



AfCAP
Africa Community Access Partnership



The use of appropriate high-tech solutions for road network and condition analysis, with a focus on satellite imagery

Progress Report No. 1



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AFRICA COMMUNITY ACCESS PARTNERSHIP (AsCAP)
Safe and sustainable transport for rural communities

AfCAP is a research programme, funded by UK Aid, with the aim of promoting safe and sustainable transport for rural communities in Africa. The AfCAP partnership supports 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 programme follows on from the AFCAP1 programme that ran from 2008 to 2014. AfCAP is brought together with the Asia Community Access Partnership (AsCAP) under the Research for Community Access Partnership (ReCAP), managed by Cardno Emerging Markets (UK) Ltd.

See www.research4cap.org

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Airbus DS

Acronyms, Units and Currencies

AfCAP	African Community Access Partnership
AfDB	African Development Bank
CERSGIS	Centre for Remote Sensing and Geographic Information Services
ESA	European Space Agency
GIS	Geographical Information System
GPS	Global Positioning Satellite
HIC	High Income Country
IoT	Internet of Things
IQL	Information Quality Level
IRI	International Roughness Index
LIC	Low Income Country
LIDAR	Light Detection and Ranging
LVR	Low Volume Road
PMU	Programme Management Unit
RAMS	Road Asset Management System
RCMRD	Regional Centre for Mapping of Resources for Development
ReCAP	Research for Community Access Programme
SAR	Synthetic Aperture Radar
UAV	Unmanned Aerial Vehicle
UK	United Kingdom

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1. Executive Summary

This progress report confirms the production on previous deliverables and assesses the progress during phase 2, which is the research trials part of the project.

The main activities undertaken so far in phase 2 are:

- The confirmation of partner countries Uganda, Zambia and Ghana, plus the firm interest of Kenya, who are yet to fully commit.
- Initial visits to Uganda and Zambia to assess capacity, identify areas of interest for the surveys, commit resources, plan ground truthing surveys, assess and plan training, identify potential high-tech solutions for each country and agree a way forwards.
- Initiation of the procurement of satellite imagery for Uganda and Zambia.
- Revision of methodology to suit the existing processes in each country.

During phase 2 the project has progressed, but is slightly behind schedule, mainly due to the delay in Kenya being able to commit to the programme and the delay in production of the peer review.

There have been challenges for countries to commit resources at short notice, as the partner countries have not had time to include the costs in their annual budgets. The situation on the ground varies, with varying levels of responsibility for rural roads and therefore ability to include these in the project, as well as varying standards of mapping and abilities to carry out condition surveys. It has also been a challenge to select an area that has a full range of conditions, from very poor to very good, which is required for calibration of the system.

It may also still be possible to include other countries such as South Sudan and Malawi, at least in the training aspects of the project, if they show interest and commitment.

2. Introduction

This project is designed to look to the future for road management in Africa and explore different and innovative solutions to well established problems. It is a regional project that is expected to work with at least four countries; so far those identified are Ghana, Uganda and Zambia, whilst commitment from Kenya is pending. The project started on 25th April 2016 and is due to complete in May 2017.

The confirmed partner agencies are:

- Uganda – UNRA, with support from Makerere University
- Zambia – RDU, with support from the NRSC Zambia
- Ghana – Ministry of Roads, with support from CERGIS

For this project it was necessary to define the problems facing road management in Africa today that could be impacted by this research. Those can be summarised as:

- Lack of knowledge of the low volume road network
- Insufficient information upon which to base planning and maintenance decisions
- Insufficient resources to collect and process the necessary information outlined above

The satellite assessment aspect was borne out of the research undertaken in Nigeria to map and assess the condition of rural, unpaved roads. The main principle of that research was to test the feasibility of using satellite imagery as a way to avoid on-the-ground surveys in an area that is heavily

involved in conflict and where many areas are too dangerous to visit. This research builds on that by testing the methodology in the real world situation using local systems and processes, with the aim to produce a guideline to the most cost effective methodology for carrying out this process. Other high-tech solutions will also be explored as appropriate.

The inception report set out a slightly revised staff input programme and a revised payment schedule, both of which were accepted. There were no major comments on the ToR and the programme remained as per the consultant's proposal.

This progress report sets out the status of Phase 2 of the project, which is the trials phase where the methodology is being tested in the field.

3. Background

This project is expected to lead to alternative, cost-effective methods to support asset management through enabling countries to gain a better understanding of their rural road networks and to be able to make more informed decisions on the funding for maintenance and management of those networks. In addition to this the project is expected to develop a method for using cost-effective satellite imagery to assess the condition of roads, following on from previous research undertaken in Nigeria in 2013. We have liaised with the other regional AfCAP projects on asset management and climate resilience and recommendations are made later in this report.

The project objectives as stated in the ToR are to provide a cost-effective and reliable high-tech solution for the capture of management data related to inventory and condition of a country's rural road network. The project is also expected to enhance the capacity of relevant partner-country Road and Transport ministries, departments and agencies in the key areas covered by the project. In line with the ReCAP guiding principles the project is expected to incorporate a process for keeping relevant agencies fully informed on project outcomes and how these outcomes can be cost-effectively utilised in normal practice.

An extensive literature review has been undertaken which has uncovered a large amount of previous research in the areas of remote sensing to establish knowledge on rural road networks, as well as research and practical experience in other high-tech areas of road knowledge and management that could be applied in the African context.

4. Progress to date

4.1 Summary

This is the first progress report and, along with progress report no. 2, is designed to monitor progress through the pilot phase of the programme. So far the Inception report, Desk Study report and initial peer review were completed in Phase 1. The Peer review was carried out on the Desk Study report by the Satellite Applications Catapult, as an initial check to ensure that the project was on the right track. The main peer review will be at the end of phase 2. This progress report covers the main activities during phase 2.

There have been some delays in completing Phase 1; initially in finalising the desk study report but mainly in the Peer Review. The delays were due to a protracted contracting period between TRL and the peer reviewers Catapult, plus availability of Catapult staff to carry out the review.

It was proposed and agreed that the initial country visits would go ahead before the Peer Review was complete, in order to maintain progress. It was decided that the ground truthing could be

planned as part of these visits as this would be carried out using local resources and as far as possible using the established methodology in each country. It was therefore not influenced directly by potential comments on the desk study report.

The main aims of Phase 2 are shown below in Table 1.

