that Latin American countries should be included, hence the Spanish translation.

3 Policy Development and RAI Embedment in National Statistical Systems

Policy is a key enabler for RAI measurement and can greatly enhance the chances of regular measurement and reporting. The team liaised with joint partners to support the development of policy for RAI, including the Asian Development Bank (ADB) and the United Nations Economic Commission for Europe (UNECE). It should be noted that, at the time of writing, the African Development Bank (AfDB) is actively considering becoming a partner and is expected to formalise this soon.

The ADB is interested in RAI as it supports their Strategy 2030 Operational Plan. The fifth operational priority of Strategy 2030 is Promoting Rural Development and Food Security, with a focus on rural roads, market infrastructure, and agri-logistics centres and networks to enable the integration of producers, agri-businesses, and consumers in the national, regional, and global food systems. The ADB is developing an Asian Transport Outlook (ATO) document, which will work with countries and partners to consolidate transport related data, policies, indicators etc. The ATO will cover all modes of transport and geographical areas, and there is interest to include the RAI. Linking with this strategy should motivate Asian countries to measure RAI, with the active involvement of ADB as a new co-partner to RAI. If other regional Multilateral Development Banks (MDBs) could follow suit the chances of reaching Tier 1 would be greatly improved. TRL actively liaised with ADB to assess how RAI can be incorporated into this strategy.

The AU renewed their interest to include RAI in their rural roads policy. A meeting was held on June 26th 2020 in which the African Union Commission agreed to share their Rural Development Strategy with ReCAP and TRL and invite comments on incorporation of RAI into that strategy. AU provided their 'Unlocking Rural and Remote Areas' Access to Basic Infrastructure and Services' Final Report Volume 1 Strategy (dated November 2019) in July 2020. The indicators listed in that report are preliminary.

TRL responded to AU in July 2020 and noted that the planned indicators include one very similar to RAI, but not identical (e.g. it uses % of households with access instead of number of people, and uses 'all-weather' instead of 'all-season), so it is not clear why RAI was not used; also the report discusses secondary indicators including access by motorcycles and waterways, for which suggestions were included in the RAI Supplemental Guidelines in the section on Secondary Indicators.

TG3 also promoted the inclusion of RAI in the World Bank's International Development Association (IDA) 19, devised to pool and leverage funds to achieve greater development impact in IDA countries. However, despite support from the World Bank and the Department for International Development (DFID) this was not possible. The Policy Guide produced during TG3 does recommend that the RAI is included in future IDA replenishments whenever possible.

The Policy Guide also included a strategy to encourage countries to include the RAI in their National Statistical System (NSS). At a country level this puts the onus on NSOs or their equivalent to put in place plans to measure RAI on a regular basis. In general, when an activity is embedded in the NSS, it is undertaken as a matter of course. This should also be made a requirement for all countries measuring the SDGs. To achieve this would require active motivation from the UN, most likely via the Inter-Agency Expert Group (IAEG-SDGs) who have the status to influence how countries measure the SDGs.

In addition, the World Bank indicated in January 2020 that they were considering how RAI might be incorporated into HDM-4. TRL produced a brief note (Annex A) on how RAI fits into a general planning framework for roads agencies, and how RAI might be incorporated into HDM-4 either as exogenous benefits or through Multi Criteria Analysis.

The two key aspects of the Policy Guide were incorporating RAI as part of Rural Development Policies and providing support to National Statistical Systems.

3.1 Rural Development Policies

There are potentially many different aspects to Rural Development Policy, relating to agriculture, education, health, employment, welfare, housing etc. Transport is a key enabler of those, and hence rural transport policies and plans are a necessary part of wider rural development policy.

It is important to emphasise, as stated in the Policy Guide and Roadmap produced under TG3, that RAI is an infrastructure indicator. RAI measures only one aspect of rural infrastructure development and must be part of a broader suite of indicators covering both infrastructure and services.

The Sustainable Mobility for All (SuM4All) Global Roadmap of Action toward Sustainable Mobility (GRA) includes RAI as an indicator (SuM4All, 2019a). It also lists several other supporting indicators for rural roads infrastructure and services. We understand that there are plans to pilot the GRA in South Africa prior to wider rollout, and that countries will be encouraged to measure indicators as part of that initiative.

There are also several examples of regional events and conferences that have produced agreements and commitments relating to rural development and sustainable transport. If RAI can be included in such agreements it will help to promote its measurement.

The Policy Guide and Roadmap made the following points in relation to inclusion of RAI in policy:

- RAI policy at National Level: The RAI must be part of a wider policy framework for rural development, and its inclusion in a country's statistical system must be planned and agreed early in the planning phase for any rural development programme.

- RAI policy at sub-national Level: RAI should also be considered for policy development at sub-national level, especially for larger countries that have a State system with varying degrees of autonomy.
- Absolute Numbers. RAI should also be presented as absolute numbers, which will help to make it more relevant to policymakers at all levels and should be used to promote its calculation.
- Targets: Reasonable targets should be set for RAI. The GRA identifies an 'aspirational' target of 100% for RAI. But for many countries 100% is not a reasonable target, such as those with extreme mountainous terrain, or designated river navigation channels, or with vast deserts or forests. Rural access should not be narrowly focused on roads, without regard for conservation or for protection of fragile zones, or the impacts of climate change. It must also take account of the ability of a country to maintain its existing and future road network infrastructure. In addition, in South Asia and increasingly in Africa, motorcycles and autorickshaws are the mainstay of personal mobility and account for a growing share of rural commerce. 'All-season' for motorcycles and autorickshaws is not the same as 'all-season' for 4-wheeled vehicles. In the not too distant future, self-driving all-terrain vehicles, or drones, could provide an important transport service, hence accessibility may well need to be redefined.

3.2 Support to Statistical Systems

Support to Statistical Systems is a focus of several international development efforts. The international community is providing support to statistical systems in Low-Income Countries (LIC)s. It is important that any efforts to help the uptake and embedment of RAI are tied in with this support to avoid duplication of effort and to leverage the work going on in these areas.

Areas for cooperation include:

- General Support to NSOs: Many donors also have programmes to strengthen NSS at country level. For example, the United Kingdom Office of National Statistics (UKONS) is supporting Ghana, Kenya, Rwanda and UNECA to strengthen statistical systems.
- Support to NSOs for SDG measurement: It is a challenge for many countries to measure all 232 SDG indicators. Resources are scarce, especially in the poorest nations, so some countries have decided to prioritise which indicators they will measure. This tends to be done based on the IAEG-SDG Tier system, where countries prioritise the indicators that have a higher Tier level. This support is often separate from general support to NSOs.
- Strengthening SDG reporting: The UN Statistical Division maintains a database of National Statistical Offices around the world. There have been various efforts to strengthen and standardise the national reporting of SDGs, including implementation of several platforms. The World Bank has also established a Data Catalog where SDG indicator results and metadata can be published and disseminated. The UN Global Platform (UNGP) provides a Global Platform for learning about trusted data, projects, applications, services and partners.
- New Data and Technologies: Data and the way in which it is processed is changing how traditional statistical processes are undertaken. This has an impact on how NSOs or their equivalent in a country, can harness data for sustainable development monitoring. It is important for NSOs to strengthen their production and use of statistics and change their mindset towards producing more open and transparent data. There are many opportunities for use of new data and technologies for RAI, and in fact RAI is a good case study for which some of those new data and techniques could be applied.

- Embedment of RAI in an NSS: The RAI should fit into any other reporting process that the country already follows. The NSO in a country should liaise with other agencies (roads agencies, development agencies, mapping agencies etc.) as necessary and incorporate the RAI into its NSS, along with the other SDGs.

4 Explore Opportunities for Additional Countries to Measure and Verify RAI

4.1 Online Survey

The team undertook a survey in TG3 of countries that are measuring, or planning to measure, RAI, and how. The team used existing ReCAP contacts, as well as TRL project and HDM-4 contacts, and contacts provided through the custodian and partners in order to invite countries to participate in the survey. TRL took the lead in managing the planning, administration and collation of results for the survey. Details of the survey can be seen in Annex B.

4.2 Website Search

In addition, TRL undertook an extensive website search for countries that have measured RAI in the past, between 2016 and the present. This included contacting road authorities and NSOs where possible. There is a list of NSO contacts for every country in the world, on the United Nations Statistics Division (UNSD) website, which was very useful. This uncovered very few new measurements of RAI, but it did identify many countries who had **not** measured RAI and why. There were many comments found that either a methodology was not established, or that no attempt had been made to source the data. This suggests that greater efforts at raising awareness, including more dissemination of the RAI project results and Supplemental Guidelines, would be beneficial in encouraging more countries to measure RAI.

4.3 Country Liaison

The TRL online survey identified 34 countries that showed an interest in measuring RAI, see Table 1.

Table 1: Countries with interest in measuring RAI

Afghanistan	Guatemala	Sierra Leone
Australia	Guinea-Bissau	Solomon Islands
Azerbaijan	Honduras	Tanzania
Bangladesh	Hungary	Timor L'Este
Botswana	Ireland	Turkmenistan
Cabo Verde	Kazakhstan	Ukraine
Cambodia	Namibia	Zimbabwe
Colombia	New Zealand	Uganda
Costa Rica	Nigeria	United States
Ecuador	Panama	Vanuatu
Egypt	Paraguay	
Ethiopia	Russia	

General Data Protection Regulations (GDPR) were followed to gain permission for countries to complete the online surveys and allow TRL to contact them following their response.

Only 14 full responses were received, from Afghanistan, Bangladesh, Botswana, Cambodia, Costa Rica, Ecuador, Ethiopia, Guatemala, Guinea-Bissau, Honduras, Panama, Paraguay, Sierra Leone, Solomon Islands. It should be noted that the survey responses shown in Annex B show 15 countries, but Ecuador completed the form twice. TG3 followed up these responses to encourage those countries to undertake RAI measurement, and had follow-up email, telephone discussions and/or webinars with representatives from Bangladesh, Costa Rica, Ethiopia, Ireland, Namibia, Tanzania and Uganda. The team encouraged countries to undertake RAI measurement, primarily using their own resources and data where possible, but with remote support from the TRL RAI team. A summary of progress in selected countries is given in Annex E.

It should be noted that the impact of Covid-19 in many countries hampered the ability of staff to provide data and liaise with the RAI team, yet the team were able to advance the discussions and provide support to at least seven (7) countries during this period.

5 Strategic Roadmap to Achieve Tier 1 Status

A strategic Roadmap for the promotion of RAI to Tier 1 on the IAEG-SDG monitoring scale was developed in TG3. The aim of this Roadmap is to achieve measurement of SDG 9.1.1 in enough countries to achieve Tier 1 status by 2025. This Roadmap was presented in the 'Roadmap and Policy Guide' report submitted in March 2020. To achieve Tier 1 it will be necessary to measure RAI in 50% of UN countries and populations in each region where it is relevant.

5.1 Partners

The UNECE, United Nations Environment Programme (UNEP) and ADB as co-partners are supportive of RAI and have been able to assist in awareness raising through their own contacts and methods.

The TG3 team has liaised closely with the ADB who are developing their rural policies and are keen to include RAI. TG3 met with Cornie Huizenga and Sudhir Gota on June 11th 2020 to discuss how RAI can be promoted further within ADB. TRL actively liaised with ADB to assess how RAI can be incorporated into this strategy. James Leather of ADB confirmed on July 2nd 2020 that, as there are few transport related SDG indicators, RAI is under consideration in the Asian Transport Outlook (ATO) which has the objective of improving data and data reporting, and assisting in policy dialogue to improve ADB assistance.

