Terms of Reference

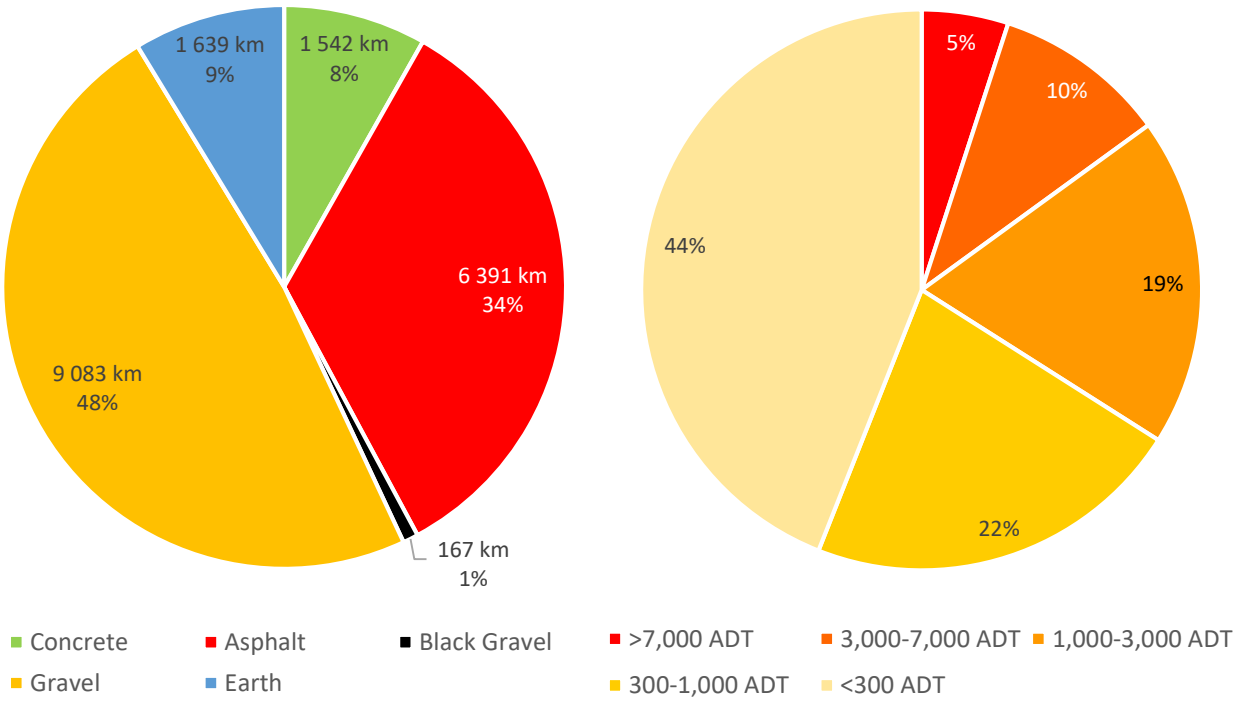
RAMS Phase II - Institutionalization of RAMS in MOTC's Business Process

A. Introduction

1. The Cabinet of Ministers of the Kyrgyz Republic (COM) aims to improve the sustainability of the road network by implementing a Road Asset Management System (RAMS) that is fit for purpose, affordable, and sustainable. From 2023 onwards, the RAMS will form the basis for planning and budgeting for the road network in the Kyrgyz Republic. As part of the ADB-financed *CAREC Corridors 1 and 3 Connector Road Project*, Phase I RAMS development provided the COM with a software tool to provide a transparent approach to allocating the budget for road maintenance, rehabilitation and improvement, responding to the growing needs of the industry. Under the *CAREC Corridors 1 and 3 Connector Road Project - Additional Financing*, Phase II RAMS development will increase the amount of data collected, further improve the RAMS application and institutionalize the approach to use the RAMS application. The Ministry of Transport and Communications (MOTC) is the Executing Agency for this project. The Phase II RAMS development is expected to take place over a 30-month period, with most activities and draft deliverables to be completed in the first 24 months.

2. The Phase II RAMS development will focus on the 18,821 km of international, national and local roads managed by MOTC. This includes 8,100 km of paved roads (cement concrete, asphalt and black gravel) and 10,721 km of unpaved roads (gravel and earth). Approximately one-third of the road network has traffic volumes exceeding 1,000 ADT (including some unpaved roads), while nearly half the road network has traffic volumes below 300 ADT (predominantly unpaved local roads).

Figure 1 Road Network by Surface Type and Traffic Volume



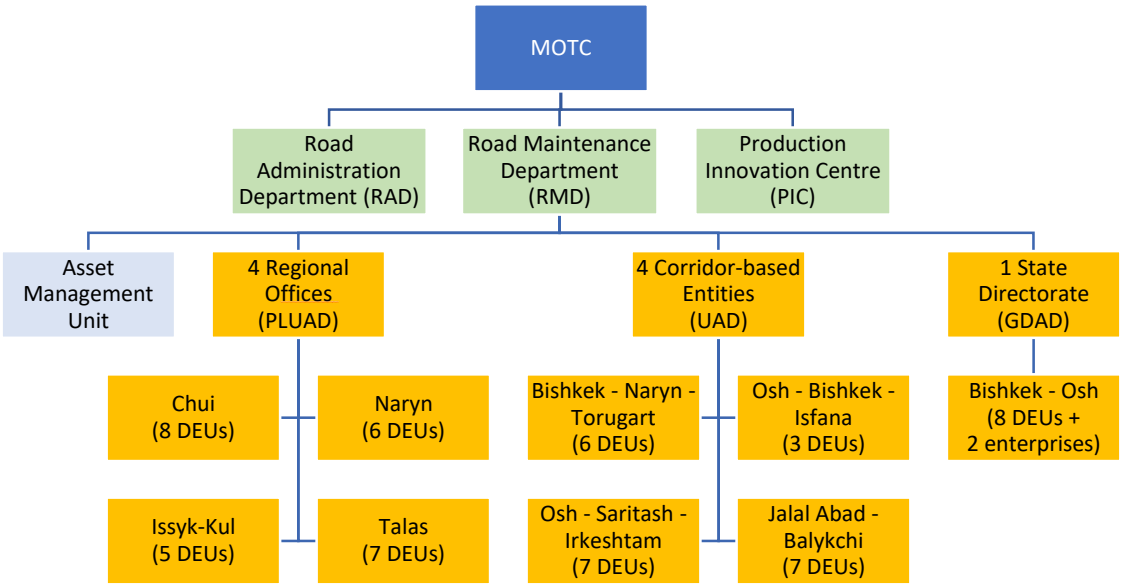
Source: Phase I RAMS development

B. Institutional Framework

3. For the Phase II RAMS development, the Consultant will be expected to work closely with nominated staff from MOTC and underlying entities to ensure that they are able to effectively optimize and prioritize road asset maintenance, rehabilitation and improvement needs whilst developing and managing the road

network in Kyrgyz Republic. MOTC will provide access to all available information and reporting that was prepared during Phase I RAMS development. Below is diagram of the entities involved in RAMS development.

Figure 2 Organizational units under MOTC relevant to RAMS



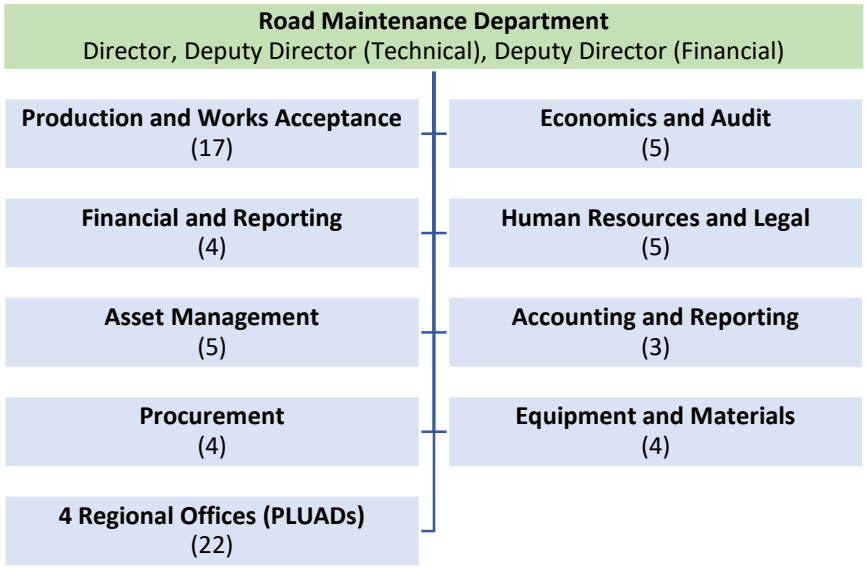
4. **Ministry of Transport and Communications (MOTC)**. MOTC is responsible for policy setting, regulation, coordination and control, as well as programming, planning, execution of construction works and maintenance and operational services. MOTC has the authority to launch tenders, use budget funds, and act as the Client for the works related to its area of competencies.

5. **Road Administration Department (RAD/УАД)**. RAD under MOTC is responsible for "general improvement and development of the road network" including activities such as development of policies and strategies, writing of laws, decrees and regulations, proposing and monitoring of implementation of norms and standards, writing of terms of reference for consultants and contractors, and linkages to state institutes.

6. **Road Maintenance Department (RMD, also referred to as DDH/ДДХ)**. RMD is responsible for preparation and implementation of the annual works plan, acceptance of physical works, controlling of all material and equipment purchases by the DEUs, preparation of annual budget requests, financial plans, and financial reporting for the road sector. The Procurement Department of RMD conducts public procurement of goods (materials) and services (subcontracts, works). RMD has 72 permanent members of staff, including 22 persons located in the 4 regional offices (PLUADs) for regional supervision. The organization chart for RMD is shown in the following figure.