Table 1 - Summary of Phase 2 Aims

No.	Aims of Phase 2	Actions
1	Feedback from Peer Review	Adjust methodology based on feedback
2	Confirm partner countries	Gain firm commitment of partnership
3	Make initial visits to each country	Identify teams, areas to be surveyed, maps, other partners and training needs, identify high-tech solutions to be trialled
4	Pilot high-tech solutions	Countries to seek funding for research, undertake identified pilots
5	Ground truthing condition surveys	Confirm maps, carry out condition surveys
6	Background training in country	Train all team members to be competent with GIS
7	Revise methodology	Establish rules and criteria for condition assessment
8	Identify imagery required	Identify satellite imagery and start to procure from various sources

4.2 Expected progress

By the progress report date it was expected that the following activities would have taken place:

- Inception report submitted and approved
- Desk study report submitted and approved
- Partner countries confirmed and local resources committed.
- Peer review submitted and reviewed.
- Initial visits undertaken to all partner countries
- Some high-tech solutions identified and funding sought

4.3 Activities undertaken

The following activities have been undertaken since the start of the project.

4.3.1 Inception Report

This was submitted on time in May 2016.

4.3.2 Country Selection Report

This was submitted early so that the desk study could confirm the characteristics of the potential partner countries. Four main partner countries were selected, with some others left as possibilities if the original countries were unable to commit the resources. So far three have committed, which include Ghana, Uganda and Zambia, with Kenya yet to commit, if Kenya cannot commit then Tanzania will be invited as the alternative. In addition the participation of South Sudan and Malawi was considered and these countries can still potentially fulfil a role if they are able to provide staff and resources.

4.3.3 Desk Study Report

This was submitted two weeks later than scheduled. There were a number of reasons for this, including the workload of the consultant which was hampered by other projects (including AFCAP projects) being delayed and causing a backlog of work in July.

4.3.4 Peer Review

The first part of the Peer Review was completed on 20th September by the Satellite Applications Catapult, approximately 2 months behind schedule. This was delayed due to the late submission and approval of the desk study, plus procurement issues and availability of the peer reviewer. The peer review has been passed to the ReCAP Technical Manager for comment.

4.3.5 Initial partner country visits

Initial visits have been made to Uganda and Zambia, a detailed report of these can be seen in Annex H. These visits took place on the following dates:

- Uganda was visited between 4th and 8th September 2016
- Zambia was visited between 9th and 15th September 2016

A visit is planned to Ghana from the 25th to the 30th September 2016. At present Kenya has not confirmed their participation in the programme so a visit to Kenya is still pending.

These visits involved meeting the main stakeholders in the project, for example:

- AFCAP coordinator
- Project team in the host organisation
- Remote sensing specialist partners who will be involved in the training
- Other potential partners or donors

The main aims and progress of the initial visits are shown in Table 2:

Table 2 – Aims and Achieved Actions

Aims of initial visits	Achieved actions
Present the project and meet the main stakeholders,	This was achieved in Uganda and Zambia.
Become familiar with the existing system of condition assessment in each country	This was achieved through the field visits and by talking to the staff responsible for condition

	assessment surveys.
Assess the existing system against that proposed in the desk study report	This process has started and is ongoing
Carry out a field visit to assess potential roads/networks for the study	This was undertaken in Uganda and Zambia, and is planned for Ghana
Identify the geographic area to be trialled in the pilot phase	This has been identified for Uganda and Zambia, see Annex H
Plan ground truthing/condition assessment in line with country practices	These plans have been made for Uganda and Zambia, in-car dashboard cameras were provided from the project and training was given in their use, see Annex H.
Make a plan/programme for ground truthing	This has been planned for Uganda and Zambia, see Annex H.
Identify suitable organisations to carry out background training	The local partners identified so far are Makerere University for Uganda and National Remote Sensing Centre for Zambia
Identify an image interpretation team and assess their capacity.	This was finalised in Uganda and most of the team have been selected for Zambia.
Determine background training necessary to be carried out by local partners	This has been initiated in Uganda and Zambia and will be finalised by the partners themselves
Programme the background training	A tentative training plan has been made for Uganda and Zambia, see Annex H
Identify a potential date for specialist training by the consultants	A tentative date has been identified for Uganda and Zambia, see Annex H
Initiate a search for available imagery or plan a tasking mission to collect imagery for the trial area.	Searches have been initiated for both areas in Uganda and Zambia

4.4 Challenges

- Kenya is finding it hard to commit resources to the project as the project was not active in time for them to include the costs in their annual budget. Kenya has recently committed to the project and an initial visit is planned in early October 2016.
- South Sudan was interested to participate, but the present conflict has precluded their involvement. However, Uganda has agreed that South Sudan could send a participant to the training in Kampala and it could be possible to carry out a joint research area. This will be further explored.
- Malawi was also interested, but Zambia was selected ahead of them, mainly due to the presence of a local remote sensing centre and a firm commitment for funding. However, as above it would be possible for Malawi to attend the training in Lusaka with a view to

possibly carrying out a test area near the border of the two countries. This will be further explored.

- There have been some delays in implementing the ground truthing. This has implications for imagery selection and ensuring that the imagery is of a similar date to the ground truthing. In Zambia this is not yet an issue as the dry season is still ongoing, but in Uganda the rains are due and cloud cover is building, which will make it increasingly difficult to gain high quality imagery. In Ghana this is less of a problem as SAR imagery will be used which can see through cloud cover, and in Kenya the selected area will be in an arid/semi-desert area, so again it is less sensitive.
- All countries have had some difficulty in securing funding to carry out condition surveys, mainly because they have had no chance to include the work in their annual budgets, so have had to re-allocate resources from a different activity.
- There has been an issue with the responsibility for roads. Most countries have two or three different institutions looking after their roads, but AFCAP only works through one of these. The AFCAP associated institution has therefore found it difficult to include the roads which are not under its jurisdiction. In the case of Uganda the AFCAP partner UNRA does not have responsibility for the lowest level of road, local/community roads, which is the level that provides the majority of community access.
- The above issue also meant that it has been a challenge to get a full range of conditions across all roads. Most of the UNRA roads we visited on the site visit were in good to fair condition, but to encounter poor or very poor roads we would need to survey local or community roads, which UNRA are not comfortable doing. We did agree that UNRA would try to collect a sample of these roads, but the data set for this level of road will not be comprehensive.

4.5 Gender

The consultants have encouraged the partner countries to involve women as much as possible in this project. To that end it can be reported that the in-country teams are made up of approximately six staff, with Uganda including four women and Zambia including one woman.

4.6 Capacity Building

Wherever possible we have identified local institutions to carry out the background training, which will provide a more cost effective and sustainable solution. The specialist training from Airbus will be considered as a 'training of trainers' so that the local specialist institution will be able to maintain that knowledge and pass it on in the future. We will use regional conferences and events to disseminate the knowledge gained, with local partners making the presentations wherever possible.