The team presented progress on the RAI to the online UNECE Transport Statistics Meeting on 17th June 2020. UNECE added a page on their Transport Statistics statswiki on 9th July with background information and links to the 2016 Methodology and 2019 Supplemental Guidelines, and to the RAI Policy Guide and Roadmap, and to the Azavea RAI Measurement tool.

The team also held an online meeting with staff from the UNEP World Environment Situation Room (WESR) on 22nd June 2020 to discuss the status of RAI and to discuss how UNEP could include RAI material and data on their website. A follow-up meeting was held with UNEP on 22nd July 2020 and produced a brief document with suggested text for inclusion on the WESR, which was sent to World Bank and copied to UNEP WESR team on 24th July 2020. The document included some standard text from the WB Data Catalog and from the UN SDG website, and links to the WB Data Catalog. This was designed to help reinforce the fact that RAI is a Tier 2 indicator, to help anyone using the WESR site to navigate to the WB Data Catalog, and introduce users to the information and resources contained there. This is also important to provide consistency across WB and UN sites regarding status of individual SDGs goals and targets. World Bank as custodian will liaise with the WESR on these updates.

5.2 Policy Development

Policy development as mentioned above is key to increasing the range of countries measuring RAI. If the RAI can be included in policy by regional or international organisations, then it is highly likely that countries will follow.

The RAI Supplemental Guidelines will be the core document that guides countries in how to measure RAI. These should be disseminated and should have supporting documentation that ensures consistent and evaluable measurement of the RAI. The training webinars in TG3 provide information on the Supplemental Guidelines and how to use them to measure RAI.

The RAI Measurement Tool is also a good demonstrator of how RAI can be measured and presented. It can be a very powerful visual aid to a presentation or promotion of the RAI and has been built into the Roadmap for achieving Tier 1. At present the tool is available online to view and test, so practitioners can be encouraged to learn about RAI by using the tool and compare their own in-country data with open data for population (WorldPop) and road network (OpenStreetMap). TG3 also held a meeting with representatives from the UN Global Platform on 24th June, they expressed clear interest and a plan to move the RAI Measurement Tool onto the platform and will continue to coordinate with ReCAP.

5.3 Roadmap Action Plan

The Roadmap included some activities identified for an Action Plan towards 2025. The key activities are as follows:

- Include in IDA Replenishments: Proposal to include RAI in future IDA Replenishments.
- Publish the Supplemental Guidelines: World Bank as custodian has published the Supplemental Guidelines on the Data Catalog. World Bank is also liaising with UNSD to update the Metadata for SDG 9.1.1 on the UNSD website and to update the SDG e-Handbook to incorporate 9.1.1.
- Publicise and Coordinate RAI: A number of activities were recommended to promote and coordinate RAI, including arranging workshops and events through the custodian and partners, promotion at high-profile international events and to develop video materials to support measurement and reporting of RAI. Specific aims are to include the RAI in the UNEP World Environment Situation Room (WESR), include it in the High-Level Political Forum on Sustainable Development (HLPF) and record who is reporting RAI through various online platforms. Meetings have been held with UNEP and they are keen to include the RAI in the WESR.
- Document and Record Metadata: Recording the metadata is important, otherwise the measurement is not transparent or repeatable. The custodian should enforce this and the metadata for any RAI calculation should be stored in the World Bank Data Catalog.
- Road Network Mapping: Custodian and partners to provide support to countries to enhance their road network mapping as part of existing projects. This will be useful for many development efforts, not just RAI.
- Liaison with WorldPop: Check that WorldPop data aligns with latest population projections, as well as demonstrating the potential for this type of population data.
- Keep up to date with new technologies: The RAI methodology should be reviewed every 3-5 years to take account of new technologies, platforms and definitions (including the Degree of Urbanisation (DEGURBA) urban boundaries initiative).

- Further development of the RAI Measurement Tool: It is recommended that the RAI Measurement Tool developed by Azavea under the ReCAP SDG 9.1.1 support project is continued and moved onto the UN Global Platform. The RAI tool could also be extended to calculate RAI at sub-national boundaries, which would give it potential additional traction in roads agencies as a planning and prioritisation tool.
- Further research on RAI: It is recommended that further research on RAI is conducted. There have been several studies in the past that demonstrated correlation between RAI and poverty, for example. However, with a refined RAI methodology, further study is warranted. This could include studies to compare RAI and the Human Development Index (HDI), which is a composite measure of health, education and income.
- Monitoring progress: Monitoring of progress of the Action Plan should be achieved through the World Bank Data Catalog; and through the SDG reporting website.

Since the Roadmap was produced, ReCAP has published a 'Scoping Study to Explore the Suitability of SDG Indicator 9.1.2. for Rural Access: Final Report' (Sieber et al, 2020). Among other things, it suggested the idea of an integrated 'Transport SDG Report' which, if agreed, would further bolster visibility of the RAI. TRL submitted comments on that report to ReCAP.

Also, the UN Statistical Commission (2020) report on the 51st session (3-6 March 2020) endorsed the DEGURBA methodology for delineation of cities and urban and rural areas for international and regional statistical comparison purposes. With respect to the RAI, it is difficult to determine what the impact of using DEGURBA on RAI would be without extensive testing, versus use of either national urban definitions or the Global Rural Urban Mapping Project (GRUMP) database. We suspect that in some countries, RAI may decrease as a result of using DEGURBA, but in others, RAI may increase. DEGURBA basically brings the semi-urban areas around towns and reasonable sized settlements into an urban definition, but these areas would most likely have all-season access anyway. It also depends on where the roads are, and what the relative distribution of rural and urban populations are within a country. We believe any changes to RAI values are likely to be minimal. The easiest way to test this would be to request Azavea to re-run their RAI measurement tool using DEGURBA instead of GRUMP, for all countries, compare the results, and perform a quick analysis to determine the changes and causes of changes in countries.

However, more pertinent questions are whether all UN SDGs (and other non-SDG indicators) will start reporting using the same definitions of urban/rural; whether there will be any harmonisation effort; and whether UNSD is also providing advice to national statistical offices for reconciliation of national indicators.

It is important for the future development of RAI to monitor these developments.

5.4 Roadmap Programme

A programme of implementation was developed to show the key steps necessary to support policy development and produce enough RAI measurement results to encompass 50% of all UN countries by 2025. A programme for the Roadmap can be seen in Annex C.

A visit to Washington to share results with the World Bank and other partners was scheduled. This was cancelled due to Covid-19, but a wrap-up meeting with World Bank, ReCAP, DfID, and TRL was held on 21st July 2020.

TRL also prepared and submitted an Information Pack to World Bank containing all relevant reports communications and documentation to date.

6 Produce Regional Video Webinars and Develop for Future Training

Two regional training webinars, in Africa and Asia, were held in June 2020 to provide guidance and raise awareness of the RAI process and to gauge interest from potential 'Quick Win' countries, both in LICs and High-Income Countries. The agenda for the webinars is shown in Table 2.

Table 2: Outline for RAI Webinars

1	**Introduction and Background to RAI, including:** • Brief History • Introduction to World Bank Methodology (2006) • Introduction to Revised World Bank Methodology (2016) • Introduction to Supplemental Guidelines (2019) • Introduction to SDGs • Q&A	15-20 mins
2	**RAI as part of the SDGs:** • Brief Introduction to the SDGs • Key Organisations involved in RAI and resources required • SDG 9.1.1 (Tier 3 --> Tier 2 --> Tier 1) • Roles and Responsibilities for RAI reporting and publication • Q&A	15-20 mins
3	**RAI and Rural Development:** • The Role of Indicators • RAI and Rural Development Policy • RAI Targets, as Absolute Numbers and as a suite of indicators • Q&A	15-20 mins
4	**RAI Data Sources:** • Population / Road Networks / Boundaries • Q&A	15-20 mins
5	**RAI Methodology using Case Study for Malawi:** • Organisational • Road Network Data • Population Data • Urban/Rural Boundaries • RAI Metadata • Q&A	15-20 mins
6	**RAI Accessibility Factors:** • Why Accessibility Factors, what are they and who defines them? • Components of Accessibility Factors • The Importance of Ground Truthing • Case studies • Q&A	15-20 mins
7	**Future direction of the RAI:** • Options for future measurement of RAI • Q&A	15-20 mins

The countries selected for the webinars were Bangladesh and Uganda. These countries were selected because they have had previous experience of RAI, appeared to have good data for RAI measurement, and were keen to be involved. Follow-up meetings were held with both Bangladesh and Uganda, which included both the Roads Authorities and the Statistical Offices. Both countries are keen to move ahead with measurement and have been introduced to the World Bank team.

Representatives from other countries were also invited to attend. Annex D lists the attendees at the webinars and lists the additional questions that were raised.

Originally, two regional video webinars were proposed. These were to be prepared as PowerPoints and delivered live to participants. However, because of the Covid-19 situation, with many participants working from home and unable to easily access computers and internet, the method of preparation and delivery was changed. The new delivery strategy involved preparing the training material in advance and delivering pre-scripted webinars to an invited audience. Participants were able to submit questions in advance, and these were included in the presentations as Frequently Asked Questions.

The final products were video webinars, with live Questions and Answers (Q&A) sessions held at the end of each webinar. Seven separate webinars were recorded, to make them easier to access and download if necessary. The live Q&A details were reported on a separate slide and have been included in the videos before submission to ReCAP and to World Bank (following approval by ReCAP). The webinar videos have been submitted for publication on the ReCAP YouTube Channel. At least 70 people were invited to attend each webinar.

A survey was also conducted at the end of the webinars to assess the content and delivery. Results of the feedback surveys are also given in Annex D.

Due to Covid-19 restrictions, the webinars were recorded in advance so that if participants were unable to view them at the time, they could be viewed at a later date. This also allowed for smooth delivery of the webinars and gave the facilitators more time to concentrate on the Question and Answer sessions. Attendance was between 15 and 17 for each webinar.

7 Promote RAI at Regional Conferences and Events in TG3

This activity was designed to promote uptake and embedment of RAI at various events, including at the Geospatial World Forum in Amsterdam in April 2020, and the Second Global Sustainable Transport Conference in Beijing in May 2020. However, all relevant events were cancelled or moved online. These efforts were compensated for in the additional work undertaken for the webinars as mentioned in Section 6, and through various other activities as mentioned below.

A key aspect of uptake and embedment is to raise awareness of the RAI, its importance and how it can be used to monitor accessibility of the poorest rural communities. The RAI team had previously made presentations and held workshops/seminars at high-profile events in TG2, but the opportunity to do this in TG3 was limited by the time available to write papers and present them.

The RAI team already had a paper submitted to the T2 conference in Mozambique for May 2020, developed under TG2. This event was cancelled, so a similar paper was instead submitted to the TRB Bridging Transportation Researchers Online Conference from 12-13th August 2020.

TRL continued to liaise with other organisations supporting RAI, such as WorldPop, ADB, AfDB and UN for the UN Global Platform.

The RAI team presented at the UNECE 71st Session Working Party on Transport Statistics on 17th June 2020 as part of the engagement with partner agencies described in Section 5.

Papers and journal submissions are described in Section 9.

8 RAI Measurement Tools

A RAI Measurement Tool was developed by Azavea under the ReCAP SDG 9.1.1 Support Project. No further software development work was carried out on the RAI measurement tool during this reporting period.