7. **Asset Management Unit (AMU)**. Under RMD, the recently created Asset Management Unit is responsible for operating the RAMS on behalf of RMD. It receives the outputs of the RAMS prepared by PIC and consultants. Currently the unit has four full-time staff members, although these staff members also have responsibilities besides RAMS. RMD is currently being restructured, and it is expected that the number of staff of the AMU will increase. Planned staff positions include a unit head, a data analyst, a GIS expert, a data collection expert, a maintenance planner, and a transport economist.

Figure 3 Organizational Structure and Staff Numbers of the Road Maintenance Department



8. **PLUADs and UADs**. Road maintenance activities are managed by 4 Regional Offices (PLUADs/ПЛУАД, currently referred to as RO/PO) and 4 corridor-based entities (UADs/УАД) as well as 1 State Directorate (GDAD/ГДАД) responsible for the main Bishkek-Osh road. Under each PLUAD/UAD/GDAD are a number of local maintenance units (DEUs). Under the State Directorate, there are also 2 state-owned contractors.

9. **DEUs**. Implementation of the road maintenance activities is carried out by 57 local maintenance units (DEUs/ДЭУ) under the PLUADs/UADs/GDAD. The DEUs are also responsible for collecting data on the road network under their responsibility each year during spring and autumn surveys. This data currently forms the basis for the annual budget requests that are sent to RMD as the basis for the annual budget request of MOTC (this system will change with the development of the RAMS).

10. **Production Innovation Centre (PIC/ПИЦ)**. PIC is a state-owned enterprise under MOTC responsible for data collection. Under Phase I RAMS development, it was responsible for data collection and supporting some of the post-processing in all paved roads using the TRASSA survey vehicle and radar traffic counters. Under Phase II RAMS development, PIC will be a nominated subcontractor to the Consultant and will be responsible for data collection and post-processing, ensuring a sustainable capacity is developed in the country for future surveys on an annual basis. The Consultant will support PIC in the data collection and ensure it works according to internationally accepted norms in data collection and validation.

C. Background of RAMS Development

11. RAMS development in the Kyrgyz Republic has gone through several steps over the past 10-15 years. A roads database was installed at the MOTC in 2007. Some road inventory and condition data were collected and loaded into the system, but the system broke down soon thereafter and has been out of service ever since. The database is understood to have had capabilities to estimate annual maintenance works and costs using current condition data, but lacked capabilities to undertake lifecycle analyses.

12. In 2014, a pilot Pavement Management System (PMS) based on an Excel spreadsheet was developed under the World Bank's *National Road Rehabilitation Project* (NRRP). The project supported the identification of the priority road network, the provision of technical assistance and training, and studies in view of continuing the improvement of the road network and its management. Outputs delivered included i) road inventory data, ii) data for structures, iii) traffic data including 9 vehicle classes from manual counts carried out under the NRRP, iv) condition data based on visual surveys and International Roughness Index (IRI) collected using Vehicle Intellectual Monitoring System (VIMS) roughness survey equipment that was delivered to MOTC under a project funded by Japan International Cooperation Agency (JICA), and v)

Geographical Information System (GIS) survey data recorded at 10m intervals during the VIMS survey. Data was collected for 6,000 km of paved roads. The data was intended as input for the Road Network Evaluation Tool (RONET) for use in planning including estimating funding needs for road maintenance. RONET was also installed at RMD, but it is not currently used.

13. In 2016, JICA supported the development and implementation of a Bridges and Tunnel Management System under its Technical Cooperation Project for Capacity Development for Maintenance Management of Bridges and Tunnels. The system was installed at the RMD and incorporates a map interface. It is currently being actively populated by selected inspectors who assess the structures and log data into tablets. The collected data is then remotely transferred to the central database at the RMD. The data collected may be used to develop short- and long-term bridge and tunnel maintenance management plans.

14. In 2017, the Government through Resolution 539 established the Production and Innovation Center (PIC). The PIC has a TRASSA survey vehicle that includes three vehicle mounted laser profilometers for measuring road roughness, rutting and other road geometric characteristics. Video recordings of road surface and ancillary assets can also be made using cameras that can be mounted on the survey vehicle. Post-processing of the collected data is carried out in the office to discern basic road inventory items and to identify surface defects such as potholes and cracking. The PIC also undertakes manual inventory and condition assessments for ancillary assets such as drainage, traffic signs, road marking etc. using GPS-enabled tablets loaded with supporting data collection software. Collected data is stored on a system currently located at PIC office. The system can estimate costed road works based on current condition (without performing lifecycle analysis). PIC is also in the process of procuring additional data collection equipment and intends to coordinate collation of road crash data with the police.

15. In 2018, the MOTC launched Phase I RAMS development entitled: "*Data Collection and Establishment of Road Asset Management System*". A contract was signed with Destia-Finnroad in August 2018, and the contract ended in December 2021. The works performed under Phase I resulted in the following outputs:

- MOTC and PIC were supported in the collection of data for 7,513 km of paved roads, including basic inventory, pavement distress data (roughness, rutting and surface distress) and traffic data.
- A GIS-based Road Information System (RIS) was developed to (i) store the entered data in a database, (ii) generate reports and graphs, and (iii) develop the Road Asset Referencing System. The RIS is located in RMD and is accessible through desktop computers connected to the database through the local area network.
- Collected road and traffic data, together with bridge data from the JICA TA was validated and entered into the RIS database that features built-in rules and data upload procedures for any devices used for data collection.
- A Road Asset Referencing System was developed to show the road network with local road maintenance unit boundaries and to identify local reference points (bridges, culverts, kilometre posts, border crossings, railway crossings).
- A *Data Collection and Management Manual* was prepared.
- A treatment matrix for bituminous roads was developed (based on an HDM-4 analysis) to determine the optimum treatment for a road section based on the condition and traffic data collected for that road section.
- A web-based Maintenance Planning System (MPS) was developed to (i) view collected data in GIS maps, graphs and photos, (ii) prepare maintenance plans at various levels. PLAUDs, UAD, and DEUs have access to the MPS data for the roads under their responsibility and can contribute to maintenance planning.
- A *Road Asset Management Manual* was developed including methodologies for planning (i) periodic maintenance, rehabilitation, and reconstruction; (ii) routine maintenance; and (iii) winter maintenance.
- A 3-year rolling works program incorporating road maintenance and improvement works was developed, optimized using multi-objective criteria.

- A *Performance Management Framework* was prepared comprising key performance indicators for auditing and monitoring. The framework is aimed at providing a systematic approach for measuring progress in asset management.
- A *Data Collection Strategy* was prepared defining the frequency for repeating data collection depending on data types and traffic levels.
- An institutional setup for the operation of the RAMS was recommended.
- Equipment was procured, including i) a server computer for the database and two desktop computers to control the RAMS, ii) five radar traffic counters, iii) a license for HDM-4, iv) a high-resolution camera and a GPS receiver for use on the TRASSA survey vehicle.
- Staff of RMD/PIC/PLUAD/UAD/DEU were trained in road and traffic data collection, data post-processing, data management, road maintenance planning, and using various systems.
- Teachers and students of the Department of Roads, Bridges and Tunnels of the Kyrgyz State University on Construction, Transport and Architecture (KSUCTA) were trained in the RAMS and its components with the aim of strengthening the capacities of professional staff graduating from the university.

16. The above-mentioned outputs were provided as part of Phase I RAMS development in the Kyrgyz Republic. The current Terms of Reference have been developed for the next Phase II RAMS development in the Kyrgyz Republic and will be a logical continuation of Phase I started in 2018. Copies of reports prepared by the Phase I consultant, will be provided to the Phase II consultant. A copy of the Final Report of the Phase I consultant can be downloaded from the following link:

https://www.dropbox.com/s/7sbkds5kq3nktzc/Final%20report.pdf?dl=0

17. Apart from the above, the Government plans to use the remaining funding under Phase I for the procurement of a new survey vehicle and related equipment for paved roads. This survey vehicle will be used for data collection under Phase II and is expected to include the following equipment:

- High-resolution distance measuring instrument with an accuracy below 0.1 metres
- Global Positioning System (GPS) receiver with sub-metre accuracy capable of connecting with different satellite systems
- Inertial Navigation System for improving GPS accuracy and dead-reckoning when satellite reception is poor
- Class 1 laser profilometers for measuring longitudinal roughness in both wheel tracks
- Transverse profiler for measuring rutting with at least 3 lasers capable of measuring full lane width and a calibrated vertical resolution below 1 mm
- 3 x high-definition forward-facing linear video cameras, each with a minimum 60˚ coverage (travelling lane and right-of-way). Cameras should have a minimum definition of 5 megapixels and must meet requirements for iRAP road safety assessments
- High-definition backward-facing linear video camera for identifying traffic signs and other items in the direction opposite to the survey direction
- High-definition downward-facing pavement linear video camera (surface defects) with a minimum definition of 5 megapixels
- Data post-processing software for semi-automatically determining surface distress types and volumes using the pavement video data
- Personal computer with data acquisition software that allows collected data to be linked together and exported in basic database format for easy processing and uploading to RAMS
- Data post-processing software that allows video and other data to be reviewed, inventory and defects to be identified, measurements to be made, and additional data to be entered using rating keyboards
- Video traffic analysing software for automatically determining traffic volumes by vehicle class
- Ground penetrating radar system with sounding depth of up to 1.5 metres

- Trailer installed falling weight deflectometer with electricity generator and load determination accuracy of 10kN and deflection accuracy of 10 µm
- Trailer installed skid resistance measuring device including irrigation system

D. Scope of Work

18. Under Phase II RAMS development, the Consultant will be responsible for the following broad activities that are explained in more detail in the following sections.