4.7 Uptake and Dissemination

The consultant has agreed to facilitate a workshop at the ICTA conference in Ghana on 26th October 2016. This workshop will be aimed at presenting and discussing the various high tech solutions as presented in the desk study report and gaining feedback on the most appropriate for African countries, as well as exploring any other possible solutions that may not have been considered before. The audience will be comprised of transport and roads practitioners from Africa and elsewhere, so very appropriate for this type of workshop.

5 Budget Against Actual Expenditure

5.1 Summary

The first two invoices for the inception report and the desk study report have been submitted. The next invoice is due when this progress report is approved. An invoice will also soon be submitted for Provisional Sums for the dashboard cameras and part of the satellite imagery.

A summary of budget against expenditure can be seen in Appendix G.

6 Next Steps

The immediate next step is to visit all of the partner countries and set up the ground truthing, as well as identifying the training required and planning for such. This will follow differing timescales for each country, but the activity following this will be to procure the satellite imagery and train identified staff in how to interpret it.

In parallel with this activity the partner countries will be encouraged to identify the high-tech solutions that they are interested in researching. When these are established the detailed tasks will need to be identified and funding sought for the research, either from the partner country or from international donors.

When the training in satellite image interpretation is complete the team will need to start the actual assessment of condition. It is expected that this activity will be under way by the time the next progress report is due.

7 Lessons Learnt

The peer review of the desk study report highlighted some very good points and issues with the desk study. Although some of the points made seem to be due to a slight misunderstanding of the aims of the research, it is understood that more explanation should have been provided in the introductory part for readers who have no prior knowledge of the project and previous research that has been undertaken in this area.

A lesson learned is that the responsibility for rural roads often lies with more than one authority, which can cause issues when you are considering the whole network. In some cases the AFCAP partner organisation does not have responsibility for the lowest trafficked and poorest condition roads that provide access to the remotest areas, which is also the road set that need to be targeted. This should be possible to overcome for research projects, but it could involve some sensitive negotiations with different service providers. At present this problem is most prevalent in Uganda, the other partner countries seem to be confident they can overcome any such issues.

The arrangement of the local inputs has been less than reliable, with both condition surveys delayed due to logistic and practical issues. This was to be expected as the methodology being followed is based around using existing systems and procedures in order to test the sustainability in a realistic situation.

The project procured Dashboard cameras for auditing the ground truthing. This technology has proven to be better than expected and a trial is being considered to use these cameras as the main mode of condition assessment, in a similar way that the ground truthing in the Nigeria research was carried out.

8 Conclusion and Recommendations

The inception report and country selection reports were completed on time. The desk study was submitted slightly late. The desk study has now been peer reviewed and a revised version will be submitted as a separate peer review document by the 14th October 2016. Four countries have been

confirmed, but there is a possibility to include two others in a lesser capacity. Two have been visited so far and have shown good cooperation.

All countries have faced challenges for funding as they did not have sufficient preparation time to include an estimate for this project in their annual budget. It could be useful for AFCAP to ask countries to prepare a contingency budget for regional projects such as this that were not motivated individually.

The ground truthing programmes that were agreed have already been delayed. Programming and timely implementation is important for projects such as this where the work has to be carried out during a particular season. A delay of a month or two could mean that activities have to be postponed until the next season.

The countries visited so far have shown some interest in the proposed high-tech solutions. The next step will be to define exactly what each country would like to research and to cost the potential research. In the short term the partner countries will need to allocate funds or seek external funds, if research is to be carried out within the timeframe of this project. We will encourage the partner countries to consider more long term funding for such research if it is likely to extend beyond the time of the project.

Appropriate partners have been identified in each country so far. These partners are all specialists in remote sensing and have agreed to assist with training of local staff to bring all team members up to the required level, before the specialist trainer arrives.

The methodology for condition assessment will be refined and specialist training courses developed to suit. The specialist training will be undertaken by Airbus DS and TRL. The second round of visits to each country will include this training. These visits are planned for late October or November.

Some interim recommendations are:

- Countries are given more notice to be able to allocate funds for research projects, such as the high-tech solutions which will only be defined once the project is under way.
- Countries are given support in seeking funding for additional activities, such as the high-tech solutions
- Dashboard cameras are considered for use as the principal means of evidence for road condition assessment
- All levels of road ownership and responsibility are engaged with the project, to avoid issues between the different bodies

Annex A: Results Achieved in Reporting Period (Date)

Progress against workplan.

Activity	Expected Progress for Reporting Period	Actual Progress for Reporting Period	Deviation	Challenges	Corrective Action / Comment ¹	
					Action	By Whom?
- Inception Report	Completion by 9 th May 2016	Completed by 6 th May, final revision 16 th May 2016	None	None	Small revisions to report	RW
- Country selection report	Completion by 4 th July 2016	Completed by 22 nd June 2016	Two weeks early at the request of PMU	To get countries on board before desk study complete	Minor revisions, some countries still to commit fully	RW
- Desk Study Report	Completion by 4 th July 2016	Completion by 22 nd July, final revision 27 th July 2016	2 weeks late	Some issues with getting info. from countries and commitments	Minor revisions to report	RW
- Peer Review	Completion by 20 th July 2016	Completed by 19 th September 2016	2 months.	Desk study late, also issues with contracting peer reviewer and their availability	Revision of desk study necessary, to involve Airbus and TRL	RW, AO, AI

¹ If appropriate (i.e. if planned activities were not implemented) then signal what actions will be taken by whom to address deviations from the work plan.

Title of report

- Initial country visits	August-September 2016	Started in September	1 month	Delays in report and peer review, necessary to start in dry season	Visit programme adjusted to take account of delays and seasons	RW
- Visit to Uganda	August 2016	September 2016	1 month	Delay in desk study report	Necessary to start in dry season, ground truthing started but satellite aspect may need adjusting as a result of peer review	RW
- Visit to Zambia	August 2016	September 2016	1 month	Delay in desk study report	Ditto.	RW
- Visit to Ghana	August/September 2016	Pending (planned for end of September)	1 month	General delays in reporting	Not necessary to start in dry season due to different methodology	RW
- Visit to Kenya	August/September 2016	Pending	1 month plus	Kenya not yet confirmed participation in the project	AFCAP have assisted in trying to get Kenya to commit	RW, AFCAP