At the RAI Working Group meeting in April 2020 it was agreed by UN and Azavea that the tool would be sited on the UN Global Platform (UNGP). Azavea provided text to support the establishment of the tool on the UNGP. Ronald Jansen of the United Nations Statistical Division (UNSD) was very positive about including the tool on the UNGP. UNSD, TRL and Azavea held a meeting on 24th July 2020 to discuss potential pilot countries, at which some potential countries were identified. A separate meeting was held with UNSD, World Bank and TRL on 28th July 2020 to discuss potential piloting of RAI on the UNGP and how countries could be involved. It was agreed that a Task Team would be formed which would essentially take over from the RAI Working Group currently led by ReCAP. The Task team would be led by Atsushi Iimi of the World Bank RAI team and be supported by other partners.

The RAI measurement tool will be disseminated as a development product to elicit feedback and allow its further development in line with the needs of countries measuring RAI.

On 29th June 2020, World Bank informed TRL / ReCAP of the completion of version 0.1 of a 'Conflation Engine', which is designed as an innovative and flexible RAI calculation toolkit that is designed to interact with road asset management systems. This tool conflates flexibly different geometric datasets (existing GIS shapefile data; georeferenced RAMS and HDM4 data; and OpenStreetMap), and imports population data from NASA SEDAC/World Pop/Census data to calculate RAI'. Code and a User Manual for this toolkit were also published. The principal goal is to develop a digital platform for RAI calculation and Rural Accessibility Program (RAP) preparation in World Bank. The timing is good in that it increases the visibility and awareness of RAI among the Bank's projects and can contribute to wider SDG initiatives going forward. TRL submitted technical comments on the Conflation Engine to World Bank on 14th July 2020, designed to ensure consistency with the official methodology and guidelines.

9 General Dissemination of RAI (TG2 and TG3)

9.1 RAI Working Group Meetings

During the course of the project a total of six RAI working group meetings have been held:

- January 2018
- July 2018
- September 2018
- January 2019
- May 2019
- September 2019
- January 2020
- April 2020

The April 2020 meeting of the RAI Working Group was held in TG3, and the minutes can be seen in Annex F.

A further meeting is expected in Autumn 2020, which is likely to mark the end of formal ReCAP involvement in the RAI.

9.2 Papers and publishing in TG2 and TG3

Five papers have been written on RAI during the course of TG2 and TG3. They are summarised in Table 3. Full details of papers produced under TG2 are provided in the TG2 Final Report.

Table 3: RAI Papers

Paper	Phase	Notes
Raising the Profile of the Rural Access Index as a Vital SDG Indicator for Measuring Rural Development and Connectivity	TG2	Presented at PIARC Conference, Abu Dhabi October 2019 All ReCAP presented materials are available for download on the dedicated PIARC WRC webpage on the ReCAP website.
Potential For Measurement of the Rural Access Index in the Future	TG2	
How to use GIS to measure Rural Access for SDG 9.1.1	TG2	Submitted to Africa GIS conference in Rwanda November 2019. A special issue journal will publish papers presented at the conference later in 2020.
Using Accessibility Factors to measure the 'all-season' aspect of roads for the Rural Access Index.	TG3	Submitted to T2 conference in Mozambique for May 2020, however T2 was cancelled. Paper therefore adjusted and re-submitted to the TRB online conference on 'Bridging Transportation Researchers', due to be held 11-12 August 2020.
Motivating countries to measure the Rural Access Index (SDG 9.1.1)	TG3	For submission to a relevant journal. Summarises the work to date and the recommendations from the Policy Guide and Roadmap.

10 Deliverables

The Deliverables for TG3 were as follows:

- Scientific Paper: The scientific paper was completed and approved for submission to a relevant journal.
- Roadmap and Policy Guide document: This report was submitted in March 2020 and comments were received from ReCAP and UNECE. These comments were addressed, and the final report was submitted and approved in June 2020.
- Policy Brief for RAI: This report was submitted at the end of May 2020.
- Draft Final Report for RAI: This was submitted at the end of May 2020.

11 Conclusions and Recommendations

This section provides a summary of conclusions and recommendations made during the TG2 phase of the project, and conclusions and recommendations for TG3.

11.1 Conclusions

There is widespread interest in RAI from all continents. It is a very important indicator for LICs and Middle-Income Countries (MICs) who have high percentages of their rural population with limited access to all-season roads. However, it is considered to be less relevant to many countries in Europe and North America because their RAI percentage is at, or very close to, 100%.

The TRL online survey was interesting because it provided responses from across the world. Despite this, it has been difficult to get countries to commit to measurement, although much of this at present may be down to the continued effects of the Covid-19 pandemic. Other issues identified by respondents include the resources necessary to measure RAI, the fact that it does not align to rural accessibility monitoring in many countries (service indicators are often used over network indicators), coordination between government agencies and the perception as mentioned above that it is less relevant as the country nears 100% RAI.

The online survey and the desk study web search confirmed that few countries have measured RAI. The reasons for this include not being aware that a methodology was available, because the required data was not available or because the resources available for measurement were limited. Also, for some it was a low priority compared to other SDG indicators. However, there was interest from some countries to measure RAI, with remote support provided by TRL.

Also, some countries are measuring RAI using a different methodology to that established in 2016. Very few are actually reporting their progress or results to the custodian or to the UN, hence it is not necessarily showing up in UN SDG reporting. This indicates that it would be beneficial to raise the profile of the RAI and make more countries aware that a methodology is available that requires minimal resources for measurement and can be undertaken relatively quickly and easily if the data is available.

If targets are used for RAI in LICs and MICs they should be set at a realistic level, and need to be specific to each country, based on their current road network, its state of maintenance and the resources available to extend and maintain it in the future. Targets should not be based on generic factors such as continental groupings or the development progress made by a country.

Towards the end of TG3 the ReCAP scoping study for SDG 9.1.2 was finalised and circulated. This included a recommendation for a suite of SDG Transport Indicators, which would include RAI.

The DEGURBA methodology for the delineation of cities and urban and rural areas for international and regional statistical comparison purposes was endorsed by the United Nations Security Council (UNSC) in March 2020. This has potential to impact RAI measurement, although it is not immediately clear exactly how (see Section 11.2.8 for more details).

11.2 Recommendations

11.2.1 Follow the Roadmap for Tier 1 promotion by 2025

The Roadmap to reach Tier 1 by 2025 was produced in March 2020. This is an ambitious timetable, so the custodian would need to actively raise awareness of RAI and promote its measurement to as many countries as possible. World Bank should leverage its influence with partners and other donors to encourage new countries to measure RAI according to the Supplemental Guidelines.

11.2.2 Promote RAI inclusion in policy

As reported in the Roadmap and Policy Guide, the RAI should be promoted and included in national and development agency policy where possible. This is an effective way to ensure that it will be measured in the future, in accordance with the established methodology. RAI is now included in partner's plans for the future, so synergies should be explored to include RAI in regional and national policies.

11.2.3 Add more partners

The Current partners to the custodian in SDG 9.1.1 are:

- UNECE
- UNEP
- ADB

AfDB is interested and is actively discussing partnership with WB. It is desirable to have more regional representation in the RAI partners, for example South America where there is considerable interest according to the online survey. Other institutions identified as potential partners are the Inter-American Development Bank (IADB) and the Islamic Development Bank (ISDB).

11.2.4 Leverage the support of partners

Reaching Tier 1 is an ambitious task for the custodian, so the assistance of SDG 9.1.1 partners and other regional institutions should be maximised. Partners and institutions have good links to individual countries, which can be leveraged to influence countries to measure RAI.

11.2.5 Include RAI at all levels

There is an incentive to measure RAI at sub-national level, especially for larger countries that have semi-autonomous States. This could also help with planning and prioritising resources for road network development.

11.2.6 Promote Supplemental Guidelines

It is desirable for the World Bank as custodian to further promote the Supplemental Guidelines, now that they have been established on the WB Data Catalog website.

11.2.7 Further develop RAI Measurement tool

There is potential for the RAI measurement tool to help with promotion and calculation of the RAI. The tool should be established on the UNGP for demonstration and feedback purposes, then further developed to assist countries to measure RAI online easily and quickly.

11.2.8 Link to SDG 9.1.2

The SDG 9.1.2 Scoping Report recommends an integrated 'Transport SDG Report'. This would give further impetus and focus on RAI and should be followed up by ReCAP and the World Bank.

11.2.9 Test DEGURBA rural/urban boundaries

The UN Statistical Commission (2020) Report on the 51st session (3-6 March 2020) endorsed the DEGURBA methodology for delineation of cities and urban and rural areas for international and regional statistical comparison purposes. With respect to RAI, it is difficult to estimate what the impact of using DEGURBA on RAI would be, versus use of either national urban definitions or the GRUMP database. It is suspected that in some countries, RAI may decrease as a result of using DEGURBA, but in others, RAI may increase. DEGURBA basically brings the semi-urban areas around towns and

reasonable sized settlements into an urban definition, but these areas would most likely have all-season access anyway. It also depends on where the roads are, and what the relative distribution in a country of rural and urban populations is. It is therefore likely that any changes to RAI values will be minimal. The easiest way to test this would be to request Azavea to re-run their RAI measurement tool using DEGURBA instead of GRUMP, for all countries, compare the results, and perform an analysis to determine the changes and causes of changes in countries.

11.2.10 Consider advice for developing road network information

As mentioned in TG2, there is great benefit in accurate and up to date georeferenced road network information, not just for RAI but for many other uses and indicators. It would be useful to inform countries in how to assess their network information, link it to open source online data sources and develop consolidated mapping and road inventory information that can be used for development purposes. There are emerging sites such as the Facebook 'MapWithAI' tool which scrapes satellite data to produce road networks that can be checked and edited in OpenStreetMap. These tools will make it far easier to complete accurate mapping and inventory of road networks.

11.2.11 Resource the Task Team to support countries on RAI measurement

There is agreement to form a multi-disciplinary Task Team to support country involvement in the UNGP and RAI measurement. It will be led by the needs of countries wishing to measure RAI, but lessons from the trial countries under this project suggests that they may need additional resources beyond what can be provided voluntarily by the Task Team to prepare data for RAI measurement, especially with respect to road network data.

11.3 ReCAP exit strategy for RAI

ReCAP has committed significant resources to support the RAI over the past four years. The initial input allowed World Bank to develop the original geospatial methodology in 2016 and trial it in eight countries. Following this a second tranche of funding was made available from 2018 to 2020 to develop a harmonised approach to data collection and measurement of the RAI that is relevant, consistent and sustainable. This led to the development of the Supplemental Guidelines and many supporting documents, including a Roadmap for the promotion of SDG 9.1.1 to Tier 1 on the IAEG-SDGs scale. During the period of the project, four countries have trialled the refined methodology contained in the supplemental guidelines, whilst more than 70 countries have been contacted directly with a view to measuring the RAI, either via the online survey or directly through custodian, partner or other contacts. Along with the several papers written and presentations that have been made at international conferences, this has served to disseminate information on the RAI and promote it to a wide range of stakeholders.

The RAI project completed in July 2020, and a handover and exit strategy has been provided for the custodian, the World Bank, in order to safeguard the valuable work that has been carried out under this project and to ensure that the Roadmap goals are met.

Throughout the deliverables already submitted on this project there are several recommendations on the role of the custodian and RAI partners, which should form part of the future support to RAI. However, to reach the agreed goal of Tier 1 status by 2025, there is still a lot of work to do. The project team discussed with ReCAP and World Bank how best to hand over the results of the surveys, training materials, webinars and other deliverables to World Bank as the custodian, and how best to ensure that the momentum built up on this project is carried forward.