- Procure equipment to strengthen the capacity of RMD, PIC and underlying entities to collect and manage data for the entire road network
- Update data for the paved road network and expand the data collection to include the unpaved road network
- Further develop the database in the Road Information System (RIS) to incorporate the collected data for paved and unpaved roads as well as data for structures
- Further develop the web-based Maintenance Planning System (MPS) to include functionality to present and combine data from the database, and to further improve the planning for paved roads and expand the planning to unpaved roads and other assets
- Support MOTC in developing a legal basis for integrating the RAMS into annual planning and budgeting procedures, and prepare an Action Program for further development of the RAMS
- Support the initial operation of the newly established Asset Management Unit under RMD and provide recommendations for strengthening the institutional structure of RMD, PIC and underlying entities to operate and manage the RAMS
- Identify annual funding needs and suitable funding sources for road maintenance and repair, providing support to the establishment of a new road fund
- Provide capacity building and training to staff of RMD, PIC and underlying entities
- Develop a university course on RAMS to strengthen the capacities of future generations of engineers

19. All solutions proposed by the Consultant must be fit for purpose, reflecting local requirements and capacities, must be sustainable in the long-term, and must meet minimum requirements outlined in this Terms of Reference. The preference is for the Consultant to use/adapt/improve existing equipment or systems at the MOTC as much as practical, guiding the PIC in data collection, data processing and data management and building capacity within RMD for data analysis and planning.

Equipment Procurement

20. The Consultant will procure the following equipment that will be used in carrying out the services under this assignment and complementing the already available survey equipment. Procurement will be in line with ADB procurement regulations.

21. **Survey equipment for unpaved roads**. The existing TRASSA survey vehicle and the proposed new survey vehicle are not suitable for use on unpaved roads, as vehicle and equipment are easily damaged. To allow unpaved roads to be surveyed under Phase II RAMS development, the Consultant will procure a set of survey equipment to be installed on an existing MOTC vehicle (4x4 pick-up, to be provided by MOTC). The survey equipment to be procured will include one set of the following items that will be installed on the vehicle to be provided by MOTC. The Consultant will prepare the detailed specifications and carry out the procurement in line with ADB Procurement Guidelines.

- GNSS/INS**Ошибка! Закладка не определена.** receiver with sub-metre accuracy
- Class 3 bump integrator with a calibrated vertical resolution below 0.5 mm
- Rugged distance measuring instrument based on proximity sensor with an accuracy below 1 metre

- High-definition video cameras consisting of forward- and backward-facing cameras with a minimum 60˚ coverage (travelling lane and one additional lane) or a single 360˚ camera. Cameras should have a minimum definition of 5 megapixels

22. **Survey equipment calibration**. All existing survey equipment to be used in this assignment as well as the newly procured survey equipment will be installed and calibrated before use according to international standards. The Consultant will carry out the installation and calibration, and will prepare an *Equipment Calibration Report*. The equipment may not be used for data collection under this assignment until the report has been approved. Separate partial reports may be prepared for different equipment to allow approval for that equipment to proceed and to avoid delay of the related surveys. The Consultant will involve PIC in the calibration process and will provide training on equipment calibration to PIC staff. The Consultant will also prepare an *Equipment Calibration Manual* specifying the activities to be undertaken in the maintenance and calibration of the different types of survey equipment used for data collection.

23. **Server and computers**. The Consultant will assess the condition and technical specifications of the existing RAMS server procured under Phase I and determine the need for procuring a new server with improved specifications. If considered necessary, the Consultant will procure a new server together with three additional desktop computers suitable to working with the RAMS (complementing the two computers procured under Phase I). The Consultant will prepare the detailed specifications and carry out the procurement in line with ADB Procurement Guidelines.

Data Collection and Post-Processing

24. **Data collection and post-processing**. The data collection will include the collection of data using the existing and newly procured survey equipment, as well as the subsequent post-processing of the collected data. The data collection and post-processing will be carried out by the Production Innovation Centre (PIC) with support from the Consultant. The data collection for unpaved roads will be financed through the government budget, while for paved roads and traffic counts it will be financed through a provisional sum under the contract for the Phase II Consultant. For all data collection and post-processing, the Consultant will work closely with PIC and provide on-the-job and formal capacity building. The Consultant will be responsible for ensuring that the target lengths of roads are surveyed and the resulting data is post-processed by PIC, and for ensuring the quality of the data entered into the database.

25. **New data collection for 600 km of paved roads**. Of the 8,100 km of paved roads, 7,513 km were surveyed under Phase I RAMS development. This leaves approximately 600 km of paved roads that have not yet been surveyed (generally because these roads were under construction), and which need to be surveyed under Phase II. The Consultant, through PIC, will carry out a full data collection of these paved roads, including basic inventory, condition and traffic data. This will involve drive-over surveys using the TRASSA survey vehicle or the new survey vehicle to collect GPS, roughness, rutting and video/photo data, and the subsequent post-processing of this data to identify basic inventory data and surface defects in line with the approach used under phase I. Data collection for these roads will be carried out in 2022 in order to ensure that data is available for the entire paved road network. The applied approach for collecting new data in paved roads will be presented in an updated version of the *Data Collection and Management Manual*.

26. **Updating data for 7,500 km of paved roads**. Data collection for 7,513 km of paved roads was carried out in 2018-2019, with some data collection carried out in subsequent years. The paved roads surveyed included approximately 10% with traffic volumes exceeding 7,000 ADT, 45% with traffic volumes of 1,000-7,000 ADT and 35% with traffic volumes below 1,000 ADT. The collected data needs to be updated in line with the *Data Collection Strategy* developed under Phase I[1]. Under phase II, it is assumed that the entire

[1] The Data Collection Strategy recommends updating condition and traffic data every year for the roads with more than 7,000 ADT, every two years for the roads with 1,000-7,000 ADT (half the road length each year) and every 3 years for the remaining roads with less than 1,000 ADT (one-third of the road length each year). This implies that each year approximately 750 km of high traffic roads will need to be surveyed, as well as 1,700 km of medium traffic roads, and 900 km of low traffic roads, resulting in a total length of 3,350 km of paved roads to be surveyed each year.

paved road network surveyed under phase I, will be surveyed again under phase II over a period of three consecutive years (2022, 2023 and 2024), implying a total survey length of approximately 7,500 km. The Consultant, through PIC, will carry out a data collection update for these paved roads, focusing on condition and traffic data. The condition data collection will involve drive-over surveys using the TRASSA survey vehicle or the new survey vehicle to collect roughness, rutting and video/photo data, and the subsequent post-processing of this data to identify surface defects. Inventory data is not expected to have changed and will only be updated through post-processing of the video data where changes have occurred as a result of implemented works (these roads will receive priority for data collection in 2022). Data collection for these roads will be carried out in 2022, 2023 and 2024 in line with the *Data Collection Strategy*. The applied approach for updating data in paved roads will be presented in an updated version of the *Data Collection and Management Manual*. This will include an updated version of the *Data Collection Strategy*, describing data collection frequencies and providing a schedule for updating inventory, condition and traffic data for paved roads in the medium-term.

27. **Data collection approach for unpaved roads**. Under Phase I, a data collection approach was developed for paved roads. Under Phase II, the Consultant will develop a similar approach for data collection in unpaved roads, identifying the data types to be collected and the means and equipment to be used. This will take into account the different defect types and defect evolution in unpaved roads. Account will also be taken of the equipment procured for surveying unpaved roads. The proposed data collection strategy will be presented in an updated version of the *Data Collection and Management Manual*.

28. **Data collection for 2,000 km of important unpaved roads**. Data collection for unpaved roads will focus on important unpaved roads, including all international unpaved roads (700 km) and all unpaved roads with more than 1,000 ADT (950 km) as well as a limited number of other unpaved roads providing important connectivity. The total length of important unpaved roads is expected to amount to approximately 2,000 km. For these important unpaved roads, the Consultant, through PIC, will collect data, including basic inventory, condition and traffic data. This will involve drive-over surveys using the survey equipment for unpaved roads procured under this assignment and installed on a vehicle of MOTC to be provided to PIC. The drive-over surveys will as a minimum collect GPS, chainage, roughness and video data. This data will be post-processed to identify basic inventory data and surface defects in line with the data collection approach for unpaved roads. Data collection for these roads will be carried out in 2022 and completed in 2023. The applied approach for collecting data in important unpaved roads will be presented in an updated version of the *Data Collection and Management Manual*. This will list the identified important unpaved roads, describe the data to be collected for important unpaved roads, define data collection frequencies and provide a schedule for updating inventory, condition and traffic data for important unpaved roads in the medium-term.

29. **Data collection for 6,000 km of other unpaved roads**. The remaining 8,700 km of unpaved roads have less than 1,000 ADT, and the majority have less than 300 ADT. Under phase II, surveys will be carried out in up to 6,000 km of other unpaved roads. For these less important unpaved roads, the Consultant, through PIC, will carry out a basic data collection aimed at recording data on location, length, surface type, general condition and traffic category for these roads. This will involve drive-over surveys using the survey equipment for unpaved roads procured under this assignment and installed on a vehicle of MOTC to be provided to PIC. The drive-over surveys will collect GPS, chainage, roughness and video data. Post-processing will be limited to determining the surface type, overall condition category based on visual assessment, and traffic category based on moving traffic counts (this data may also be recorded during the drive-over survey). The video data will be made available for further post-processing if required. Where the moving traffic counts show that the road should be considered as an important unpaved road (more than 1,000 ADT), full post-processing of the data will be carried out as part of the previous task. Data collection for these roads may be initiated in 2022, but will largely be carried out in 2023 and 2024. The applied approach for collecting a basic set of data in unpaved roads will be presented in an updated version of the *Data Collection and Management Manual*. This will describe the data to be collected for other unpaved roads, define data collection frequencies and provide a schedule for updating inventory, condition and traffic data for other unpaved roads in the medium-term.