Annex B: Steps for Next Reporting Period to 7th November 2016

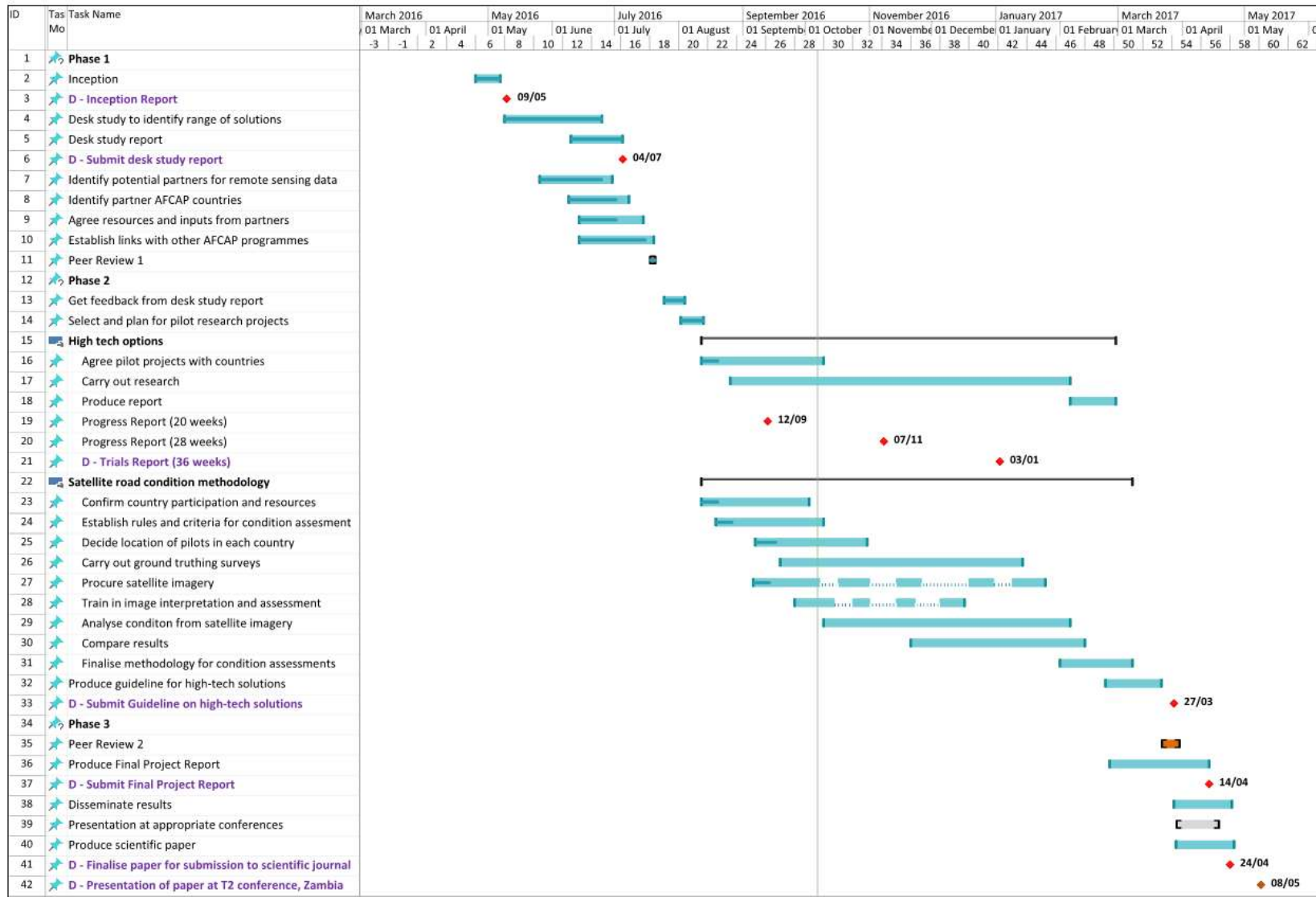
Workplan for next reporting period.

Activity	Expected Progress for Reporting Period	Planned sub-activities ²
- Initial country visits	Complete all initial visits and get commitments for ground truthing surveys	Two country visits remain. The first is scheduled for 26-30 September to Ghana and the last in October to Kenya or an alternative country. They will follow largely the same format as the visits to Uganda and Zambia.
- Ground truthing	Complete all ground truthing before the next reporting period	Ground truthing will consist of: <ul style="list-style-type: none"> • Carrying out condition surveys on the trial roads • Collating the data • Analysing the data and producing it in a format that is easy to compare to the image interpretation
- Specialist Training	It is expected that all specialist training in image interpretation will be carried out during the period	Airbus DS will be carrying out the specialist training in three countries, with TRL staff taking on this role in the final country as a way to test the replicability of the training. There are two levels of training: <ul style="list-style-type: none"> • Background training to get all team members to a similar level of competence in GIS and other necessary computer skills, to be carried out locally • Specialist training to be carried out by the consultants
- Image interpretation	It is expected that the image interpretation will be started in all countries, but some may not be completed by the next	Image interpretation will be carried out by the local teams themselves. This task will include: <ul style="list-style-type: none"> • Assigning conditions to each length of road in line with the criteria set • Comparing this to the ground truthing and analysing the results

² If planned activities were not implemented in the period covered by this report, then the actions proposed in Annex 1 to address this should also appear in this column.

	reporting period	
- High-tech solutions	All countries should have identified the high-tech solutions they are interested to research and should have started to explore potential sources of funding, with assistance from AFCAP.	These sub-activities will depend on the solutions selected by the countries themselves and whether they manage to secure funding for them. There has been interest so far mainly in the social media app for reporting maintenance or safety issues with the road. It would require eternal funding to produce the app.

Annex C: Updated Workplan



Annex D: Progress towards ReCAP logframe outputs

Intervention Logic	Indicator	Next Milestone Target Date (from Inception Report)	Next Milestone Target (from Inception Report)	Comment. (Risks, challenges, will Targets be achieved, and on time?)	Achievement ³	
<p>Outcome: Sustained increase in evidence base for more cost effective and reliable low volume rural road and transport services, promoted and influencing policy and practice in Africa and Asia</p>	<p>1. SUSTAINABILITY: Partner Government and other financiers co-funding research with ReCAP. Contributions in kind (K) and Core Contributions (C)</p>	October 2016	3 countries committed and engaged, Kenya yet to agree. Need to agree by 1 October 2016	Kenya has lack of funds, may ask AFCAP for supplementary funding or may try to take on project without specific funding, need firm commitment or will consider other countries	This reporting period	3 countries committed and funding
					Cumulative to date	As above
	<p>2. Concrete examples of change (applied or formally adopted), influenced by ReCAP research that will be allied to #km of road in focus countries.</p>	Too early to identify change	November 2016, ground truthing should be complete	Ground truthing is delayed in 2 countries, local resource arrangement is a challenge, despite funding being confirmed.	This reporting period	Some countries have started to allocate resources
					Cumulative to date	As above
	<p>3. Number of citations in academic articles of ReCAP peer reviewed articles and/or working</p>	Not due until end of project			This reporting period	None
					Cumulative to date	None

³ Evidence to be attached to the report submission.