The project team have prepared an information pack, which has been provided to World Bank as part of the RAI handover, which includes the following:

- A summary of key reports produced under the project and links to their location on the ReCAP website.
- A summary of Journal Papers and Conference Events at which RAI has been the subject.
- A summary of the status of coordination with partner agencies and other relevant key stakeholders.
- A summary of the status of country engagement with countries interested to measure RAI. This is divided into a list of countries who are actively engaged and those who have just shown an interest.

The team have also sent introductory emails to World Bank and UNGP to present all countries who are engaged with measuring RAI during TG3, and asking those countries who are keen to measure RAI to contact the custodian.

12 References

ADB, (2019) Strategy 2030 Operational Plan for Priority 5: Promoting Rural Development and Food Security, 2019–2024, Available at: https://www.adb.org/documents/strategy-2030-op5-rural-development-food-security - Manila, Philippines

Facebook, (2019) Mapping roads through deep learning and weakly supervised training, Available at: https://ai.facebook.com/blog/mapping-roads-through-deep-learning-and-weakly-supervised-training/ Accessed on: 10/12/2019

GTF (2019). Global Tracking Framework (GTF), Sum4All. https://sum4all.org/global-tracking-framework. Accessed on 19 August 2019

Roberts P, Shyam KC, Rastogi C, (2006). 'Rural Access Index: A Key Development Indicator', Transport Paper TP-10. World Bank, Washington D.C. USA

Sieber, N. et.al. (2019). Scoping Study to Explore the Suitability of SDG Indicator 9.1.2 for Rural Access Project, Final Report GEN2173A, London: ReCAP for DFID.

SuM4All, (2019a). 'Global roadmap of action toward sustainable mobility', World Bank, Washington D.C. USA

SuM4All (2019b). Universal rural access: companion paper to global roadmap of action toward sustainable mobility. Sustainable Mobility for All (SuM4All), Washington DC. 44p

UN, (2015) Transforming our World: The 2030 Agenda for Sustainable Development, New York, USA

UN Statistical Commission, (2016) Report of the Inter-agency and Expert Group on Sustainable Development Goal Indicators, New York, USA

Vincent S, (2018). 'Status Review of the Updated Rural Access Index (RAI)-Final Report'. Available at: http://www.research4cap.org/Library/Vincent-CDS-2018-StatusReviewUpdatedRAI-FinalReport_GEN2033C-180529.pdf

Workman, R. and McPherson, K. (2019). Consolidation, Revision and Pilot Application of the Rural Access Index (RAI): Supplemental Guidelines. ReCAP GEN2033D. London: ReCAP for DFID.

Workman, R. and McPherson, K. (2020). Consolidation, Revision and Pilot Application of the Rural Access Index (RAI): TG2 Report, ReCAP GEN2033D. London: ReCAP for DFID.

Workman, R., Starkey, P. and McPherson, K. (2018). Consolidation, Revision and Pilot Application of the Rural Access Index (RAI), Inception Report, GEN2033D. London: ReCAP for DFID.

World Bank (2015). 'A new measure of rural access to transport - Using GIS Data to Inform Decisions and Attainment of the SDGs'. Available at: http://pubdocs.worldbank.org/en/418041445369861024/TransportICT-Newsletter-Note23-Oct-highres-00000002.pdf Washington D.C. USA

World Bank (2016). Measuring Rural Access Using New Technologies. Available at: http://documents.worldbank.org/curated/en/367391472117815229/Measuring-rural-access-using-new-technologies Washington D.C. USA

Annex A: Planning Frameworks and RAI

A general framework for planning systems and tools in roads agencies, and where the Rural Access Index (RAI) fits in

This note describes a general framework of systems and tools that a roads agency typically uses to plan and manage its road network. It also discusses how calculation of the Rural Access Index (RAI) might best fit into these systems, and in particular addresses whether RAI might be calculated using Road Asset Management Systems (RAMS) or HDM-4 (Highway Development and Management tool).

Figure 1 shows two distinct aspects of long and medium term planning: *asset preservation* and *network development*. Routine maintenance is not shown in Figure A1, and is considered as a 'given' for the purposes of this note.

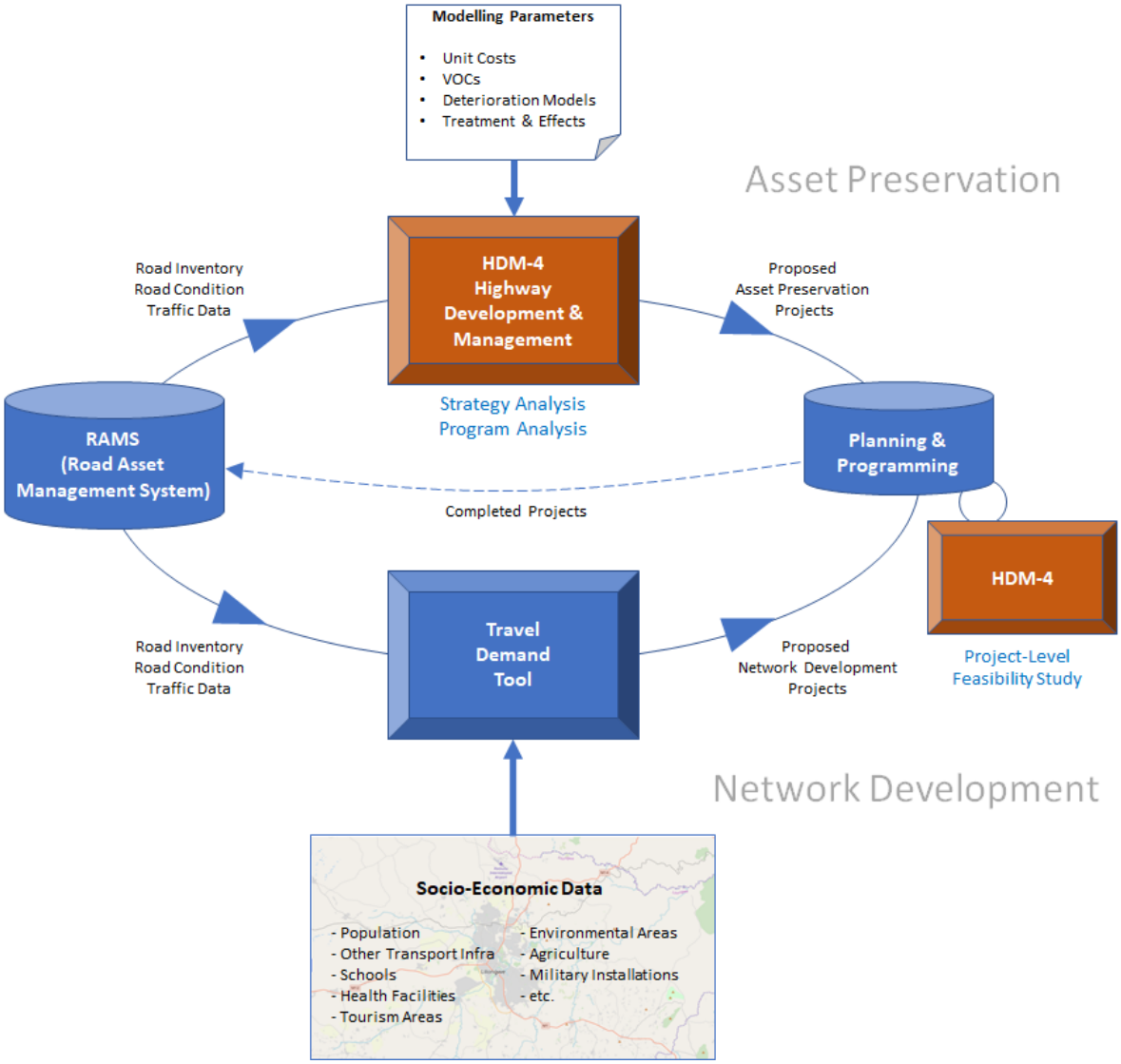


Figure A1: General Framework for Planning Systems and Tools in a Roads Agency

Asset preservation is concerned with the rehabilitation and maintenance of *existing assets*. Projects may include overlays, reseals of paved roads, regravelling of unpaved roads, etc. These may be

scheduled (at specific times or at regular intervals), or responsive (based on condition/traffic criteria). In order to budget and plan for the medium to long term, deterioration modelling can be used to predict the future condition of assets and to propose interventions. Sophisticated tools such as HDM-4 can be used for strategy analysis, to estimate future asset preservation needs for various categories of road, and for programme analysis to develop prioritised work programmes under different budget constraints. Different maintenance alternatives are typically drawn up for different classifications of road – primary, secondary, tertiary etc. Asset preservation projects are typically shorter in duration than network development projects.

Network development is concerned with expanding and improving the network. Network development projects may include construction of new roads, reconstruction of failed roads, widening of existing roads, upgrading from gravel to paved etc. The remit of the road agency is typically to develop and maintain the road network in line with national and/or regional development goals, while keeping the road network efficient, safe and of good quality. Preparation of network development plans is typically part of wider transport planning exercises which take into account regional development goals, existing and planned or forecast levels of population, social infrastructure such as schools and health facilities, other transport infrastructure, tourism zones, economic development zones, agriculture etc. Analysis and forecast of travel demand, including development of other transport modes, is a critical component of road network development planning. Long term transport and/or road network development plans are typically generated every 10 years or so, creating a pipeline of projects for further investigation, feasibility study, consultations, environmental impact assessment and mitigation, resettlement action planning, preliminary and detailed design etc. before construction commences. HDM-4 may be used at the feasibility stage to estimate costs and benefits of a proposed project over its life cycle.

Road Asset Management Systems (RAMS)

RAMS store data on road inventory and condition that are under the ownership or management of a roads agency. At the most basic level, a RAMS may include spreadsheet tools, although spreadsheets have severe limitations (on amount of data they can store and analyse, security, the ability to share data). At an early stage, roads agencies will reach those limitations and move to RAMS based on database technology. There are many commercial off-the-shelf database applications, designed for small to medium-sized agencies which are extensible and can be used by remote offices and also field operations (e.g. to conduct surveys and store results, to record maintenance activities or project information). As complexity grows, and as asset management principles become more embedded in the agency and responsibilities become more formal, the RAMS needs to evolve and consider other data and inspection regimes (including bridges, geotechnics, drainage, street lighting etc.). Advanced systems can incorporate real-time information from sensors (e.g. traffic sensors, slope failure, air quality, noise), and integrate incident management. However, even entry-level RAMS require significant effort to implement properly, and rely on the development of detailed policies and procedures, including quality assurance procedures, that in some LICs are lacking and which sometimes lead to implementations with very poor confidence in the coverage and quality of their data.