30. **Traffic counts for paved and unpaved roads**. For the paved and unpaved roads for which surveys will be carried out, the Consultant, through PIC, will carry out one-day classified traffic counts using the 5 SDR radar traffic counters procured under Phase I. For the 7,513 km of paved roads surveyed in Phase I, traffic counts were carried out in 341 traffic counting locations. The Consultant will carry out traffic counts in the paved road network in these same Phase I counting locations, expanding the number of counting locations in the paved road network where this is considered necessary, including for the 600 km of paved roads to be newly surveyed under Phase II. For the unpaved road network, traffic counts will be carried out for the approximately 2,000 km of important unpaved roads. For the other unpaved roads, traffic estimations will be made based on moving traffic counts using the collected video data – if these traffic estimations show traffic volumes to be in the order of 1,000 ADT or more, the road will be seen as an important unpaved road and a one-day traffic count will need to be carried out. In total, the Consultant, through PIC, will carry out one-day traffic counts using the SDR radar traffic counters in up to 600 locations. The majority of these will be in paved roads (approximately 400-450 counts) and the remainder in important paved roads (approximately 150-200 counts). The traffic counts for each road will be carried out in the same period as the road surveys for that specific road.

31. **FWD data collection for paved roads**. The Consultant, through PIC, will collect deflection data on pavement strength for a sample of up to 100 km of paved roads to be identified in coordination with RMD. The deflection data will be collected using the falling weight deflectometer to be procured under this assignment. The Consultant will provide on-the-job training to PIC staff in the collection of deflection data as well as in the post-processing and analysis of this data to determine the pavement strength. The applied approach for collecting and post-processing FWD data in paved roads will be presented in an updated version of the *Data Collection and Management Manual*.

Road Information System (RIS)

32. **Paved road data**. The Consultant will check and validate all collected and processed data for paved roads, followed by entry into the database in the Road Information System (RIS). Since the data to be collected for paved roads will be the same as in Phase I, the structure of the database is considered suitable to allow the paved road data collected under Phase II to be entered. The Consultant, through PIC, will carry out the data validation and entry into the RIS database of all data for paved roads collected under this assignment. The Consultant will provide on-the-job training to PIC staff in paved road data validation and entry. All data entry will include the date of collection of the data concerned.

33. **Unpaved road data**. The Consultant, through PIC, will check and validate all collected and processed data for unpaved roads, followed by entry into the RIS database. Since the data to be collected for unpaved roads will include datatypes specific to unpaved roads (especially regarding surface defects), the Consultant will need to adjust the structure of the RIS database to allow the data to be entered. The Consultant will provide on-the-job training to PIC staff in unpaved road data validation and entry. All data entry will include the date of collection of the data concerned.

34. **Deflection data**. The Consultant will check and validate all deflection data collected using the FWD for paved roads, followed by entry into the RIS database. Since pavement deflection data has not yet been included in the RIS database, the Consultant will need to adjust the structure of the RIS database to allow the data to be entered. The Consultant will provide on-the-job training to RMD and PIC staff in deflection data validation and entry. All data entry will include the date of collection of the data concerned.

35. **Bridge data**. Bridge data was collected with JICA support in 2014-15. The available data was entered into the RIS database under Phase I. RMD plans to update the data for 600 bridges in the international road network. Any collected data will need to be entered into the RIS database. The Consultant will make any necessary adjustments to the RIS database to allow the collected bridge data to be entered and will support RMD and/or PIC in the entry of the collected data. The Consultant will provide on-the-job training to RMD and PIC staff in bridge data validation and entry. All data entry will include the date of collection of the data concerned.

36. **Spring and Autumn Survey data**. Data on the road inventory and road condition is also collected during the spring and autumn surveys carried out by the DEUs with involvement of the PLUADs/UADs and RMD. Some of this data is suitable for inclusion in the RIS database, complementing the data collected through drive-over surveys, especially regarding the planning of routine maintenance and repair. The Consultant will analyse the data collected during the spring and autumn surveys and identify useful data suitable for inclusion in the RIS database. The Consultant will make the necessary adjustments to the RIS database to allow the collected spring and autumn survey data to be entered. The Consultant will provide on-the-job training to DEU and PLUAD/UAD staff in validation and entry of data from the spring and autumn surveys. All data entry will include the date of collection of the data concerned.

37. **Culvert data**. RMD through the DEUs has been collecting data on culverts as part of their road passportization. So far, data has been collected for approximately 9,000 culverts of a total of approximately 19,000 culverts. The Consultant will make the necessary adjustments to the RIS database to allow the collected culvert data to be entered. The Consultant will provide on-the-job training to DEU and PLUAD/UAD staff in validation and entry of culvert data. All data entry will include the date of collection of the data concerned.

38. **Web-based data entry module**. The RIS database is currently only accessible through a desktop computer connected to the local area network of the database server, with the necessary software installed. To enable the entry of certain data types by the DEUs, the PLUADs/UADs and the PIC, the Consultant will develop a web-based data entry module. This will also include the possibility of batch uploads of validated data from the survey equipment, exported in a basic database format. The data entry module will furthermore allow new roads to be added by uploading the GPS tracks of the roads concerned, followed by the relevant data for that road. The data entry module will furthermore include the ability to amend existing GPS tracks while keeping the original data in case alignments are changed or errors in the existing GPS track are encountered. The web-based entry module will restrict the data that may be entered or edited by each user depending on the authorisation level, including restrictions per subnetwork managed by each DEU. The Consultant will provide on-the-job training to PIC and RMD staff as well as staff from DEUs and PLUADs/UADs in the entry of data using the web-based data entry module.

39. **Quality control**. The Consultant will be responsible for ensuring the quality of the data entered into the RAMS database. The procedure for quality control will be described in a *Quality Management Plan* to be submitted together with the *Inception Report*. Apart from supervising the data validation by PIC, the Consultant will carry out audits of the entered data to ensure quality is in line with the *Quality Management Plan*.

40. **Data Collection and Management Manual**. A *Data Collection and Management Manual* was developed under Phase I. The Consultant will renew or update this manual, incorporating the data collection procedures for paved and unpaved roads (including FWD data collection and analysis) and for updating previously surveyed roads. The manual will also describe the equipment to be used and the manner of using this equipment. The manual will include a detailed description of the validation procedures to be applied and the process for data entry into the RIS database. The manual will further include a detailed description of the annual data collection needs and a programme for data collection in future years, based on the *Data Collection Strategy* developed under Phase I.

Maintenance Planning System (MPS)

41. **Data assessment and standard reporting module**. The RIS database allows the data to be reviewed and filtered, and allows certain standard reports to be prepared based on the data in the database. However, the RIS database is only accessible from the local area network and using computers with the database software installed. The Consultant will transfer this functionality to the web-based Maintenance Planning System (MPS), allowing data in the RIS database to be accessed, filtered and exported for use outside the database. The Consultant will also review the set of standard reports that can be prepared, and transfer this function to the web-based MPS, amending and expanding the set of standard reports as required.

42. **Treatment matrix for bituminous roads**. A treatment selection tool for bituminous roads was prepared under Phase I. This defines the type of routine maintenance, periodic maintenance or rehabilitation/improvement to be carried out in a specific road, based on the roughness, degree of cracking, degree of rutting, number of potholes, and traffic volume of that road (as reflected in the collected data). This is presented in the form of a treatment matrix, defining the optimal treatment for each road case. The treatment matrix was prepared using an HDM4 strategy analysis. The Consultant will review this tool and further improve its functioning based on lessons learned during its use and on the new and updated data collected under Phase II. The Consultant will further expand the treatment matrix to include deflection data based on the FWD measurements (where available). The Consultant will carry out a new strategy analysis using HDM4 to check the validity of the treatment matrix and make the necessary amendments to the proposed treatments. The Consultant will incorporate the updated treatment matrix for bituminous roads into the Maintenance Planning System (MPS). The updated treatment matrix for bituminous roads and a description for its use will be included in a *RAMS Planning Manual* to be prepared by the Consultant.

43. **Treatment matrix for cement concrete roads**. The treatment matrix prepared under Phase I applies only to bituminous roads. The Consultant will prepare a similar treatment matrix for cement concrete roads that make up 8% of the network. The resulting treatment matrix will allow the necessary treatments to be determined based on collected data on surface defects, traffic, etc. The Consultant will incorporate the updated treatment matrix for cement concrete roads into the MPS. The new treatment matrix for cement concrete roads and a description for its use will be included in a *RAMS Planning Manual* to be prepared by the Consultant.

44. **Treatment matrix for unpaved roads**. For unpaved roads a treatment matrix tool does not yet exist. The Consultant will develop a treatment matrix or other suitable tool that allows the necessary treatments to be determined based on data collected for unpaved roads regarding surface defects, traffic, etc. The Consultant will incorporate the updated treatment matrix for unpaved roads into the MPS. The new treatment matrix for unpaved roads and a description for its use will be included in a *RAMS Planning Manual* to be prepared by the Consultant.

45. **Prioritization of road treatments**. Under Phase I, a Priority Index was introduced that is based on a Functionality Index and a Condition Index[2]. The Priority Index forms the basis for ranking road sections and related treatments in order of priority. The Consultant will review the Priority Index approach, and its applicability to paved roads. The Consultant will also assess the suitability of the Prioritization Index approach to unpaved roads, and make any necessary amendments for use in unpaved roads. The criteria for prioritization will be reviewed and adjusted as necessary, including any necessary amendments to the approach or the formulas, scores and weights applied. The Consultant will incorporate the resulting approach for prioritization of treatments into the MPS. The updated prioritization approach and a description for its use will be included in a *RAMS Planning Manual* to be prepared by the Consultant.