Intervention Logic	Indicator	Next Milestone Target Date (from Inception Report)	Next Milestone Target (from Inception Report)	Comment. (Risks, challenges, will Targets be achieved, and on time?)	Achievement ³	
	papers, conference papers etc.					
<p>Output 1: RESEARCH and UPTAKE: Generation, validation and updating of evidence for effective policies and practices to achieve safe, all-season, climate-resilient, equitable and affordable LVRR and transport services in African and Asian countries.</p> <p>(Low Volume Rural Roads : LVRR / TS – Transport Services)</p>	<p>1.1 LVRR: Number of peer reviewed papers generated from ReCAP supported or related LVRR research projects made available in open access format.</p>	May 2017	May 2017		This reporting period	None
					Cumulative to date	None
	<p>1.2. TS: Number of peer reviewed papers generated from ReCAP supported or related LVRR research projects made available in open</p>	May 2017	May 2017		This reporting period	None
					Cumulative to date	

Intervention Logic	Indicator	Next Milestone Target Date (from Inception Report)	Next Milestone Target (from Inception Report)	Comment. (Risks, challenges, will Targets be achieved, and on time?)	Achievement ³	
	access format.					
	<p>1.3 Engineering Research: National policies, manuals, guidelines and/or research outputs that have been fully incorporated into Government/Ministerial requirements, specifications and recommended good practice as a result of ReCAP engineering research (including climate change adaptation and AfCAP and SEACAP adaptations).</p> <p>To include introduction of new policies and modification to existing policies.</p>	May 2017	May 2017	Guidelines will be complete by May 2017, but it will take a lot longer for them to be incorporated into government policy.	This reporting period	None
					Cumulative to date	None

Intervention Logic	Indicator	Next Milestone Target Date (from Inception Report)	Next Milestone Target (from Inception Report)	Comment. (Risks, challenges, will Targets be achieved, and on time?)	Achievement ³	
	<p>1.4 TRANSPORT SERVICES Research: National policies, regulations and/or practices for rural transport services modified or introduced as a result of ReCAP research (including road safety and gender and AFCAP and SEACAP research)</p> <p>To include introduction of new policies and modification to existing policies.</p>	May 2017	May 2017	This depends on what high-tech solutions are taken forwards by the countries. Even after the research it will take time to incorporate into government policy	This reporting period	None
					Cumulative to date	None
	<p>1.6. LVRR and TS information generated for dissemination, and disseminated, that is not peer reviewed. Total to include research papers, final research reports, workshop reports, manuals and guidelines.</p> <p>CHECK IF THIS IS TO BE</p>	Trial report due in January 2017	January 2017		This reporting period	Trials have just started so nothing to report yet
					Cumulative to date	As above

Intervention Logic	Indicator	Next Milestone Target Date (from Inception Report)	Next Milestone Target (from Inception Report)	Comment. (Risks, challenges, will Targets be achieved, and on time?)	Achievement ³	
	PART OF Service Provider Reporting					
Output 2: CAPACITY BUILDING: The building of sustainable capacity to carry out research on low volume rural roads, and rural transport services in African and Asian countries.	2.1. African / Asian experts or institutions taking lead roles in ReCAP Research Projects.	May 2016	October 2016	Local partners have been brought in, but funding may be an issue.	This reporting period	From the 3 committed countries there are other institutions who have been brought in to partner the local team, either Universities or Remote Sensing Centres. They will play a key role in the project.
					Cumulative to date	
	2.3. Research projects with female researcher inputs at senior technical level.	October 2016	October 2016	Involvement of women is dependent on availability, but Uganda have shown good initiative in identifying women in senior roles.	This reporting period	In Uganda four of the team of six are women and three will play a senior technical role. In Zambia there is one woman on the team, but not in a lead role. Ghana team is yet to be determined.
					Cumulative to date	As above
Output 3: KNOWLEDGE: Generated evidence base of LVRR and	3.2. ReCAP generated knowledge presented and discussed at high	April 2017	April 2017	If project is delayed the T2 conference	This reporting period	None

Intervention Logic	Indicator	Next Milestone Target Date (from Inception Report)	Next Milestone Target (from Inception Report)	Comment. (Risks, challenges, will Targets be achieved, and on time?)	Achievement ³	
transport services knowledge is widely disseminated and easily accessible by policy makers and practitioners (including education and training institutions).	level international development debates and conferences			may be missed	Cumulative to date	None
	3.3.ReCAP generated knowledge disseminated through significant workshops and dedicated training, virtually or physically, that are rated by participants as effective..	April 2017	Recently planned to hold workshop at ICTA conference in October 2016		This reporting period	None
					Cumulative to date	None

Annex E: Participant Data

There have been no formal training events to date. The first training events are scheduled for October 2016, dates yet to be confirmed.

Name	Position	Organisation	Gender	Contact details

Capacity Building Recipients

Name	Position	Organisation	Gender	Contact details

Annex F: Partner Contribution

Surveys and Assessment:

There are no constructed trial sections within this project. The trials consist of carrying out condition surveys and assessing the road condition from a satellite image of the same area. Condition surveys are planned for October and November 2016. However a site visit was arranged during the initial visit of the Team Leader, which required the following resources:

Uganda	Duration	Number	Total	Cost	Total
Vehicle	1 day	1	1		
Equipment	N/A	N/A	N/A	N/A	N/A
Staff	1 day	4	4		

Zambia	Duration	Number	Total	Cost	Total
Vehicle	1 day	1	1		
Equipment	N/A	N/A	N/A	N/A	N/A
Staff	1 day	4	4		

Training

No training has yet taken place, training is planned for October and November 2016. Local partners have also been engaged for the training.

Staff Time

During the visit of the Team Leader several staff were made available to attend the initial presentation and to facilitate the visit by providing information and making introductions to different departments or other stakeholders. There were approximately 15 staff in attendance at each presentation, for approximately 2 hours. In each country the main coordinator spent approximately 2 days with the consultant, in addition to the site visits. Other key staff were consulted as necessary.

Other costs

No other costs were utilised.