Highway Development and Management Tool (HDM-4)

HDM-4 is a tool which is used by many roads agencies, particularly in Low Income Countries (LICs) and Medium Income Countries (MICs). As indicated above, it can be used to analyse asset preservation alternatives and generate (proposed) asset preservation programs and plans. On the network development side, it can be used at feasibility study stage to estimate the economic costs and benefits

of a proposed individual roads project, by analysing vehicle operating costs and treatment costs over the predicted life of the asset. In the early stages of implementation, a roads agency will likely require consultancy input to run HDM-4 and generate asset preservation alternatives and program analysis, extracting and translating data from the RAMS and conducting confirmatory surveys to ensure confidence in the data. In the early years, it is likely that a roads agency will continue to use consultants to run HDM-4 on an annual basis to develop asset preservation programmes, but after a period of years may build up sufficient internal capacity to run it in-house. At the project level, HDM-4 may be mandated by the agency (and/or World Bank or other multilateral development bank), and used by consultants on the feasibility study. In order to develop asset preservation programs at the network level, data is normally extracted from the RAMS and imported into HDM-4. Some sophisticated RAMS implementations automate the preparation of *some* HDM-4 input files from RAMS data – including data on road inventory, condition, and traffic. However, HDM-4 is not capable of importing georeferenced data, and has no concept of storing or analysing population data either within the influence area of the road or outside the influence area of the road.

Rural Access Index (RAI)

The Rural Access Index (RAI) is an indicator used to measure rural accessibility. It is defined as 'the proportion of the rural population who live within 2 km of an all-season road'. The RAI was also adopted as the UN Sustainable Development Goal (SDG) 9.1.1 in 2016.

RAI is very much aligned with network development objectives, and in fact the motivation for any agency to measure RAI is linked to 'rural accessibility' being defined as a development goal of the country. It therefore tends to be more relevant for LICs and MICs, as many HICs have almost 100% RAI and so is less relevant to measure. RAI can be calculated using the data sets, tools and expertise that are already used for network development planning (in particular, road network mapping and population mapping). Geographic Information System (GIS) tools lend themselves very well to this type of analysis[1].

Also, as indicated above, asset preservation alternatives are typically drawn up for different classifications of road – e.g. primary, secondary, tertiary – or for different traffic bands - e.g. high, medium, low. Population data is not typically used in developing asset preservation strategies, and therefore is hardly ever found in RAMS implementations.

With regard to organisational mandates, the road network data used to calculate RAI typically comes from a number of different agencies – the national roads agency, the rural roads agency, and perhaps NGOs (non-government organisations) or community-based organisations. While many national roads agencies may use RAMS, many rural roads agencies do not (or, if they do, then they will likely use a different system from that of the national roads agency). Also, in many countries, rural roads agencies tend to be more district-based, and it is quite possible that there is no single entity in the country with a remit to consolidate district data into a national system. (Philippines, for example, has around 79 provincial road government offices, but the central Department of Interior and Local Government has no remit or system to consolidate these district data sets).

For the above reasons, it is not recommended to incorporate RAI in RAMS or in HDM-4. In fact, the RAI Supplemental Guidelines show how RAI can be calculated using GIS tools, using roads data from

[1] It is true that most RAMS implementations incorporate GIS, but this is primarily for purposes of displaying and analysing road centreline and related data – classification, inventory, condition, traffic, etc. These are the types of data that are included in RAMS for purposes of asset preservation, not for network development. Separate GIS analysis (of other transport infrastructure, schools, hospitals, environmentally sensitive areas) is always conducted outside the RAMS.

RAMS systems, and population and urban/rural boundary data from either the national statistical office or from on-line sources such as WorldPop. There would be little benefit to the RAMS or to HDM-4 of including population data in either.

Potential Uses of RAI in HDM-4

There are two main ways in which RAI could possibly be included in HDM-4, through **Multi-Criteria Analysis** (MCA) or **exogenous benefits**.

MCA provides a means of comparing project alternatives using criteria that cannot easily be assigned an economic cost. MCA is included in HDM-4 project analysis, and supports 9 criteria to evaluate:

- Economic (RUC, and NPV)
- Safety (Accident analysis)
- Functional (Comfort and Congestion)
- Environment (Air Pollution)
- Energy (Energy efficiency)
- Social (Social Benefits) *
- Political

Social benefits are already incorporated in MCA. RAI (or some variant of it, such as number of people for whom a given project would improve accessibility to an all-season road) could be included as a proxy for Social Benefit. The user in HDM-4 specifies the importance of each of the 9 criteria as the basis for project selection. Note that this functionality is applicable at the project level only in HDM-4. However, further investigation would be required to determine the impact in HDM-4 if any, and to produce guidance notes or additional documentation.

The other way of including improved accessibility in HDM-4 would be through **exogenous benefits**. Using exogenous benefits, improved accessibility could be assigned a monetary value, which would be included as a benefit in HDM-4 cost benefit analysis. The calculation of that monetary value would be performed outside HDM-4 and would be linked, for example, to the number of people for whom a given project would improve accessibility. Exogenous benefits (and costs) are associated with improvements to roads (rather than maintenance) and can be used at strategy, programme and project level. Further research would be needed to produce guidelines on assigning monetary value to improved accessibility.

None of the above methods would necessitate any changes to Road Asset Management Systems (RAMS) in order to implement them.

We note that UK DFID is currently funding a Business Case review of HDM-4 which aims to identify future enhancements/developments of HDM-4 (report due later this year). The WB has been consulted during the review.

Annex B: RAI Online Survey

The RAI online survey consisted of the following questions.

Q1.	Have you calculated the Rural Access Index (RAI) within the past 5 years? If so, please give the RAI value(s) and the year(s) of calculation.
Q2.	If you have calculated RAI recently, has it been formally included as part of your country's SDG reporting process?
Q3.	Please give a brief description of the methodology used to calculate RAI, including the date and source of road network data (e.g. from recent GPS survey, or from on-line mapping platforms), the date and source of population data (e.g. from national census, or from on-line sources), and how you interpreted the 'all-season' aspect.
Q4.	Is RAI included as part of any policies and programmes to improve rural accessibility in your country?
Q5.	Are you planning to calculate RAI in 2020? And if so, what methodology are you planning to use?

A summary of the survey is shown below:

2. Permissions and consent

Navigate: << #2. Permissions and consent >> All Pages

Please provide your consent if you wish to continue with the survey. Create Chart

		Response Percent	Response Total
1	I have read and understood the RAI privacy notice	100.00%	15
2	I consent to my survey responses and contact details being collected as detailed in the RAI privacy notice	100.00%	15
		answered	15
		skipped	0

Please provide your consent for us to contact you about the calculation and reporting of RAI in your country (this is not required in order to complete the survey). Create Chart

		Response Percent	Response Total
1	I consent to being contacted for the purposes of the RAI project	100.00%	13
		answered	13
		skipped	2

3. Contact details

Navigate: << #3. Contact details >> All Pages

Please provide us with your contact details:

		Response Total
Full name:	100.0% (15)	15
Your organisation:	100.0% (15)	15
Your role/position:	100.0% (15)	15
Country:	100.0% (15)	15
Email address:	100.0% (15)	15
Telephone number:	100.0% (12)	12
	answered	15
	skipped	0

4. Survey

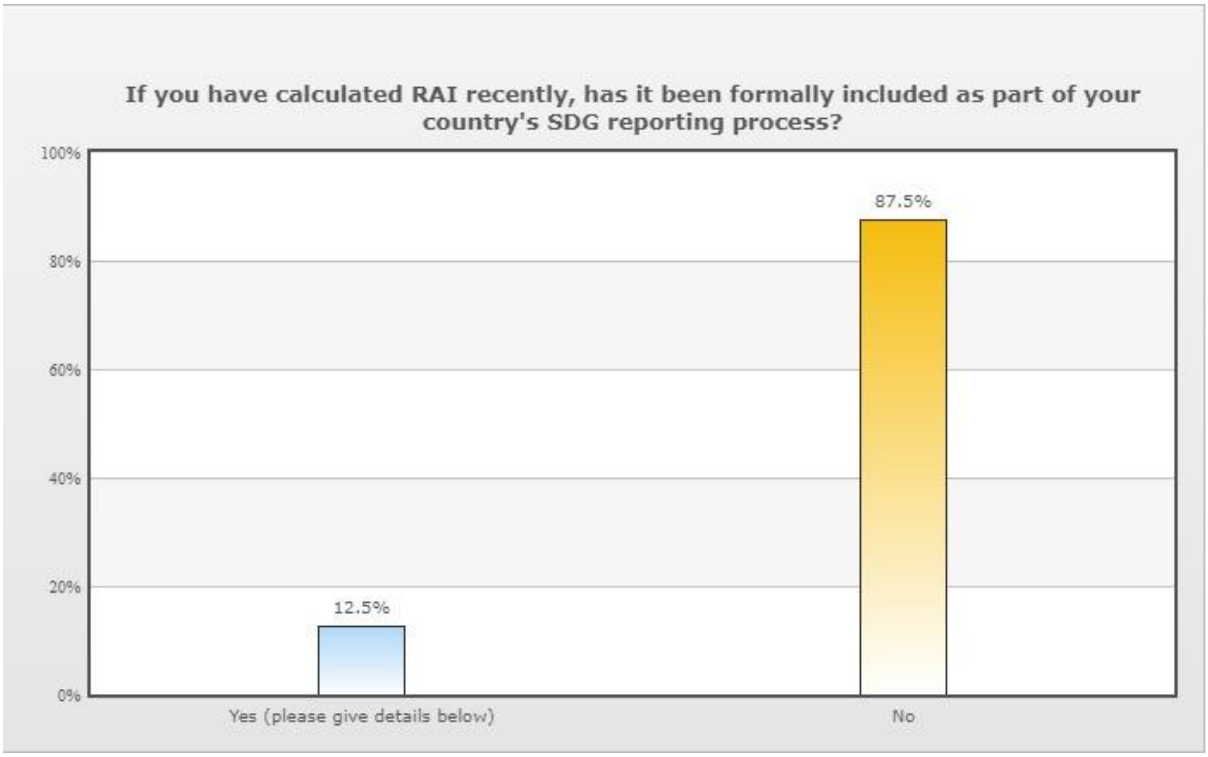
Navigate: << #4. Survey >> All Pages

1. Have you calculated the Rural Access Index (RAI) within the past 5 years? If so, please give the RAI value(s) and the year(s) of calculation. If not, please skip to Question 4.

		Response Percent	Response Total
1	View	100.00%	9
		answered	9
		skipped	6

2. If you have calculated RAI recently, has it been formally included as part of your country's SDG reporting process? Create Chart

			Response Percent	Response Total
1	Yes (please give details below)		12.50%	1
2	No		87.50%	7
Details of reporting process: (2) View				
			answered	8
			skipped	7



3. Please give a brief description of the methodology used to calculate RAI, including the date and source of road network data (e.g. from recent GPS survey, or from on-line mapping platforms), the date and source of population data (e.g. from national census, or from on-line sources), and how you interpreted the 'all-season' aspect. If you have produced a methodology document, please share it with us after completion of this survey by emailing it to: RuralAccessIndex@trl.co.uk.

		Response Percent	Response Total
1	View	100.00%	6
		answered	6
		skipped	9

4. Is RAI included as part of any policies and programmes to improve rural accessibility in your country? Please give details.

		Response Percent	Response Total
1	View	100.00%	13
		answered	13
		skipped	2

5. Are you planning to calculate RAI in 2020? And if so, what methodology are you planning to use? Please give details. If you have produced a methodology document, please share it with us after completion of this survey by emailing it to: RuralAccessIndex@trl.co.uk.

		Response Percent	Response Total
1	View	100.00%	14
		answered	14
		skipped	1

Annex C: Roadmap Programme

Annex D: Webinar Events

TG3 held two RAI webinar events as follows. Both events covered two sessoins

- Event 1: June 25th and 26th
- Event 2: June 29th and 30th

D.1 Attendees

Attendees at these events are listed in Table D.1 .