46. **Decision support tool for bridges and tunnels.** Under Phase I, the bridge data collected with JICA support in 2014-15 was entered into the database. In addition, a Bridge Condition Index and Bridge Priority Index were introduced. The Consultant will review the approaches for treatment selection and treatment prioritization to be applied to bridges as well as tunnels and galleries, and amend these as necessary. Account will be taken of the new data to be collected by RMD. The Consultant will incorporate the resulting approaches into the MPS to allow for planning of bridge treatments. The new decision support tool for

[2] The Functionality Index reflects the importance of a road section and awards scores based on the road class, the technical category, the traffic volume, the number of population centres served, the number of traffic accident black spots in the section, and the prioritisation of the section by local authorities. The score ranges from a minimum of 5 to a maximum of 20. The Condition Index reflects the condition of the road section and awards scores based on the degree of cracking, the roughness, the number of potholes, the degree of rutting, the extent of previous repairs, and the length of edge breaks. The score ranges from a minimum of 4 to a maximum of 24. The Priority Index combines both scores with a maximum score of 480.

bridges and tunnels and a description for its use will be included in a *RAMS Planning Manual* to be prepared by the Consultant.

47. **Routine and winter maintenance planning tool**. The planning systems developed under Phase I focus mainly on selecting and prioritizing current repairs, mid-term repairs (periodic maintenance) and rehabilitation/improvement treatments based on collected data stored in the database. For routine maintenance carried out by local maintenance units (DEUs), a separate system has been developed based on data collected by DEUs through visual inspections during autumn and spring surveys, while for winter maintenance a system has been developed based on levels of service. The Consultant will review these routine and winter maintenance planning tools and further develop these into workable systems that may be used to plan routine and winter maintenance. The Consultant will incorporate the resulting approaches into the MPS. The updated planning tool for routine and winter maintenance and a description for its use will be included in a *RAMS Planning Manual* to be prepared by the Consultant.

48. **Three-Year Rolling Plan**. The Consultant will update the Three-Year Rolling Plan for road maintenance, rehabilitation and improvement prepared under Phase I, expanding this to include the new roads surveyed under Phase II. The rolling plan should be prepared using the MPS, complemented by an HDM4 analysis to compare and verify the results. The three-year rolling plan will focus on mid-term repair (periodic maintenance), capital repair (rehabilitation) and improvement works to be carried out in the planning period, with a detailed plan for the first year and general plans for years 2 and 3. This will be complemented by a description of the volume and cost of routine and winter maintenance to be carried out each year. The three-year rolling plan will also include proposed treatments to be carried out in bridges and tunnels during the planning period. The optimized works should be packaged into projects. The methodology used for the packaging should be reproducible and documented in the *RAMS Planning Manual* to be prepared by the Consultant. The Consultant will prepare a three-year rolling plan in 2023 for the period 2024-2026, and update this in 2024 for the period 2025-2027.

49. **Plan monitoring**. The RAMS system developed under Phase I allows plans to be prepared and saved in the database. Under Phase II, the Consultant will further develop this part of the system to allow updated versions of the plan to be saved and registered, and to allow the implementation of the plan to be monitored. This will include tables and graphs to show progress in the implementation of the annual plans and three-year rolling plans.

50. **Monitoring tool for key performance indicators**. Under Phase I, a Performance Management Framework was developed that identifies a set of key performance indicators (KPIs) reflecting the performance of the road network. This includes indicators regarding the condition of the road network and bridges, as well as indicators regarding the volume of works carried out, the level of financing provided, the number of traffic fatalities and the road user satisfaction. The Consultant will review the KPIs and propose amendments as required. The KPIs will be expanded to include additional statistical data regarding the road network (lengths and percentages by class, technical category, surface type, traffic, condition, etc.). The Consultant will further automate the calculation of the KPIs and road network statistics in the MPS based on collected data entered into the RIS database. This will include the automated generation of an *Annual Road Network Report* reflecting the actual value of the different KPIs and road network statistics and comparing this to previous years, both in tabular and graph format.

51. **RAMS Planning Manual**. The Consultant will prepare a *RAMS Planning Manual* that describes the different elements of the Maintenance Planning System and how these are to be used in preparing annual plans and budgets. The manual will describe the treatment selection tools as well as the tools for prioritizing treatments. The manual will cover the planning of current repairs, periodic maintenance and rehabilitation/improvement works as well as routine and winter maintenance planning in paved and unpaved roads, and the planning of treatments in bridges and tunnels. The manual will describe both the underlying tools and algorithms, as well as the use of the Maintenance Planning System by users.

Institutional Reform

52. **Institutional setup for RAMS operation**. The Consultant will review the existing and proposed setup for operation of the RAMS (data collection, data processing, data management and data analysis as the basis for planning and budgeting) and propose adjustments as required. The Consultant will work out a detailed organizational setup for future operation of the RAMS, and will support MOTC, RMD and PIC in initiating the necessary reforms. This will be presented in a *RAMS Operation Manual* and in a workshop involving RMD, PIC, the representatives from the PLUADs/UADs/GDAD and the DEUs. The Consultant will support MOTC, RMD and PIC in carrying out the necessary reforms and in operating the RAMS and carrying out related business practices during the assignment period.

53. **Asset Management Unit**. An Asset Management Unit was established under RMD in Phase I. The Consultant will provide support to RMD in the strengthening of this unit, identifying necessary staff positions and supporting RMD in the hiring or transfer of suitable staff and training of existing staff. The Consultant will further support RMD in preparing detailed terms of reference for each of the staff positions in the unit, and preparing reporting procedures for the unit. The Consultant will assess the annual budget needs for the operation of the RAMS by the asset management unit, including outsourcing of data collection and management, and assist RMD in justifying this as part of the budget request. This will be presented in a *RAMS Operation Manual* and in a workshop involving RMD, PIC, the representatives from the PLUADs/UADs/GDAD and the DEUs.

54. **Implementation of maintenance activities**. Routine and winter maintenance are currently carried out by local maintenance units (DEUs) under RMD. Budget allocations for maintenance are limited, and a significant portion of the available funding is spent on fixed costs of the DEUs. Private sector participation is limited to larger works and development partner financed projects. The Consultant will review current implementation modalities for routine and winter maintenance and repair, and asses the capacities and budget expenditures of the different DEUs. The Consultant will prepare a proposal for converting the DEUs into commercially viable enterprises. This proposal will also include the partial and gradual opening up of routine and winter maintenance to competitive bidding with participation of the private sector. The Consultant will also review the option of performance-based contracts for routine and winter maintenance, either as service-level agreements (SLA) with the DEUs or as performance-based contracts (PBC) with contractors. The resulting proposal will be presented in a *Maintenance Implementation Report* and in a workshop involving RMD and representatives from the underlying PLUADs/UADs/GDAD and DEUs.

Road Financing

55. **Funding needs**. Based on the data collected under phases I and II, the Consultant will carry out an analysis of the unconstrained short- and long-term funding needs for maintenance, rehabilitation and improvement. This will be compared to current and past budget allocations and uses. Apart from the unconstrained budget scenario, the Consultant will carry out a strategy analysis for 3 other budget scenarios (current budget allocation and 2 intermediate budget levels), optimizing the budget allocations and determining the impact of the different budget scenarios on future road network conditions. The results will be presented in a *Road Financing Report* and in a workshop to MOTC and MOF.

56. **Funding sources**. Current budget allocations to road maintenance and repair are insufficient to meet the needs, impacting on road network conditions. The Consultant will review road user charges currently being collected in the Kyrgyz Republic and the related revenue amounts, identifying suitable sources for financing the funding needs for road maintenance and repairs. This will look at existing revenues as well as the possible introduction of new road user charges or amendments of the rates applied. The results will be presented in a *Road Financing Report* and in a workshop to MOTC and MOF.

57. **Road Fund and Road Board**. The Kyrgyz Republic used to have a Road Fund, but this was abolished in 2018. In late 2021, the Government re-established the Road Fund and established a Road Board to manage the fund. The Consultant will review the experiences with road funds in the Kyrgyz Republic and

internationally, and provide recommendations for the new Road Fund and Road Board. This will include recommendations for the organizational structure for the secretariat of the fund and the Road Board, the earmarking of road user charges to finance the fund, the rates and revenues from road user charges to be allocated to the fund, the scope of works to be financed by the fund, the procedures for using the funds and making payments for implementation of works, and the financial and technical reporting and auditing requirements for the fund, amongst others. The results will be presented in a *Road Financing Report* and in a workshop to MOTC and MOF.

58. **Road Financing Report**. The Consultant will prepare a Road Financing Report describing the optimum budget for road maintenance and repair, and the impact of lower budgets on future road network conditions. The report will also identify possible funding sources based on road user charges that are already being collected or that may be introduced. A first draft of the report will be prepared early 2023 based on available data, as a support document for enhancing the operation of the new Road Fund. The report will be updated in subsequent years as more data becomes available for the road network.

RAMS legal basis

59. **Legal basis for annual data collection**. In order to ensure that data is collected and updated regularly, the Consultant will support MOTC in preparing and issuing a legal instrument defining the responsibility for carrying out data collection and post-processing on an annual basis. The legal instrument should refer to the frequency for repeating data collection and include targets for annual data collection, allocating responsibility for achieving this. The legal instrument should also include the need to allocate annual budget amounts to finance the data collection, processing, validation and entry into the RAMS database. The legal instrument should further clarify the role to be played by PIC in the data collection and management. This will build on Decree No. 372 of July 1, 2016 “On Approval of the main directions of the road sector development for 2016-2025” that is currently being updated.