Annex H: Country Reports

Summary of TRL initial visit to Uganda – GEN2070A

5th - 8th September 2016

Background

- The consultant became familiar with institutional structure of UNRA and ownership of the road network:
 - UNRA: National Roads
 - Districts: District Roads
 - Communities: Local roads
- Viewed DTIMS and asset management system, gained information on how it works and how it is used
- Obtained a copy of condition assessment forms, guidelines and sample report
- No data available yet for the asset management project, apart from the sample training surveys

Ground Truthing

- Defined area to be assessed, approximately 10km by 18km, (Fig.1) including:
 - 44.4km of UNRA roads
 - Approximately 140.3km of district roads
 - Approximately 46.4km of local roads
- The ground truthing condition assessment team will be led by Doreen Wafula from the Planning Department who arranges all condition surveys, with station staff assisting. All are familiar with the condition assessment regime and it will be carried out in the same way that UNRA normally carry out these surveys. Team will use the Dash-Cam whilst undertaking surveys, as well as the Road-Lab smartphone software. Rodgers to assist with the use and operation of the Dash-Cam. Driver to be told to drive at maximum comfortable speed so that the speed from the Dash-Cam can be compared to the World Bank index.
- Ground truthing is programmed to start in the week commencing 12th September 2016, with the following identified in order of priority:
 - All UNRA roads within the designated area should be surveyed.
 - If possible, survey as many district and local roads within the selected area as possible. It is recognised that these roads are not under the responsibility of UNRA
 - If possible, also survey the UNRA roads that we travelled on during the site visit, in case it is possible to extend the area with archive imagery.
- UNRA condition assessment has been compared to the outline methodology in the desk study report and the five categories should give similar results.
- Collect data and enter into DTIMS spreadsheet. Produce outputs, including strip maps with indications of condition using coloured scale. Condition will be consolidated on a 1km basis for UNRA roads and on a 250m basis on district and local roads, as the condition changes there more often.

- Collate and store video imagery on the server. Review video images on computer to use as an audit/double check against the ground truthing.
- Collate and store Road-Lab results from smartphone. Review results on computer and use as audit/double check against the ground truthing.

Image interpretation

- Procurement of imagery is under way, based on the agreed area.
- A team has been arranged for image interpretation, including 3 from UNRA and 3 from Makerere University. Two reserves have also been identified in case of late unavailability. Staff identified are:
 - Anthony Gidudu/Makerere University
 - Lydia Mazzi Kayondo/Makerere University
 - Lydia Letaru/Makerere University
 - Justine Amulen/Makerere University (reserve)
 - Immaculate Katutsi/UNRA
 - Doreen Wafula/UNRA
 - Rodgers Mugume/UNRA
 - Richard Akuze/UNRA (reserve)
- Outline training plan finalised, final version to be confirmed before training visit. Lydia Kayondo has confirmed that Makerere University will be able to supplement the training in GIS before the Airbus training expert arrives.
- UNRA and Makerere University to arrange venue for training.
- All participants to be provided with laptops that have QGIS installed, version 2.14.5.
- Training expected to take place over 3 days in the week commencing 3rd October 2016, but dates will be confirmed when the ground truthing is completed. Will be facilitated by Alex Irving of Airbus DS. This training should be regarded as a training of trainers so that the people trained will be able to pass on their knowledge to others in the future.
- The actual image interpretation should be carried out by someone who did not go on the site visit and is not familiar with the roads included in the area. This is to avoid any prejudices which could skew the results.
- When training is complete the staff trained can proceed to assess the imagery to define road condition on all identified roads. In advance the existing GIS mapping should be confirmed and images aligned to match.

Potential High-tech solutions

The following are potential technologies identified by UNRA during the presentation on the satellites project and have been discussed. This should be seen as a shortlist against which concept notes can be prepared and potential funders can be identified and approached. UNRA to explore possibilities for funding where appropriate, AFCAP and TRL will assist as necessary.

- UAVs / Drones – Planning department of UNRA is planning to procure a UAV, including operation and training. The UAV would initially be used for road alignment planning, so making a DEM of a particular area to save the ground work involved in surveying. Various options are available, including photography, LIDAR and photogrammetry. UAVs could be multi-copters or fixed-wing drones, or a hybrid of both, which is becoming increasingly

popular for road uses because the range is superior and a larger area can be covered in a shorter time. There has also been research carried out in the States on condition assessment of unpaved roads using UAVs, there is potential for building on that research so a potential use would need to be identified and the benefits quantified.

- Archive imagery – there are several potential uses for this. The imagery can be used for back analysis, comparing a new system of maintenance to an old one (in Uganda a new system is being introduced). It could also be used to determine the necessary frequency of condition assessments, by comparing the changes in condition over a number of years. Very high resolution imagery has been available for less than 10 years, but medium or high resolution goes back far enough to be able to track the development of road networks, which may be of use in transport planning.
- Climate resilience – hydro-climatics: Water is the main enemy of roads and with climate change this challenge will increase. Satellite imagery can be used to map catchment areas and identify areas at potential risk to climate change. There is software available that will predict the drainage requirements on a road using satellite imagery, which could also be useful.
- Mobile phone data – is this of limited use? The use of mobile phone data will be determined by the access to the data, which would require the agreement of the mobile phone companies. It would only be able to involve data that is not sensitive and does not have personal details. The most useful will be smartphone data that is geo-referenced. We already have apps that will measure IRI through the phone accelerometer, which will be trialed in this project. Mobile phone data has been used in Boston to identify potholes, it is possible that this app could be developed for similar uses in Africa.
- Social Media – it should be possible to develop an app that allows people to easily report road defects or road safety issues. This would need to include the ability to geo-reference pictures and send them to UNRA or the relevant authority. UNRA would need to assess the spread of mobile phone use in remote areas, which are the areas that would be likely to benefit most from this type of intervention. The benefits of this technology are that it would reduce the need for UNRA to visit areas of failure or defects in order to plan their maintenance, which could be useful in remote areas or where resources are scarce.
- Mapping of materials was also mentioned. This technology has already been established in a number of countries, some through TRL research, so this technology can be passed on and developed by UNRA.

Programming

- Programme for pilot phase in Uganda has been produced, as shown below.