Table D.1 - Webinar Event Attendees

	Name of Attendee	Country and representation
	Event 1	
1	Alamgir Hossen	Bangladesh, Bureau of Statistics
2	Monzur Sadeque	Bangladesh
3	Mostafa Morshed	Bangladesh
4	Cecilia Escalante	RISE project, Tanzania (World Bank)
5	Christopher Ngwira	Zambia, Research and Development Unit
6	Manuel Tangale	Mozambique
7	Nkululeko Leta	ReCAP
8	Presley Chilonda	Zambia, Research and Development Unit
9	Chisomo Kauma	Malawi, Malawi Roads Authority
10	Rezaul Roni	Bangladesh
11	Michael Anyala	ADB
12	Annabel Bradbury	ReCAP Programme Manager
13	Robin Workman	TRL RAI Team Leader
14	Kevin McPherson	TRL RAI Technical Specialist
15	John Proust	TRL RAI Presenter
16	Zhao Wang	TRL RAI Video Editor
17	Moises Abdou	TRL International Division
18	Spencer Rigler	TRL Account Director for Overseas
	Event 2	
1	Joel Ndapandula	Namibia
2	Henry Nkwanga	ReCAP
3	Mark Henry Rubarenzya	Uganda
4	Sophie Tekie	Namibia
5	Matheus Naboth	Namibia

6	Emmerentian Mbabazi	Uganda
7	Lipumbu Ndapandula	Namibia
8	SMG950F	Not known
9	Rii	Not known
10	Francis Dimu	Malawi, Malawi Roads Authority
11	Alexander Blackburn	United Nations Economic Commission for Europe, Sustainable Development Division
12	Anne Joselin	UK Department for International Development
13	Annabel Bradbury	ReCAP Programme Manager
14	Dave Runganaikaloo	ReCAP Programme Manager
15	Robin Workman	TRL RAI Team Leader
16	Kevin McPherson	TRL RAI Technical Specialist
17	John Proust	TRL RAI Presenter
18	Zhao Wang	TRL RAI Video Editor

D.2 Clarification Questions

The following questions were received and answered during the webinars. We answered these questions live, re-recorded them during post-webinar to anonymise the questioners and to cut out background noise, and stitched them into the webinar videos prior to publication on the ReCAP website.

Module 3 RAI and Rural Development

Q1. How often is it recommended to report the RAI?
The recommended frequencies for calculation are given in the Supplemental Guidelines.

- For countries where there are major road construction or rehabilitation programmes, then it is recommended to be measured annually;
- For countries with rapid urbanisation, or where there has been conflict or economic disaster, or major natural disasters, then it should be measured every 2 years;
- For countries with RAI of 95% or more, every 5 years;
- All other countries, every 3 years

Module 4 RAI Data Sources

Q1. We have population settlement data with polygons. Will it be helpful to calculate the RAI?
Most NSOs publish their data in tabular form, nationally, and at the second level of administrative boundaries, and perhaps also at the level of the enumeration areas.

Few NSOs publish their data geographically (as polygons).

However, even if data is published as polygons at the level of enumeration area, then the shapes tend to be irregular. In urban settings, enumeration areas can be quite small, but in rural areas, they can be quite large (perhaps even up to 20 km square or more) and so are not suited for RAI calculation because they can't identify the population distribution within that 20 km.

WorldPop on the other hand generates data at 100 m squares, which is an ideal resolution for calculation of RAI.

By default, WorldPop should match with the second level boundaries within the country.

We advise that the NSO download WorldPop, compare it with their latest census data and projections and, if necessary, contact WorldPop to ask them if they can re-run their algorithms to generate a new data set reconciled at the lowest level possible (preferably, the enumeration area).

Q2. Which administrative boundaries does WorldPop use?
SDGs use the national boundaries of the FAO (Food and Agriculture Organization of the UN) Global Administrative Unit Layers (GAUL) dataset (FAO, 2015), which correspond to UN Member State recognised boundaries, and so WorldPop and RAI adhere to those national boundaries.

WorldPop currently publishes national data sets, it does not use or publish internal boundaries within a country.

Q3. Is there any issue with confidentiality of information and the ability to identify individuals or individual households at the 100 m square level with WorldPop data?
WorldPop produces a number of different data sets, including data disaggregated by age, sex, disability. For RAI purposes, we only use the population data, which is simply the number of people estimated to live within the 100 metre square, which has no confidentiality issues. With regard to other data sets, WorldPop uses data publishes by NSOs. NSOs would only release summary data at the level of the enumeration area for anonymity, so any WorldPop data for example for age or sex or disability would simply be estimates based from averages of the enumeration area, and hence three should be no confidentiality issues. WorldPop are contactable at www.worldpop.org if you need to know more information.

Q4. Do we need condition data on unclassified roads?
RAI doesn't distinguish between classified or unclassified roads. What matters is whether the road is all-season or not. There is usually very little condition data in a country on unclassified roads. We don't want to require countries to go and collect condition data unnecessarily on the unclassified network, therefore we introduced the concept of Accessibility Factors to give a broad-based assessment of all-season roads in a district or a region.

Module 5 RAI Case Study Malawi

Q1. Did Malawi calculate RAI for their Districts?
No. Within the SDG indicator framework, RAI is considered as a national level indicator.

We did recommend (and we discussed in webinar 3) that RAI be considered at the sub-national level as part of district-level policies. It would be very easy to calculate using the same process as shown in the Supplemental Guidelines. It's relevant to do that if RAI is considered as a policy indicator as it can help distinguish areas within the country that have different levels of accessibility.

Q2. If we have georeferenced census data, can we use that to calculate RAI?
Most censuses conducted nowadays tend to be georeferenced at the level of the household. Most NSOs don't release the georeferenced surveys outside the NSO because of privacy concerns about the ability to identify individuals, and so the lowest level of detail against which most NSOs publish data is the enumeration area. If the NSO wanted to calculate RAI "in-house" using georeferenced census data (i.e. not sharing georeferenced household data outside the NSO), then yes, it could be used.

Q3. Does QGIS offer a better platform than other GIS platforms for calculating RAI?
The reason we mentioned QGIS in these webinars and the Supplemental Guidelines is because it provides a free, open source desktop platform that is very capable of being used to measure RAI. It has all the basic GIS functions required. There are of course commercial off-the-shelf software packages that can be used, but some agencies don't have these commercial packages available. Part of the remit was to make calculation of RAI sustainable, so we demonstrated that it could be calculated using free, open source software, and QGIS worked well.

Module 7 RAI Future Direction

Q1. The Azavea RAI Measurement tool shows only 37,500 km of roads in Bangladesh, but Bangladesh currently has around 250,000 km of paved roads. Why are there so many roads missing?
The Azavea RAI Measurement tool is a default calculation based on OpenStreetMap data, in particular those roads classified as Primary, Secondary and Tertiary roads. OpenStreetMap contains many more additional roads, but they are not classified as Primary, Secondary or Tertiary, and so are not included in the default RAI.

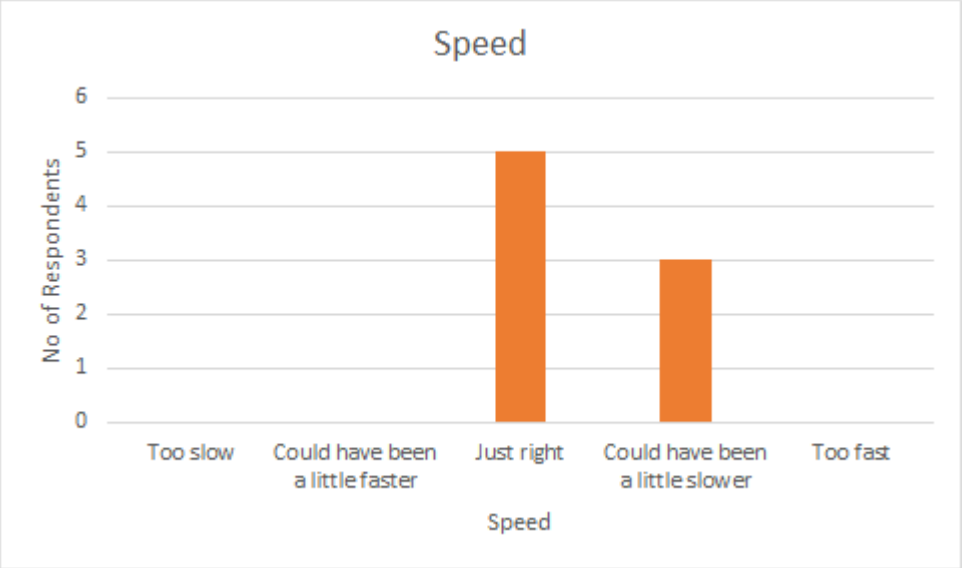
The RAI Measurement tool was designed to encourage countries to engage with the custodian, and to provide their own data where possible. So if Bangladesh can consolidate and make available its mapping among the different roads agencies, then RAI should be measured against the 250,000+ km of network.

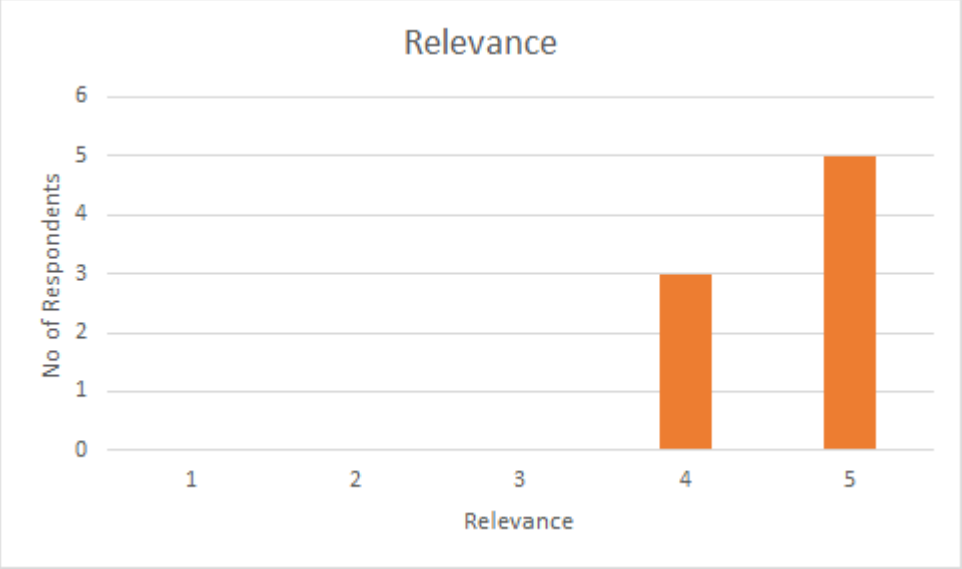
We would encourage roads agencies to update their road network mapping in OpenStreetMap, and to update the attribute data there to identify whether roads are paved or unpaved. Accurate mapping of the road network has many benefits for any country, and OpenStreetMap provides a good platform for consolidating and publishing that. But it is not necessary to update OpenStreetMap to calculate RAI.

D.3 Feedback Poll

We commissioned a poll at the end of each webinar. We received eight (8) responses in total. Overall the response was very good, participants were very happy with the quality, speed of delivery and content, and clearly came away with a good understanding of RAI. We believe this vindicates the decision to produce and publish videos that other interested countries can watch in future. Detailed responses are shown in Table D.12-2.

Table D.12-2: Responses to Feedback Poll

No	Question	Response
1	Was the webinar delivered in clear, concise English? with 1 star being difficult to understand, and 5 star being easy to understand.	
2	How did you rate the speed of delivery of the webinars?	