60. **Legal basis for using RAMS in planning and budgeting**. In order for the RAMS to be integrated into the annual planning and budgeting procedures, the Consultant will map the current procedures, building on the analysis carried out under Phase I. The Consultant will further define in detail how the current procedures will need to be amended to allow the RAMS to be integrated into the planning and budgeting procedures. The Consultant will prepare a legal instrument defining the adjusted planning and budgeting procedures and the role to be played by the RAMS, as well as the responsibilities of the different MOTC units and entities involved. This will build on Decree No. 372 of July 1, 2016 “On Approval of the main directions of the road sector development for 2016-2025” that is currently being updated.

61. **RAMS Action Program**. The Consultant will prepare a RAMS Action Program and support RMD in issuing it through a legal instrument. The Action Program will identify specific targets to be achieved (e.g. regarding data updates, planning, financing, implementation) and timeframes for doing so, and will define the responsibilities for achieving the different targets. The RAMS Action Program will be presented to MOTC and MOF for approval and subsequent publication.

Capacity Building

62. **Capacity Building Plan**. At the start of this assignment, the Consultant will prepare a *Capacity Building Plan* as part of the *Inception Report*. This will describe the existing capacity gaps related to road asset management and how these will be addressed through different capacity building and training activities to be carried out during the course of this assignment, involving the different units and entities under MOTC that are stakeholders in the RAMS. This will include, but will not be limited to, the following activities.

63. **On-the-job training and technical support to PIC**. The Consultant will provide capacity building to PIC throughout the assignment. This will focus on data collection for paved and unpaved roads using the various survey vehicles, as well as the subsequent post-processing of collected data and the data validation and entry into the RIS database. Capacity building will largely consist of on-the-job training during the implementation

of the data collection, post-processing and entry, but will be complemented by formal training sessions and training materials (e.g. *Data Collection and Management Manual*).

64. **On-the-job training and technical support to Asset Management Unit**. The Consultant will provide capacity building to Asset Management Unit under RMD throughout the assignment. This will focus on data analysis and subsequent planning and budgeting using the MPS based on the data entered into the RIS database. Capacity building will largely consist of on-the-job training during the implementation of the data analysis and planning, but will be complemented by formal training sessions and training materials (e.g. *RAMS Planning Manual*).

65. **Training for staff of RMD/PIC/PLUAD/UAD/DEU**. Apart from the specific capacity building for staff of the PIC and Asset Management Unit, the Consultant will provide training to staff of RMD, PIC, PLUAD/UAD/GDAD and DEUs who will be involved as users of the RAMS. This will consist of formal training sessions for key staff and related training materials. The Consultant shall conduct practical trainings to train the EA staff on entering the processed data into the road database, so that after the end of this assignment (contract) of the Consultant, PIC and DEU by themselves will carry out the entire cycle of work with the RAMS, including data collection, data processing and input of data into the RAMS. The training should also cover the use of other survey equipment, software and applications considered suitable for data collection in the Kyrgyz Republic, such as RoadLab or other similar tools.

66. **Development of KSUCTA courses on RAMS**. The Consultant will continue the support provided to the Kyrgyz State University on Construction, Transport and Architecture (KSUCTA) under Phase I, developing together with KSUCTA staff a specific course for university students on road asset management and RAMS, training the teachers in providing this course. This will involve a 40-hour course including all training material for students, as well as training of KUCSTA teaching staff. The Consultant will prepare the training material and carry out the training of teachers in 2022-2023, and will support the initial implementation of the course during the 2023-2024 academic year.

E. Implementation Schedule

67. The Consultant will carry out the activities listed in the scope of work over a period of approximately 30 months from mid-2022 to November 2024. A tentative schedule is included below. The assignment period will cover three calendar years, with data collection activities to be carried out in the spring-summer-autumn period (tentatively from April to October) each year. During the winter period, the focus will lie on finalizing the data processing and analysis, and on preparing the various other deliverables. The Consultant is required to provide a detailed implementation schedule as part of its technical proposal.

68. The Consultant is expected to start in mid-2022. Initially the focus will be on preparing the Inception Report and Capacity Building Plan, as well as the procurement of equipment. The Consultant will also develop the data collection procedures for unpaved roads. There will be limited time for data collection in 2022, and the focus will be on testing and calibrating the equipment and testing the new data collection procedures, as well as initiating the capacity building for PIC and the asset management unit of RMD, and the preparation of the KSUCTA courses on RAMS. During the winter season the focus will be on amending the RIS database to store collected data, and to further develop the MPS and expand its functionality.

69. In 2023 the focus will be on data collection and post-processing for paved and unpaved roads, supporting PIC in this activity. The Consultant will also further develop the RIS database and the MPS, using this to analyse the collected data and prepare a three-year rolling plan. This in turn will support the development of the different manuals and reports required under this assignment. The Consultant will further support the initial operation of the RMD asset management unit and conduct the new course on RAMS in KSUCTA.

70. In 2024 the focus will be on completing the planned data collection and post-processing. PIC will be responsible for carrying this out independently with Consultant support as required. The Consultant will

further support RMD in analysing the data and preparing an updated three-year rolling plan. During this year, all manuals and reports will be finalized, and the Consultant will pay specific attention to enabling the RMD asset management unit to independently support the planning and budgeting using the RAMS.

Subject to change

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Activity	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N
Inception	■																													
Equipment procurement	■	■	■	■																										
Equipment calibration + report		■	■	■						■	■											■	■							
Equipment Calibration Manual				■	■																							■		
Data collection				■	■						■	■	■	■	■	■	■						■	■	■	■	■	■	■	
Data validation and entry				■	■	■								■	■	■	■	■								■	■	■	■	
Data Collection Report							■												■										■	■
Data Collection and Management Manual							■	■											■	■									■	■
Updated Road Information System Database						■	■	■									■	■	■	■								■	■	
Updated Maintenance Planning System							■	■	■	■									■	■	■							■	■	■
Three-Year Rolling plan									■	■										■	■								■	■
Road Financing Report										■	■									■	■								■	■
RAMS Planning Manual										■	■								■	■									■	
RAMS Operation Manual																			■	■									■	
Legal instruments for RAMS										■	■	■								■	■									
RAMS Action Program										■	■	■								■	■									
Maintenance Implementation Report																		■	■	■	■								■	
Capacity Building		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Capacity Building Report								■											■											■
RAMS course development							■	■	■	■	■							■	■	■	■	■	■	■	■	■				

F. Deliverables

71. The Consultant will be responsible for submitting several deliverables. The main deliverable will consist of the improved Road Information System (RIS) database and Maintenance Planning System (MPS), including the collected and processed data entered into the database. This will be complemented by a number of reports and manuals describing the activities undertaken and providing guidance in the operation and use of the RAMS. The deliverables are listed below.

72. **Inception Report (after 1 month)**. The Inception Report will be prepared within 1 month after contract signing. This will describe the approach to be used by the Consultant in carrying out the services, including the equipment to be used in data collection, the necessary post-processing, the data to be entered into the database, the necessary amendments to be made to the RIS database, the improvements to be carried out to the MPS, the required resources and the final implementation schedule. The Inception Report will include a **Traffic Management Plan** for traffic management during data collection activities, to be agreed with MOTC and ADB. The Traffic Management Plan will include a system for recording any incidents or issues that may occur during data collection. The Inception Report will furthermore include a **Quality Management Plan** for quality control of the data entered into the RAMS database. The Quality Management Plan will describe the required calibration of survey equipment, the procedures to be applied in planning and implementing the surveys, the location referencing system to be used, the procedures to be applied to identify and deal with errors in data collection, the approaches to be used for backing up raw data and processed data and for avoiding data corruption and viruses, and data security measures to avoid loss of data. A **Capacity Building Plan** will also be included, describing the capacity gaps related to road asset management and how these will be addressed through different capacity building and training activities involving the different units and entities under MOTC that are stakeholders in the RAMS.

73. **Monthly Progress Reports (each month).** Each month the Consultant will prepare a Monthly Progress report indicating the activities carried out and the progress achieved with the different deliverables, as well as a detailed plan for the activities to be undertaken in the next 2 months. The report will highlight any risks or issues and propose mitigating measures.

74. **Equipment Calibration Report (after 4 months and by April in every subsequent year).** The Equipment Calibration Report will present the results of the calibration of the different data collection equipment (existing and newly procured). Equipment will be calibrated each year before the start of data collection. Surveys may only be initiated after this report has been approved by MOTC. A separate report may be prepared for each survey vehicle or trailer and the different equipment types contained in it to avoid delays in starting the surveys.

75. **Equipment Calibration Manual (draft after 5 months, final by September 2024).** The Equipment Calibration Manual provides a detailed description of the calibration process for the different equipment types, defining the steps to be undertaken in calibration and the calibration sites to be used. This will serve as guidance for PIC in replicating the calibration in future years. It should be prepared after the initial calibration of the data collection equipment and updated in subsequent calibrations, with a final version to be submitted towards the end of this assignment.

76. **Data collection and Data Collection Report (year 1 by December 2022, year 2 by December 2023, year 3 by November 2024).** Data collection will be carried out primarily outside the winter season, in the period from April to October (in 2022 the data collection is expected to start late). Subsequent post-processing, validation and entry of the collected data into the RIS database may continue on into the winter season. The results of the data collection, post-processing and entry are recorded in a Data Collection Report to be submitted each year. The Data Collection Report lists the paved and unpaved roads for which data collection, processing and entry has been completed, describing the types of inventory, condition and traffic data collected for the different roads and providing a statistical overview of the surveyed roads for the entire network (according to the latest data available). The report will include any lessons learned during the data collection that may lead to adjustments in the data collection procedures. The report will be submitted

together with the data entered into the RIS database as well as 2 copies of the raw data collected and any video files and processed data files. In case of errors or missing data, the data collection will need to be redone before it can be accepted. The total data collection will comply with the targets mentioned in this TOR and repeated in the table below. An initial report will be prepared after completion of the data collection, processing and entry in year 1, and this will be updated in subsequent years.