Figure 1: Proposed area of investigation

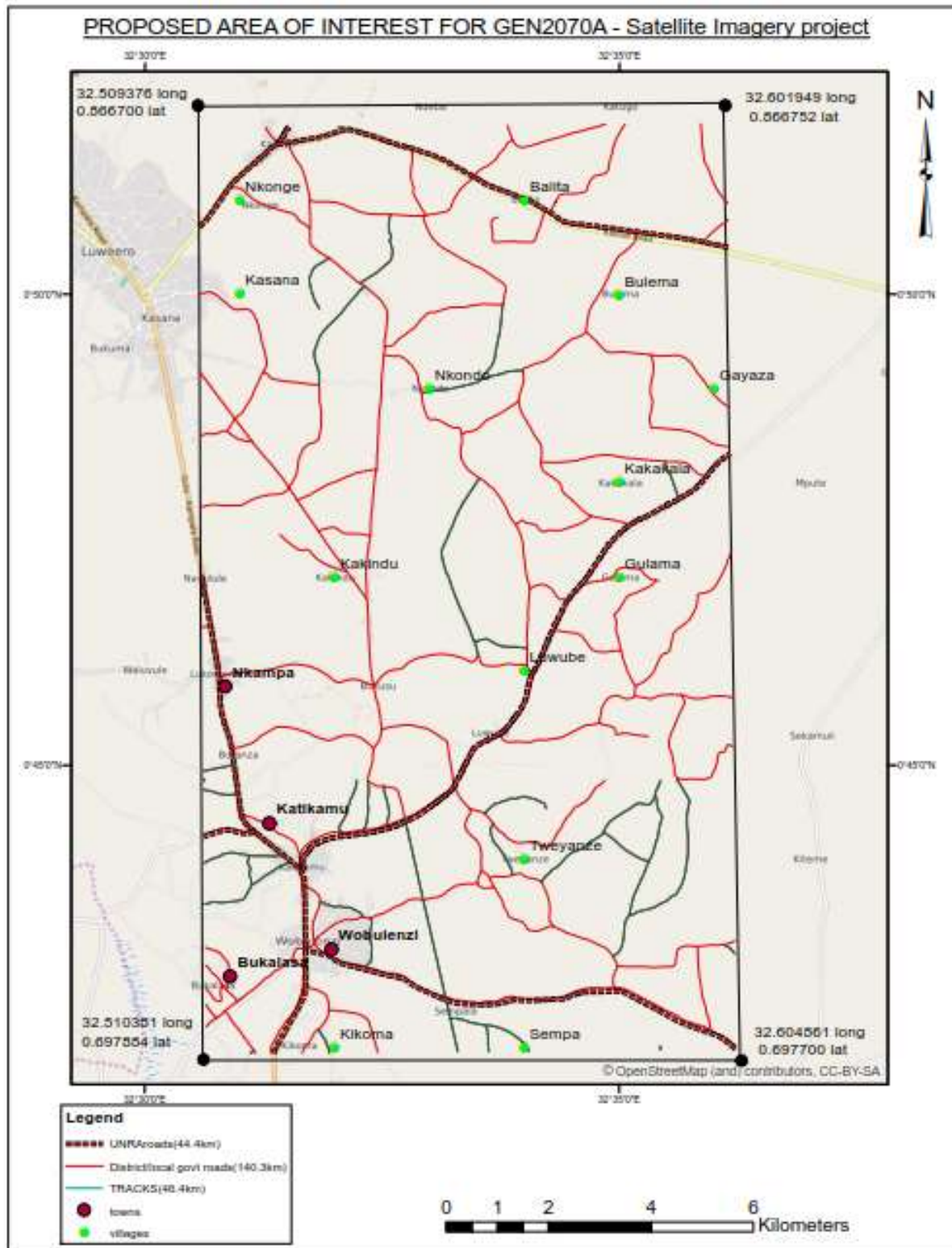
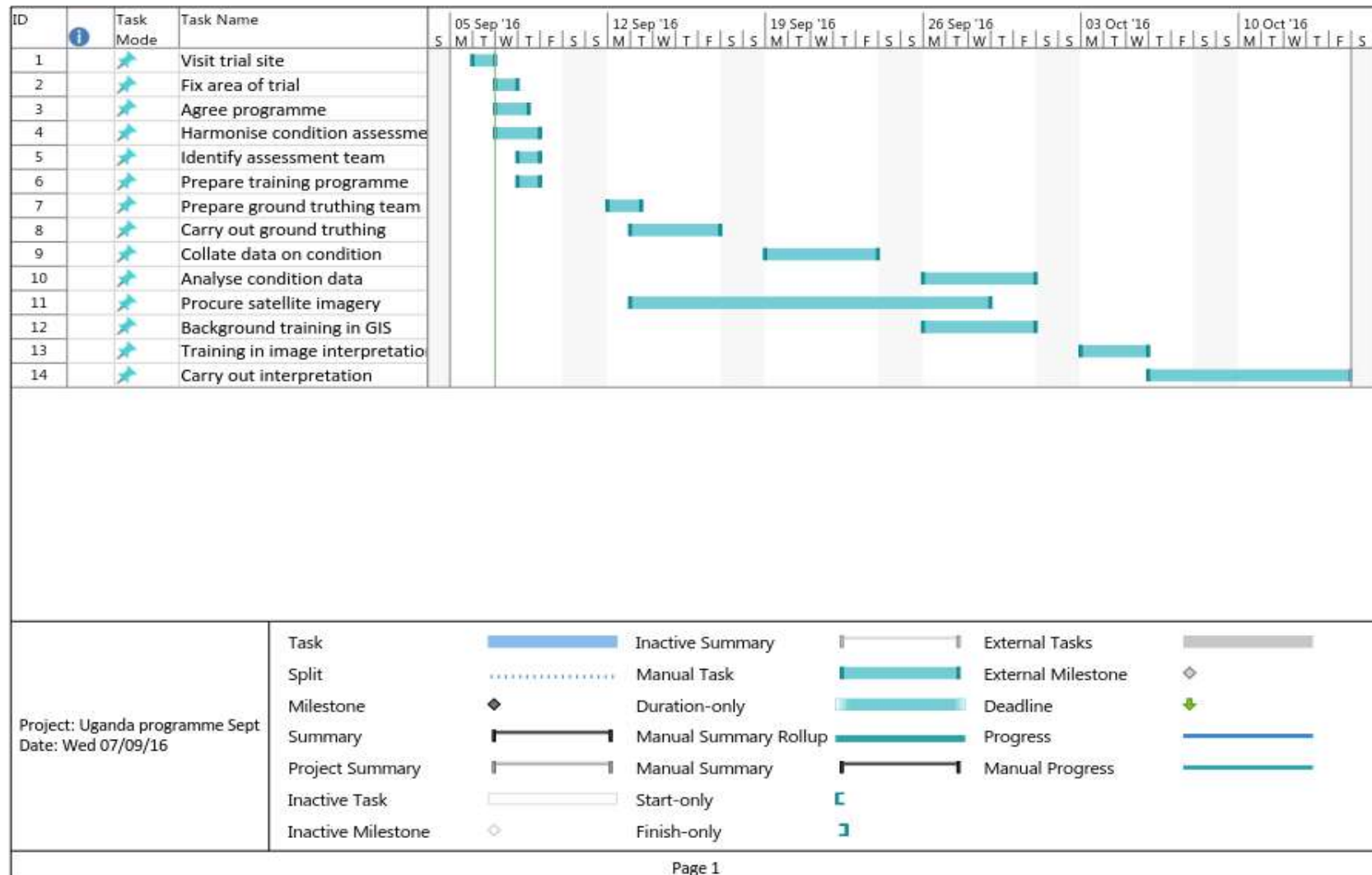


Figure 2: Programme for Uganda Satellites Programme – Pilot phase



Summary of TRL initial visit to Zambia – GEN2070A

9th - 14th September 2016

Background

- The consultant became familiar with institutional structure of RDA and ownership of the road network:
 - RDA: Trunk and Main roads, District roads, managed by Regional offices
 - Districts: unclassified roads (including local roads) MoLGH
- An asset management system exists but it is not fully utilised.
- Condition surveys being undertaken on trunk and main roads using ROMDAS via a local consultant.
- RW has obtained a copy of condition assessment forms, guidelines etc. from original district surveys, and from GEM project surveys.
- No data available yet for the asset management project, apart from the sample training surveys. Surveys due to start in w/c 19th September.