3	How did you rate the content of the webinars? with 1 star being 'not relevant', and 5 star being 'very relevant'	
4	Please indicate the two most important things you learned from the webinars	• Accessibility Factors; Geospatial Methods for Measuring RAI • Unified census block; Reconciling with WorldPop • Accessibility Factors; Differences in Methodologies • Accessibility Factors; Secondary indicators to complement RAI; RAI Measurement Tool to identify all-season roads • Importance of accuracy of road network data to measure RAI • Accessibility Factors • Importance of RAI; Use of open source tools to calculate RAI • Definition of RAI; Absolute Numbers for RAI
5	Did the webinar contain enough information on how to **calculate** RAI?	• 6 respondents replied 'Yes' • 1 respondent said, 'Not all detail was included, but the reference documents and guidelines provide enough information' • 1 respondent said, 'Overall very good, but more discussion on the classification of the road network was needed'
6	Did the webinar contain enough information on how to **publish** RAI?	• 5 respondents replied 'Yes' • 1 respondent said, 'Not all detail was included, but the reference documents and guidelines provide enough information' • 1 respondent said 'Yes, however countries may have different policies on how data is validated' • 1 respondent replied 'No'
7	Any other comments or suggestions on the webinars?	• 'The webinars are paced very well, and while some info is duplicated, it is useful to reiterate and allows users to view relevant webinar sessions rather than having to watch all 7 of them' • 'The case study could have included more details on the process of data collection'

Annex E: Summary of Progress in Selected Countries

Table E.1 lists progress in selected countries that TRL has had contact with under TG2 and TG3.

Table E.1 - Summary of Progress in Selected Countries

Country	Summary of Progress	Main Agencies
Bangladesh	Representatives from Bangladesh Bureau of Statistics (BBS) and Local Government Engineering Department (LGED) attended the RAI webinars on June 25th and 26th 2020. TRL held follow-up meeting with same representatives on July 22nd. Previous Bangladesh rural accessibility programs and indicators were based on connections to villages. There is an opportunity here, given availability of mapping and a clear understanding of what is all-season (they do not include earthen roads, or roads that are submerged for more than 1 week), to calculate RAI according to the WB geospatial methodology and supplemental guidelines. According to official statistics, Bangladesh has approximately 122,000 km of paved roads, of which 8,000 km are classed as 'not all-season'. It was noted too that OpenStreetMap for Bangladesh (primary, secondary, tertiary) represents only 37,750 km, therefore the 'default' data reported on the Azavea toolset is likely to significantly under-represent RAI. Coordination between LGED and BBS is key for calculation and publication of RAI as part of the SDGs. Subsequent to the meeting on July 22nd, TRL prepared a draft email to Director General of BBS on behalf of LGED requesting memorandum of understanding between BBS and LGED to assign responsibilities and support for calculation and publication of RAI.	Bangladesh Bureau of Statistics Local Government Engineering Department
Costa Rica	Costa Rica responded positively to the online survey conducted by TRL in February 2020. TRL held several discussions with staff from the Ministry of Environment, Energy, and Telecommunications from May to July 2020. Those staff were able to provide shapefiles and links to online web mapping services. However, the data provided did not indicate whether the roads are all-season or not, nor whether they are paved or unpaved. Also, the Ministry have so far been unable to confirm contacts with the national statistics office on policy with regards to publication of SDGs, or urban/rural definitions.	Centro Nacional de Informacion Geoambiental

Country	Summary of Progress	Main Agencies
Ethiopia	TRL had several communications with the Ethiopian Roads Authority (ERA) and a local GIS consultant in June and July 2020 with regards to measuring RAI. The local GIS consultant sent several versions of shapefiles. It quickly became apparent that the data sent represented a shortfall of around 33,000 km of rural roads from official statistics. TRL advised that ERA look into collecting mapping data for their recent rural roads programme before calculating RAI, since this is likely to make a significant difference to the final RAI estimate.	Ethiopian Roads Authority ERA Planning and Program Management Directorate
Ghana	Ghana was one of the pilot countries under TG2. The TG2 Final Report gave status at that time (our contacts in the Feeder Roads Department (FRD) in Ghana were unable to provide data on the national road network in time for calculation of RAI under TG2). TRL followed up with Ghana under TG3, but our contacts in the FRD were still unable to obtain data for the national road network. Representatives from Ghana did attend an RAI webinar in June 2020.	Feeder Roads Department
Ireland	TRL liaised with Transport Infrastructure Ireland (TII) and its Road Management Office (RMO) in May to July 2020. The TII and RMO liaised with the Irish Central Statistics Office (CSO). All the building blocks of data exist with which to calculate RAI, and Ireland is keen to calculate and publish it as an SDG through the CSO. Ireland is also a member of UNECE and it would be good to increase the number of UNECE countries that have calculate RAI. The RMO has up-to-date and accurate mapping of the road network, which is almost entirely paved and regarded as 'all-season'. The CSO also publishes population data at 1 km^2 which might be considered as a source of population data for RAI calculation, although TRL advised on 22nd July that it would be a good opportunity to compare with WorldPop 100 m^2 data. TII and RMO will continue to liaise with the CSO.	Road Management Office Transport Infrastructure Ireland Irish Central Statistics Office
Malawi	Malawi was one of the pilot countries under TG2. TG2 calculated RAI for Malawi in 2019 as 63%, but also made recommendations for improved accuracy. Malawi Roads Authority (MRA) provided up-to-date national road network data, and worked with Malawi Ministry of Transport (MOT) and Malawi NSO to endorse RAI calculation.	Malawi Roads Authority Ministry of Transport Malawi National Statistical Office
Myanmar	Myanmar was one of the pilot countries under TG2. TG2 calculated RAI for Myanmar in 2019 as 62%, but identified that there was variable quality in coverage and accuracy of data, and made recommendations for	Department of Rural Development

Country	Summary of Progress	Main Agencies
	Department of Rural Development (DRD) to consolidate their mapping in order to calculate and publish an official RAI figure.	Myanmar Central Statistical Organisation
Namibia	Namibia showed interest in measuring RAI from March 2020, and two calls were held to explain the details and requirements. Namibia were able to confirm that they have good and recent road network data and had previously considered measuring RAI. Four representatives from the Roads Authority in Namibia attended the RAI Webinars.	Namibia Roads Authority Namibia Statistics Agency
Nepal	Nepal was one of the pilot countries under TG2. TG2 calculated RAI for Nepal in 2019 as 66%, but identified that there was variable quality in coverage and accuracy of data, and made recommendations for roads agencies to consolidate their mapping in order to calculate and publish an official RAI figure.	Department of Local Infrastructure Department of Roads Central Bureau of Statistics National Planning Commission
Paraguay	The national statistical office in Paraguay responded positively to the online survey conducted by TRL in February 2020. TRL sent the Supplemental Guidelines in Spanish (draft Spanish version) in June 2020. Subsequent follow-up by TRL in July 2020 referred to the Planning Directorate in the NSO in charge of monitoring SDG indicators, however no further follow-up has been possible since the respondent did not provide an email address for the Planning Directorate.	National Statistical Office
Tanzania	Tanzania showed interest in measuring RAI, and were able to confirm that the national and rural road networks were consolidated into one mapping platform (DROMAS2, managed by TARURA) in GIS.	TARURA TANROADS
Uganda	Representatives from Uganda National Roads Authority (UNRA) attended RAI webinar on June 29th and 30th 2020. TRL held follow-up meeting with representatives from UNRA and Uganda Bureau of Statistics (UBOS) on July 22nd. UNRA does tend to have good mapping data available, at least for the national network of around 20,000 km, however only around 4,500 km of the national network is paved, and it is understood that there can be accessibility issues on the unpaved network during rainstorms.	Uganda National Roads Authority Uganda Bureau of Statistics

Country	Summary of Progress	Main Agencies
	TRL suggested using accessibility factors to assess risk of flooding, in a similar approach to Malawi and as shown during the webinars. It is known that UNRA typically conducts central annual maintenance workshops with representatives from all districts, which would be a good opportunity to hold a workshop on accessibility factors with district engineers. UBOS indicated that Uganda is planning household surveys later in 2020, with an explicit question on 'distance of the household to the nearest all-season road'. This could be an opportunity to compare methods to calculate RAI. TRL met with Uganda Bureau of Statistics (UBOS) and Uganda National Roads Authority (UNRA) on August 4th 2020 to discuss progress on intended calculation of RAI for Uganda. UBOS and UNRA are committed to calculating RAI and incorporate it into their existing SDG reporting; also to include it as an indicator for rural development planning. TRL made recommendations on road network data sources (including potentially the latest release of Facebook 'MapWithAI' data), and UBOS investigation of WorldPop as a data source; also suggested involving the National Planning Authority (NPA) in discussions, and discussing responsibilities for RAI calculation with Ministry of Works and Transport which has overall responsibility for district roads.	
Vietnam	TRL discussed RAI with representatives from World Bank Vietnam office in December 2019 at the ieConnect conference in Marrakesh, and forwarded to World Bank (RAI custodian) a report that had been produced in Vietnam in 2017. The methodology seemed slightly different from that of 'true' RAI (e.g. it talks of 'all-weather' roads instead of 'all-season'). The report estimated an RAI of 86% in 2017, and also referenced a Vietnam Living Standard Measurement Survey in 2012 which had also estimated 86%. It appears that this figure has not yet been published as SDG 9.1.1. for Vietnam.	World Bank country office

Annex F: Working Group Minutes

RAI Working Group Meeting Minutes
29th April 2020

Attendance:-
WB: Adam Diehl (AD), Tesfamichael Nahusenay (TN), Trevor Monroe (TM)
DFID: Anne Joselin (AJ), Alfred Alsop (AA)
ReCAP PMU: Annabel Bradbury (AB), Joseph Haule (JH)
TRL: Robin Workman (RW), Kevin McPherson (KM), Spencer Rigler (SR)
ADB: Michael Anyala (MA)
AfDB: Girma Bezabeh (GB)
Azavea: Ross Bernet (RB)
UNSD: Ronald Jansen (RJ)

Apologies: Umar Serajuddin (DEC), Brian Blankespoor (DEC), Jeremy Aguma (AfDB), Richard Malinga (AfDB), Muneeza Alam (WB), Mohammed Alsayed (IsDB), Matthew Steel (ONS), Alistair Edwardes (ONS), Jamie Leather (ADB), Joseph Haule (ReCAP PMU), Andy Tatem (WorldPop), Heather Savory (UN GWG)

1. **Response to Actions of Previous Minutes – Annabel Bradbury (AB)**
   1. TM had a meeting with the Data4Now team and TN's team, a team in Paraguay may use methods developed by the group to monitor RAI in Paraguay. TM shared with them the WB documents and 2016 methodology (Paraguay also responded to the RAI survey conducted by TRL under TG3).
   2. TN joined the call and we proceeded to discuss the World Bank's 2020 RAI initiative based on a digital platform architecture – please see item 4 in the agenda for feedback from the World Bank.
   3. There was no time to discuss the other action points from the last meeting.