Table 1 Targets for data collection, processing and entry

Survey type	Target	Year
New data collection for paved roads	600 km	2022+2023
Updating data for paved roads	7,500 km	2022+2023+2024
Data collection for important unpaved roads	2,000 km	2022+2023
Data collection for other unpaved roads (basic)	6,000 km	2022+2023+2024
FWD data collection	100 km	2022+2023
Traffic counts	600 locations	2022+2023+2024

77. **Data Collection and Management Manual (draft by January 2023, final by October 2024).** The Data Collection and Management Manual describes the different steps to be undertaken in the collection of new or updating of existing inventory, condition and traffic data for paved and unpaved roads, and its subsequent processing and entry into the RAMS database. It starts where the Equipment Calibration Manual ends. It will also describe the quality control procedures to be used for keeping backups of raw survey data, for auditing the raw data, for processing and validating the raw data and entering it into the database, and for auditing the data in the database. The manual will include a schedule for updating the RAMS data over the next 10 years, listing the roads to be surveyed and the types of data to be collected. It will also include a description of how the collected data may be presented in tables, graphs and maps using the RAMS. A draft version will be prepared after completion of the data collection in 2022, which will be used and updated in subsequent years, with a final version to be prepared by November 2024.

78. **Updated RIS database (draft by January 2023, final by October 2024).** The RIS database will require amendments to allow additional data to be entered regarding unpaved roads, FWD measurements, bridge and tunnel data, etc. Apart from the database structure, this will also include improvements to the functionality of the database to present the data in the form of tables, graphs and maps, and to automatically generate standard reports for use by RMD and other stakeholders. A draft version of the updated RIS database will be prepared by February 2023 and tested using data collected in 2022. The database will be continuously updated as necessary, with a final version to be submitted by October 2024.

79. **Updated MPS (draft by February 2023, final by November 2024).** The current Maintenance Planning System incorporates decision-making tools for treatment selection and prioritization of current repairs, periodic maintenance and rehabilitation/improvement for bituminous roads. The existing MPS will be further improved and expanded to include web-based access to the RIS database, including functionality to present the data in the form of tables, graphs and maps, and to automatically generate standard reports for use by RMD and other stakeholders. The planning module will be further strengthened to include treatment selection and prioritization for both paved and unpaved roads, as well as procedures for routine and winter maintenance planning, and for bridges and tunnels. A draft version will be prepared by March 2023 after completion of the data collection in 2022, with a final version to be prepared by November 2024.

80. **Three-Year Rolling Plan (initial by March 2023, updated by November 2024).** The Three-Year Rolling Plan will list the priority current repair, periodic maintenance and rehabilitation/improvement treatments to be carried out in the next 3 years, the annual allocations to be made to routine and winter maintenance, and the priority treatments to be carried out in bridges and tunnels. It will be prepared using the Maintenance Planning System and verified using HDM4. An initial version will be prepared using data from Phase I complemented by data collected in 2022, with updated versions prepared after the data collections in 2023 and 2024. A final version is to be prepared by November 2024.

81. **Road Financing Report (draft by May 2023, final by November 2024).** The Road Financing Report will describe the funding needs for road maintenance (and rehabilitation) based on an HDM4 strategy analysis of the collected data, indicating the impacts of lower funding levels on future road network conditions. As such it will link up with the three-year rolling plan. The report will further identify suitable funding sources that may be used to finance road maintenance and repair based on a review of existing and possible new road user charges. The report will provide recommendations for enhancing the road fund operation, describing the structure of the secretariat and Road Board, the scope of activities to be financed by the fund, the procedures for using the funds, and the necessary financial and technical auditing and reporting . All assessments and proposals will be discussed in detail with MOTC, Road Fund (secretariat and Road Board) and RMD. A draft version will be prepared by April 2023 and will be updated in subsequent years, with a final version to be submitted by November 2024.

82. **RAMS Planning Manual (draft by April 2023, final by October 2024).** The RAMS Planning Manual will describe how the Maintenance Planning System is to be used in preparing annual and three-year rolling plans and related budgets. It starts where the Data Collection and Management Manual ends. It will describe the steps to be undertaken and how the MPS is to be used in this process. A draft version will be prepared by April 2023 after completion of the data collection in 2022 and the preparation of the draft improved MPS, with a final version to be prepared by October 2024.

83. **RAMS Operation Manual (draft by January 2024, final by October 2024).** The RAMS Operation Manual will describe the different tasks to be carried out in the operation of the RAMS and when these are to be carried out in the course of the year. It will also define the units and entities that are responsible for each of these tasks as they relate to data collection, management and analysis. The manual will further describe the financial and other resources required each year for the operation of the RAMS. This manual will be prepared by January 2024 after the data collection, management and analysis has been completed in 2023 as the basis for operation of the RAMS by PIC and RMD in 2024. A final version of the manual will be submitted by October 2024.

84. **Legal instruments for RAMS (draft by May 2023, final by February 2024).** The legal instruments will define the need for annual data collection and will establish the RAMS as the basis for annual planning and budgeting. The consultant will prepare draft legal documents by May 2023. This will be followed by support to MOTC in finalizing and issuing the legal instruments by February 2024.

85. **RAMS Action Program (draft by May 2023, final by February 2024).** The RAMS Action Program will define the activities to be carried out in future years to support the further development and integration of the RAMS. It will also identify timeframes, budget requirements and responsible units and entities. The Action Program will be set up as a legal instrument, with a draft version prepared by May 2023, followed by support to MOTC in finalizing and issuing the Action Program as a legal instrument by February 2024.

86. **Maintenance Implementation Report (draft by February 2024, final by October 2024).** The Maintenance Implementation report will describe the current approach for implementation of maintenance and repair, focusing on local maintenance units (DEUs) and how available funding allocations relate to implemented work volumes and to fixed costs. The report will provide a proposal for commercialization of the DEUs, and the gradual opening up to participation by the private sector. The report will also describe the preferred contracting modalities to be applied, including a review of performance-based contracting modalities. A draft version will be prepared by February 2024 and will be discussed in detail with MOTC and underlying units and entities, with a final version to be prepared by October 2024.

87. **Capacity Building Report (by December each year, final by October 2024).** Capacity building will be carried out throughout the assignment. The Capacity Building Report will list all capacity building and training activities undertaken, and the participants of those activities. It will describe the progress made in implementing the Capacity Building Plan submitted as part of the Inception Report. It will also describe further capacity building requirements beyond 2024. Initial versions will be prepared by December each year, with a final version to be prepared by November 2024.

88. **University course on RAMS (draft by April 2023, final by July 2024).** The university course on RAMS will encompass a 40-hour course with a detailed description of the structure of the course, training material for students, guidance notes for teachers, and minutes on the completed training of the KUCSTA teaching staff and the first two implementations of the course in the 2023-2024 academic year. A first draft of the course material will be submitted by April 2023 for approval for the subsequent academic year. A final version will be submitted by July 2024 after implementation of the 2 pilot courses in the 2023-2024 academic year.

89. **Draft Final Report and Final Report (by September and November 2024, respectively).** The draft final report will summarize all tasks undertaken as part of the assignment. It shall contain the lessons learnt and recommendations for future data collection, management and analysis. The draft report shall include an executive summary with outputs for distributing to other stakeholders. The consultants will finalize the Draft Final Report by incorporating the comments received from MOTC, Road Fund and RMD.

G. Payment

90. The payments for this assignment will include four components:

- Provisional sum for reimbursement of procured equipment against receipts
- Payment for the services to be provided by the Consultant against monthly invoices
- Provisional sum for reimbursement of data collection and management by PIC against receipts
- Provisional sum for reimbursement of seminars, workshops and trainings against receipts

Provisional sum for reimbursement of procured equipment

91. For the procurement of survey and computer equipment, a provisional sum of $100,000 will be included under the contract. The Consultant is required to provide quotations for the different equipment types to be procured under the contract, in line with the ADB procurement regulations. Upon approval by MOTC, the Consultant will proceed with the procurement of the equipment. Payment to the Consultant will be against receipt by MOTC of the procured equipment and submission of the receipts by the Consultant. The Consultant in its financial proposal will indicate the expected amount required for the procurement of the equipment including proper justification. This will not form part of the financial evaluation.

Payment for Consultant services

92. For its services, payments will be based on the inputs provided by staff of the Consultant as reflected in their timesheets and related invoices. This will include all inputs of the Consultant (staff remuneration, per diems, travel, etc.). The Consultant in its financial proposal will indicate the price of the required Consultant services. This will form the basis for the financial evaluation.

Provisional sum for reimbursement of PIC invoices

93. For the services to be provided by PIC in the data collection and management for paved roads and traffic data, a provisional sum of $175,000 will be included under the contract. Upon contract award, the Consultant will sign a subcontractor agreement with PIC. PIC thus acts as the nominated subcontractor for this contract. This subcontractor agreement will cover all costs of PIC staff remuneration, operation of the survey equipment provided to PIC, and any overhead costs and other expenses of PIC for data collection, post-processing and entry into the RIS database for paved road data and for traffic data (both paved and unpaved roads). Data related to unpaved roads will be collected under a separate agreement with PIC and financed from the government budget. Under the subcontract, the PIC with Consultant support will be responsible for the collection, processing and entry of data for the target paved road lengths mentioned in Table 1 as well as traffic data in both paved and unpaved roads. The PIC subcontract costs will be determined by PIC, and will be the same for all bidders. The Consultant in its financial proposal will include the agreed

cost of the subcontract with PIC as the basis for the total contract bid price. This will not form part of the financial evaluation.

Provisional sum for reimbursement of seminars, workshops and trainings

94. For the seminars, workshops and training to be carried out as part of this assignment, a provisional sum of $50,000 will be included. Payment to the Consultant will be against receipt by MOTC of the receipts for approved expenditures for seminars, workshops and training by the Consultant. This will not form part of the financial evaluation.