Mapping

The level of existing GIS mapping within RDA is low, with surveys based on an excel map. There are no accurate GIS maps that can be used for road maintenance condition surveys at present, although there are staff trained in GIS within RDA. The videos taken by the team using the satellite project video camera are GPS enabled, plus the GEM team will be tracking the roads using a hand held GPS, both of which should be accurate enough for the level of mapping required.

If RDA needs assistance with mapping roads by GIS, then NRSC would be able to assist them with producing maps if required. Mapping can be checked against available satellite imagery by NRSC and a consolidated version produced. This has been included in the programme in Figure 2 as a potential activity.

The Airbus trainer will also be able to advise on mapping techniques as part of the training for the satellites project.

Ground Truthing

- Defined area to be assessed, polygon approximately 10km by 12km, (Fig.1) including:
 - Approximately 10km of District road (Paved)
 - Approximately 40km of District unclassified 'U' roads
 - Approximately 100km of local roads

All of these 'U' roads are planned under the GEM project.

- Ground truthing condition assessment team will be led by Presley Chilonda (RDU) with District office staff assisting, using the system proposed by the GEM project. All are familiar with the condition assessment regime, but it will be carried out in the way that the GEM project has recommended, not as per the normal RDA guidelines. Team will use the Dash-Cam whilst undertaking surveys, as well as the Road-Lab smartphone software. Presley to assist with the use and operation of the Dash-Cam. Roads will be grouped into lengths of

5km, each length of which will be allocated a condition from very poor to very good, as per the GEM categorisation.

- Ground truthing is programmed to start in the week commencing 19th September 2016. There is an existing list of roads for the GEM project, but it would be good if the roads in the identified area for the satellites project could be completed first, as it is important to complete the surveys while the weather is still clear so that good imagery can be procured. The priority for the satellites project is:
 - RD151 – paved road, from 0.0 to 23.00
 - Unclassified roads U2, U3, U4 and any other U roads within the area defined.
 - If possible survey as many local roads within the selected area as possible. It is important that a full range of conditions is experienced, for example some of the local roads are displaying very poor condition, which may not be seen on U roads.
- RDA/GEM project condition assessment has been compared to the outline methodology in the desk study report and the five categories should give similar results.
- Collect data and record as recommended by GEM project. If possible produce outputs, including strip maps with indications of condition using coloured scale (as per satellites desk study report). Condition will be consolidated on a 5km basis for RDA roads and local roads.
- Collate and store video imagery on server. Review video images on computer to use as an audit/double check against the ground truthing.
- Collate and store Road-Lab results from smartphone. Review results on computer and use as audit/double check against the ground truthing.

Image interpretation

- Procurement of imagery is under way, based on the agreed area.
- A team was arranged for image interpretation, including 3 from RDA and 3 from NRSC. It may be possible to include Malawi in the training if they show enough interest and are able to fund a staff member to travel to Lusaka. The team identified are:
 - Philimon Goma/RDU
 - Presley Chilonda/RDU
 - Victor Miti/RDA Regional Office
 - Lusekelo Kasunga/NRSC
 - Misozi Banda/NRSC
 - Michael Phiri/NRSC
- Outline training plan finalised, final version to be confirmed before training visit. Mr. Maango has confirmed that NRSC will be able to supplement the training in GIS before the Airbus training expert arrives.
- There is a lack of accurate GIS maps within RDA. May be possible for NRSC to produce some pilot maps of the proposed area, using google maps, video imagery and other sources if RDA GIS expert cannot produce in time.
- NRSC to arrange venue for training, RDA to contribute to logistics if required.
- All participants to be provided with laptops that have QGIS installed, currently NRSC use version 2.8, but version 2.14.5 is available and recommended.

- Training expected to take place over 3 days in the week commencing 10th October 2016 or following week, but dates will be confirmed when the ground truthing is completed. Will be facilitated by Alex Irving of Airbus DS. This training should be regarded as a training of trainers so that the people trained will be able to pass on their knowledge to others in the future, especially within NRSC.
- The actual image interpretation should be carried out by someone who did not go on the site visit and is not familiar with the roads included in the area. This is to avoid any prejudices which could skew the results.
- When training is complete the staff trained can proceed to assess the imagery to define road condition on all identified roads. In advance the GIS mapping should be confirmed and images aligned to match.

Potential High-tech solutions

The following are potential technologies identified by RDA and NRSC during the past week. This should be seen as a shortlist against which concept notes can be prepared and potential funders can be identified and approached. World Bank have indicated they would be interested to fund any roll-out from this project that RDA is interested to pursue, otherwise RDA to explore possibilities for funding where appropriate, AFCAP and TRL will assist as necessary.

- UAVs / Drones – There is some interest in drones from Zambia, but a firm purpose would need to be identified as this is an expensive undertaking. This will be further discussed and may be of interest to other donors.
- Archive imagery – there are several potential uses for this. RDA have found that there is a disconnect between when the condition surveys are done and when they are used, so there is potential for archive imagery to be used in this respect. Archive imagery could also be used to determine the necessary frequency of condition assessments, by comparing the changes in condition over a number of years. Very high resolution imagery has been available for less than 10 years, but medium or high resolution goes back far enough to be able to track the development of road networks, which may be of use in transport planning. NRSC would be able to facilitate the image interpretation, but their archive of imagery may not be comprehensive enough so some additional archive imagery will need to be procured. The imagery can be used for back analysis, for example comparing a new system of maintenance to an old one.
- Climate resilience – It is possible that a project could be developed in this area, possibly through learning from the AFCAP regional climate resilience project.
- Social Media – Zambia is interested in developing the use of social media to involve the public more in road maintenance and road safety. This will be further developed.
- Mapping of materials. Zambia has recently undertaken a project to map materials, but the consultants are not locating new sources and have not considered satellite technology to do this. Satellite imagery can assist in this area as this technology has already been established in a number of countries, some through TRL research. Information on this technology can be passed on and further developed.

Programming

- Programme for pilot phase in Zambia has been produced, as shown below.

Figures 1a & 1b: Proposed area of investigation – Chongwe district