2. **Update on Roadmap and Policy Guide and country RAI survey (RW/KM)**
   1. RW presented progress on the RAI project, including an overview of the draft Policy Guide and Roadmap that was circulated in March, the scientific paper submitted to World Development and other deliverables. He asked all participants to provide feedback as soon as possible so that the report can be finalised. Also included an overview of the planned webinars and support to countries. TRL will liaise with ReCAP to prioritise any support.
   2. The Roadmap and Policy Guide includes comparison of ranges of RAI by continent, using the Azavea RAI measurement tool using open source data (not ratified by countries). TRL suggests further research be undertaken to include groupings by other attributes such as countries with extreme terrain, archipelago countries, or countries where sea lanes or inland waterways play an important part in transport.
   3. Presenting the RAI by absolute numbers rather than % is more impactful at a country level and can help governments with planning and prioritisation of rural road investment.
   4. TRL highlighted a lack of understanding in some quarters about the role of RAI and its relation to other indicators. RAI is only one of a set of indicators, it should not be discussed

in isolation. The Global Roadmap of Action (SuM4All) puts RAI in the context of other indicators as part of a multi-sectoral approach to rural development – including access to health, education etc. – and transport services and usage.

5. RAI is also part of a wider set of statistical systems both national and international. There is a complex network of practitioners, custodians and partner agencies. A consistent methodology would really benefit the uptake of RAI. Including RAI components in donor programmes would help with embedment.
6. TRL have also conducted a country survey to get a more complete picture of which countries already collect RAI data. It was noted that some countries collect RAI, but do not publish it as SDG Indicator 9.1.1.
7. There have been 10 completed replies from countries globally – Ecuador, Sierra Leone, Costa Rica, Bangladesh, Solomon Islands, Afghanistan, Paraguay, Panama, Cambodia, Ethiopia
8. TRL plan to prepare video material for webinars for calculating RAI data over the next month.

3. Discussion on Potential Uses of RAI in HDM-4 (KM)

1. KM presented the thought paper on HDM-4 and RAI, which had previously been circulated to the WG. Could include RAI in HDM-4 through multi-criteria analysis to compare project alternatives. Also costing/quantifying the benefits of upgrading a road through improved accessibility, and incorporating those into HDM-4 using exogenous benefits.
2. Some proposals could be put forward through the HDM Global committee with agreement from the World Bank.

4. UN GWG Hosting RAI Tool on Global Platform (RB)

1. Ronald Jansen leads the team on data innovation and capacity development at UNSD in New York.
2. The Global Platform (GP) wants to do more on SDG issues, including SDG 9.1.1
3. UK ONS have provided resources for the GP for the past two years, and UNSD will take over services on the platform from 1st June 2020. The GP will still continue to be supported by UK ONS, UNSD, Canada and Netherlands statistical offices. Ownership is to be retained by the community of practice, using a cloud-based platform hosted by UNSD going forward. Several large commercial groups are contributing through provision of tools, services and data.
4. They are still keen to include as much SDG work as possible, especially 9.1.1. and would like to explore with Azavea to get the RAI calculation tool onto the platform.

Action: Azavea and ReCAP to provide RAI tool and text for publishing on GP, and links to the World Bank Data Catalog

5. WB Data Catalog hosting the RAI Supplemental Guidelines (AD)

1. AB thanked WB for publication of the Supplemental Guidelines on the World Bank Data Catalog: https://datacatalog.worldbank.org/dataset/rural-access-index-rai
2. TRL provided information on RAI and HDM-4 for the WB (also provided to the working group).
3. TN 2020 RAI initiative. The World Bank have commissioned a software engineering firm Development Seed to develop a 'Conflation Engine' to collate data from different sources, including OpenStreetMap and data from various Road Asset Management Systems (RAMS)

from national road agencies. They expect a beta version of the tool to be provided in the public domain by end June 2020.

4. The Conflation Engine takes data from various sources (including OpenStreetMap and any RAMS in a country) and combines the data to try to get a more complete assessment of network inventory and condition. It is recognised that OpenStreetMap will never be 100% accurate, and that in many countries there is no 'RAMS' for rural roads or village roads, but combined with OpenStreetMap it increases the reliability of the data. This is being trialled in Paraguay and Zambia and is involving Data4Now.
5. KM commented that in his experience georeferenced data is often not provided with RAMS – RB also mentioned that Azavea were unable to calculate the RAI using RAMS data. TN noted that there are examples of RMS systems using georeferenced data, for example iROADS, which was used (by TRL) for the DFID funded Nigeria Infrastructure Advisory Facility (NIAF). However, iROADS was used to collect data for national roads rather than provincial, or rural district roads. TN commented that World Bank country clients are being encouraged to move to georeferenced databases in their RMS systems.
6. RW noted that it was also an aim of the RAI project to not put a burden of additional data collection on countries who have limited resources, and to find the best available datasets at country level. The experience from the four trial countries had highlighted the problems with data, so the conflation engine could be a useful tool to help feed into RAI calculations.
7. KM noted that Facebook (Data for Good programme) recently released a tool that interprets satellite data to identify roads (vectors), compares that with OpenStreetMap, and highlights suggested roads for update to OpenStreetMap. This may be useful in providing an estimate of level of confidence of the coverage and quality of data in OpenStreetMap. RB is discussing this and other matters with Facebook, and will report back any relevant discussions.
8. TM noted that there is a new classification of urban/rural boundaries called DEGURBA, which categorises urban, semi-urban and rural areas. KM noted that TRL were aware of this and included references to it in the RAI Final Report for TG2.

Action: Tesfamichael Nahusenay to provide the working group with the ToR for developing the conflation engine and to update the WG on the tool, how it will work and how it will be implemented.

Action: Ross Bernet to feedback on discussions with Facebook taking place on 29th April.

6. **AfDB as Partner Agency for SDG 9.1.1 (US)**
   1. GB explained that he had spoken with US from the World Bank about accepting the role of partner agency to support the World Bank as custodian agency, but there were still internal discussions within the AfDB required before final approval is provided.
   2. There may be cost implications for being a partner agency, related to support to countries for providing RAI data for the global SDG indicator database.
   3. Once a decision is made by AfDB, the process is very straightforward, with US requesting that the IAEG-SDGs include them as a partner agency by email.

Action: AfDB to update ReCAP on their status as partner agency.

7. **Next steps for the RAI/SDG 9.1.1 and scaling up (RW)**

1. Next steps are for TRL to engage with 3-5 countries and investigate how they collect RAI data, so as to add to the list of countries (currently 34) that have collected RAI data since the 2016 methodology.
2. TRL plan to undertake a series of digestible webinars – circulate training materials, providing FAQs, and running live webinars, and then providing a suite of videos to be disseminated via the ReCAP YouTube website.
3. They are also discussing the translation of the Supplemental Guidelines into Spanish with ReCAP (the Guidelines are already available in French).
4. RW mentioned that the Sum4All 'Online Tool toward Sustainable Mobility' includes RAI data, but only results calculated pre-2016.

8. AOB

- A recommendation of the Roadmap and Policy Guide is that the World Bank (as custodian) update the UN SDG metadata to also refer to the 2019 Supplemental Guidelines. TRL have provided a recommended update to the SDG 9.1.1 metadata to reflect the Supplemental Guidelines, which should be considered by the World Bank.
- ReCAP also recommend that the UN E-handbook on SDGs be updated with the Supplemental Guidelines to support the 2016 methodology.
- AB also mentioned recent publication of ReCAP report on the scoping study for SDG 9.1.2 (passenger and freight volumes).

Action: ReCAP to propose these recommendations to IAEG-SDGs through Umar Serajuddin

Annex G: ReCAP Completion Report

Logframe Indicators (Note: The purpose of this Section of the CR is to summarise the extent to which this activity has contributed to the ReCAP's higher level objectives. Where response is YES supporting documentation is required separate to the report)				
Outcome	Question			*Response (Underline Answer)*
Sustainability	1.1 Did this project lead to any concrete examples of change, influenced by ReCAP research that will be applied to Km of road?			1. YES. World Bank is expected to accept the supplemental guidelines developed under this project and link them to the existing SDG 9.1.1 methodology. These supplemental guidelines shall form the basis for any future RAI / SDG 9.1.1 efforts. 2. The ability to calculate RAI at regional, national, sub-national and project-level, plus a renewed emphasis on absolute numbers of people 'disconnected', are important examples of helping to promote the use of RAI in policy, which should also promote calculation and embedment. It is anticipated that all of these efforts will help RAI become a mainstream indicator and help it move towards Tier I status.
	1.2 Were Partner Governments and/or other financiers involved in co-funding this research?			3. YES, Local governments were involved through Contributions in Kind (K) 4. Essentially this included arrangement and partial funding of meetings and workshops via T&S etc. All trial country governments contributed (K).
	Type of Contribution: K – Funding of Trial Sections, Staff Time, Dissemination and Training C - Funding of Research Programme Core Costs, Research Contracts, Capacity Building and Knowledge Management	Value of Contribution (in £ m)	Source:	

Research and Uptake	Were any Peer-Reviewed Papers made available in open access format generated due to the implementation of this project?	1. YES, papers were produced for PIARC (only one published) and one for Africa GIS. The scientific paper is ready for submission.
	1.3. Were any National Policies, Manuals, Guidelines and/or final research outputs been fully incorporated into Governmental/Ministerial Requirements, specifications and recommended good practice as a result of engineering research conducted during this project?	1. NO. We expect the supplemental guidelines to be incorporated into the custodian framework for RAI measurement. 2. African Union, are interested in including RAI as an annex to their rural roads policy, which could have a significant impact, TRL is continuing to follow up.
	1.4. Were any National Policies, Regulations and/or practises for Rural Transport Services been modified or introduced as a result of this project?	1. YES. Custodian accepted and published the Supplemental Guidelines on the Data Catalog, and a process is in place to include RAI in policy for African Union and ADB, and on the UNEP and UNECE websites.
Capacity Building	2.1. Did country-based African/Asian experts or institutions take lead roles during the implementation of this project? Name / Nationality / Position	1. NO
	2.2. Was this project managed through a National Research Centre (NRC) and supported by ReCAP funding for technical assistance and capacity building?	1. NO: But country-based research centres did act as counterparts
	2.3. Were female researchers involved in providing inputs at a senior technical level?	1. YES. Sritika Choudhury (TRL) advised on Sensitivity Analysis for the project.
Knowledge Dissemination	3.1. Did this Activity result in a National Research Centre (NRC) being Linked to an electronic repository for rural transport Knowledge?	1. Not Applicable
	3.2. Did this project Generate Knowledge Presented and discussed at a high-level international development conference or debate?	1. YES. Workshop held at PIARC WRC2019 conference and poster session for RAI: October 2019. 2. Other events & seminars: a. TT19 workshop: Washington DC, January 2019 b. IRIM conference: Nepal, February 2019 c. 5th International Conference on Big Data for Official Statistics: Kigali, Rwanda May 2019Rwanda UN Big Data Conference: April 2019

		d. GIS Africa event: Kigali, Rwanda, November 2019 e. SSATP: presentation at the Specialised Technical Session on Sustainable Transport at SSATP AGM, Zimbabwe, November 2019 f. ieConnect Impact Evaluation Workshop: Marrakesh, Morocco December 2019 g. Meeting with World Bank at TT20: Washington DC, January 2020
	3.3. Was the knowledge generated by this project disseminated through workshops or dedicated training?	1. Workshop at ReCAP IRIM conference in Nepal February 2019 attended by more than 100 persons
		2. Workshop in Malawi in September 2019 attended by 20 persons (including representatives from Ghana) 3. PIARC workshop in Abu Dhabi October 2019 attended by more than 50 persons 4. Training also provided through country visits 5. Two separate webinars held in June 2020 for Bangladesh and Uganda, with participants from other countries joining.