H. Staff Requirements

95. The MOTC will select an international firm associated with a local firm in accordance with ADB's Guidelines on the Use of Consultants (2013, as amended from time to time) based on the quality- and cost-based selection method using a 90:10 quality–cost ratio with full technical proposal. All international and national experts will be evaluated. Consulting services require a total of 49 person-months of international experts input, 65 person-months of national key experts and 24 person-months of national non-key experts and will take place in over a period of approximately 30 months.

Table 2 Consultant staff inputs

Expert	Months
Key International Experts	**49**
Team Leader/RAMS Specialist	18
Road Data Collection Specialist	9
Road Database Specialist	9
Web-Interface/Network Information System Specialist	9
HDM4 Specialist	4
Key National Experts	**65**
Deputy Team Leader/RAMS Specialist	24
Road Data Collection Specialist	9
Road Database Specialist	9
GIS Specialist	9
Web-Interface/Network Information System Specialist	9
Traffic Specialist	5
Non-key Administrative and Support Staff	**24**
Office Manager / Interpreter	24
Total	**138**

96. **Team Leader / Road Asset Management System Specialist (International Key Expert - 18 months)**. The candidate shall have a Master's or higher degree in civil engineering. The candidate shall have relevant experience in developing RAMS, and in road and bridge data collection. The candidate shall have at least 15 years of specific experience in similar projects in both developed and developing countries and shall preferably have at least 10 years of experience as a project manager or team leader. Regional experience in Central Asia and South Caucasus countries will be an advantage. The candidate shall be fluent in English and shall be skilled in report writing. Knowledge of Russian or Kyrgyz will be considered an advantage. Responsibilities will include the following tasks:

- Prepare the Inception Report
- Procurement of equipment
- Prepare the RAMS Planning Manual
- Prepare the Three-Year Rolling Plans
- Prepare the Road Financing Report
- Prepare the legal instruments for RAMS integration

- Prepare the RAMS Action Program
- Review and finalize all reports and manuals prepared by other team members
- Coordinate and carry out capacity building activities
- Prepare the RAMS university course with inputs from other team members

97. **Road Data Collection Specialist (International Key Expert - 9 months)**. The candidate shall have a Bachelor's or higher degree in civil engineering, and specialize in road construction/maintenance management. The candidate shall have at least 10 years of experience as a road engineer including extensive experience in road and bridge data collection and road maintenance in both developed and developing countries. The candidate shall preferably have at least 5 years of the specific experience in data collection. Regional experience in Central Asia and South Caucasus countries will be an advantage. The candidate shall be fluent in English and shall be skilled in report writing. Knowledge of Russian or Kyrgyz will be considered an advantage. Responsibilities will include the following tasks:

- Prepare workplans for data collection, post-processing and entry
- Calibrate the survey equipment and prepare the Equipment Calibration Reports
- Prepare the Equipment Calibration Manual
- Provide capacity building and support PIC in the data collection, post-processing and entry
- Prepare the Data Collection Report
- Prepare the Data Collection and Management Manual
- Support the Team Leader as required

98. **Road Database Specialist (International Key Expert - 9 months)**. The candidate shall have a Master's or higher degree in information technology, preferably specialized in database technology. The candidate shall have relevant experience in developing road databases, including GIS-based databases, and with road asset management systems. The candidate shall have at least 15 years of experience as database specialist and at least 10 years of specific experience in similar projects. Regional experience in Central Asia and South Caucasus countries will be an advantage. The candidate shall be fluent in English and shall be skilled in report writing. Knowledge of Russian or Kyrgyz will be considered an advantage. Responsibilities will include the following tasks:

- Update the Road Information System Database
- Update the Maintenance Planning System
- Support the preparation of the Three-Year Rolling Plan
- Prepare the RAMS Planning Manual
- Prepare of the RAMS Operation Manual
- Support the Team Leader as required

99. **Web-Interface/Network Information System Specialist (International Key Expert - 9 months)**. The candidate shall have a Bachelor's degree or higher in information technology, specializing in web technologies and implementation of networked information systems. The candidate must have experience in server programming and implementation of application programming interfaces (APIs) and road asset management systems. The candidate must have at least 10 years of relevant work experience and at least 3 years of experience in RAMS development. Regional experience in Central Asia and South Caucasus countries will be an advantage. The candidate shall be fluent in English and shall be skilled in report writing. Knowledge of Russian or Kyrgyz will be considered an advantage. Responsibilities will include the following tasks:

- Update the Road Information System Database
- Update the Maintenance Planning System
- Support the preparation of the Three-Year Rolling Plan
- Prepare the RAMS Planning Manual
- Prepare of the RAMS Operation Manual
- Support the Team Leader as required

100. **HDM4 Specialist (International Key Expert – 4 months)**. The candidate shall have a Master's degree or higher in civil engineering or transport economics. The candidate shall have at least 10 years of specific experience in using HDM4 to carry out strategy and program analyses for road networks. Regional experience in Central Asia and South Caucasus countries will be an advantage. The candidate shall be fluent in English and shall be skilled in report writing. Knowledge of Russian or Kyrgyz will be considered an advantage. Responsibilities will include the following tasks:

- Carry out an HDM4 analysis of the collected data for the entire network
- Review, develop and update the treatment matrices
- Support the development of the prioritization algorithms
- Determine the funding needs and impacts of budget scenarios on future road conditions
- Support the preparation of the Road Financing Report
- Support the Team Leader as required

101. **Deputy Team Leader / Road Asset Management System Specialist (National Key Expert – 24 months)**. The candidate shall have a Master's or higher degree in civil engineering from an accredited university. The candidate shall have at least 10 years of experience as a road engineer. The candidate shall have relevant experience in road and bridge data collection and in road asset management systems. The candidate shall be fluent in English and shall be skilled in report writing. Responsibilities will include the following tasks:

- Act as coordinator between the Consultant and RMD/PIC
- Support the Team Leader as required

102. **Road Data Collection Specialist (National Key Expert – 9 months)**. The candidate shall have a Bachelor's or higher degree in civil engineering, specialized in road engineering. The candidate shall have at least 10 years of experience as a road engineer including extensive experience of road and bridge maintenance and road safety and at least 5 years specific experience in road data collection. Experience in bridges and tunnels and international experience will be considered as an advantage. The candidate shall preferably be fluent in English and shall be skilled in report writing. Responsibilities will include the following tasks:

- Coordinate with and support PIC in the road data collection
- Support the International Road Data Collection Specialist as required

103. **Traffic Specialist (National Key Expert – 5 months)**. The candidate shall have a bachelor's or higher degree in transport economics or traffic engineering from an accredited university. The candidate shall have at least 10 years of experience as a transport economist or traffic engineer, preferably in the infrastructure sector. The candidate shall have at least 5 years of specific experience in the road transport sector. The candidate shall have relevant experience in road traffic surveys. The candidate shall preferably be fluent in English and shall be skilled in report writing. Responsibilities will include the following tasks:

- Coordinate with and support PIC in the traffic data collection
- Support the International Road Data Collection Specialist as required

104. **Road Database Specialist (National Non-key Expert – 9 months)**. The candidate shall have a Bachelor's or higher degree in information technology, preferably specialized in database engineering. The candidate shall have at least 5 years of experience as a database specialist and shall have relevant experience in developing databases. The candidate shall preferably be fluent in English and shall be skilled in report writing. Responsibilities will include the following tasks:

- Coordinate with and support RMD and PIC in the database development and data entry
- Support the International Road Database Specialist as required

105. **GIS Specialist (National Key Expert – 9 months)**. The candidate shall have a Bachelor's or higher degree in information technology, specialized in geographic information systems. The candidate shall have at least 10 years of experience as an IT specialist, preferably in the infrastructure sector, and shall have at least 5 years of specific experience as a GIS specialist. The candidate shall be fluent in English and shall be skilled in report writing. Responsibilities will include the following tasks:

- Coordinate with and support RMD and PIC in the GIS mapping
- Support the International Road Database Specialist and the International Web-Interface/Network Information System Specialist as required

106. **Web-Interface/Network Information System Specialist (National Key Expert – 9 months)**. The candidate must have a Bachelor's degree or higher in information technology. The candidate shall have at least 5 years of relevant work experience and at least 3 years of experience with web technologies and implementation of networked information systems and in server programming and implementation of application programming interfaces (APIs). The candidate must be fluent in English and be skilled in report writing. Responsibilities will include the following tasks:

- Coordinate with and support RMD and PIC in the web and network access to the RIS and MPS
- Support the International Web-Interface/Network Information System Specialist as required

I. Counterpart Support

107. **Background information and materials**. MOTC will provide the Consultant with copies of all reports and of the RAMS software and database prepared under Phase I so that this may be reviewed and used as the basis for developing the deliverables for Phase II. MOTC will also provide access to the Road Information System database and the Maintenance Planning System developed under phase I. MOTC will furthermore ensure support is provided by staff of Road Fund, RMD, PIC and underlying units and entities to provide further information to the Consultant as required.

108. **Survey equipment**. In support of this assignment, MOTC will provide the existing TRASSA survey vehicle and 5 SDR radar traffic counters together with additional vehicles as well as the additional survey equipment to be procured under this assignment, to PIC for use in the collection of data. All staff costs and operational expenses for the use of the equipment will be covered under the subcontract agreement with PIC (paved roads and traffic counts) or under separate government financing (unpaved roads).

109. **Office space**. Office space including desks and chairs for the Consultant will be provided for 5-8 persons in PIC, allowing the Consultant to work closely with PIC staff in the collection and management of data. A smaller office space will be provided in RMD to allow the consultant to work closely with the Road Fund, Asset Management Unit and other RMD staff.