**Terms of Reference**

**Support to the Establishment of Jordan’s**

**Road Asset Management System (RAMS)**

**Background**

The Ministry of Public Works and Housing (MoPWH) is responsible for the overall management, planning, development, operation, and maintenance of the road network in Jordan which comprises approximately 9,000 kilometers. Jordan is currently unable to provide sufficient resources for the optimal maintenance mof its road network, which is a long-term assets that requires regular maintenance. At the same time, rapid traffic growth and normal wear and tear exert pressure on the road network's capacity and performance.

Current planning for road maintenance investments depends on the availability of funds. Due to a lack of funds and the absence of efficient planning, roads are allowed to deteriorate to the point that cost-effective technical solutions are not an option. Besides the absence of institutional structure for road asset management and decision-making tools, current road maintenance planning lacks a clear and well-defined strategy for the MOPWH to plan for road maintenance investments.

The Road Asset Management System (RAMS) is a planning tool that continuously collects, stores, and presents road condition and inventory data as well as traffic data to inform the planning for short- and long-term road maintenance as well as Cost-benefit-analysis (CBA) and Life-Cycle Cost (LCC) analysis. The RAMS will allow for better planning and budgeting for road maintenance and rehabilitation works, a precondition for improving the efficiency of road maintenance investment.

The RAMS will be utilized to process road data collected, such as road inventory and condition, road traffic, road accidents, climate and hazard risks, unit costs for capital and maintenance investments, and other related data, for road planning and life-cycle cost analysis purposes. A dedicated RAMS Unit had already been established within the MOPWH hierarchy, staffed with qualified and motivated staff, and strengthened with clear responsibilities and a sustainable budget.

**MOPWH Organization (As of Oct. 2022)**

*Source: MOPWH’s Website.*

The Ministry or Public Works and Housing, through the Road Administration is responsible for road planning, construction, maintenance, and supervision of the road network in Jordan. The newly established RAMS Unit is under the MOPWH’s Road Administration, and reports to the Minister of Public Works and Housing and Secretary General of the MOPWH through the Road Administration’s Director.

**Road Network Management Status**

Currently, there is no road asset management system in place within the MOPWH, and annual maintenance contracts are carried out based on the availability of funds. There is a need, therefore, to establish a well-functioning RAMS to guide future road maintenance investments. However, the MOPWH does have a limited and fragmented road inventory and condition database from previous consulting work. The existing information needs to be assessed, and if in good quality, migrated to the new RAMS, supplemented by new information to establish the road database for road asset management purposes.

The MOPWH has IT and GIS divisions responsible for the management and administration of the MOPWH’s communications network and IT infrastructure. The MOPWH uses an existing GIS system in the ArcGIS Platform that is capable of displaying the road inventory information. The extent of the capabilities and design of such a platform shall be assessed and are included in this TOR. However, the MOPWH currently does not have a unit dedicated to managing road-condition related data and using that data specifically to program road maintenance expenditures.

**RAMS Unit**

The planned RAMS will be housed inside the MOPWH’s Road Administration. It will be operated and maintained by a dedicated RAMS Unit. The Unit will be run by a qualified manager and supported by a number of qualified and motivated engineers and staff. The unit has been recently established and is expected to be at least partially staffed before the commencement of the current consulting contract. To strengthen its ability to sustain the RAMS, the Unit will be fully resourced from the MOPWH's budget, and will be supported by external technical assistance services, if and when needed.

The RAMS Unit's mandate and terms of reference will be fully developed under this study to enable the Unit to conduct regular data collection, data analysis, and reporting on the road network’s condition to support the decision-making process for planning road maintenance activities. Besides training and capacity building, the consultant will provide support to develop clear terms of reference for the RAMS Unit's staff and their job descriptions to enable the RAMS Unit to perform its roles in managing the RAMS. The consultant will also prepare budget estimate for the RAMS Unit's annual operating costs, including budget estimate for outsourcing regular road condition data collection, analysis, and audit. In addition to having responsibility for maintaining and operating the RAMS system, the RAMS Unit will also need to provide guidance to governate offices on how to establish Road Asset Management systems (or equivalent) within their jurisdictions.

The RAMS will also support the implementation of Output and Performance-Based Road Maintenance Contracts (OPBRMC) in road maintenance, making it the primary tool for road maintenance planning and budgeting. RAMS Unit will enhance the Ministry's organizational, technical, and decision-making processes for the planning, budgeting and implementation of its road maintenance programs and investments.

**Objective of consultancy**

The objective of the present consultancy will be to help MOPWH to establish the RAMS Unit and equip the Unit with the core knowledge and resources to begin carrying out its functions. The end objective of the RAMS is to optimize MoPWH’ s total cost of ownership of road assets by ensuring the centralization of road asset information and optimizing the time of maintenance work solutions, introducing predictive analytics to guide road asset maintenance in the process. The primary objectives of the consultancy services are:

* To formalize the use of the principles of economic analysis in the allocation of recurrent and capital expenditures in the road sector, through the use of the road database and the economic evaluation model HDM-4.
* To prepare a 3-year rolling program of road works based on an economic evaluation done using the HDM-4 model.
* To prepare and an action plan for future network data collection surveys.

The Consultant, together with the RAMs Unit should work together to create a road network database, collect road inventory, road condition and traffic data for the 2,000km pilot. It is necessary to consider a sustainable system of data collection and processing on the basis of the available budget and needs of the RAMS.

**Scope of Work:**

This Terms of Reference (TOR) is to undertake the following tasks:

1. Review and assess the MOPWH’s roads data inventory, as well as the institutional, GIS and IT technology infrastructures and systems for the purpose of establishing a fit-for-purpose Road Asset Management System (RAMS) within MOPWH.
2. Undertake road inventory, road condition and traffic data collection for 2,000km of primary and secondary roads pilot (please see Annex 2).
3. To the extent possible, data collection will make maximum use of available databases. For roads where there is no data, Consultant shall collect the needed data, and train RAMS Unit’s engineers on data collection procedures and data audit protocols.
4. The Consultant shall take every effort to ensure accuracy and integrity of the tools used for the data collection.
5. Institutional and technical capacity building and training for the MOPWH’s RAMS Unit, including that needed for its role to provide further guidance to sub-national entities establishing road asset management systems.
6. The RAMS Unit’s staff should be properly trained and correct system support materials (user guides, manuals, etc..) developed in English language. Client will assess whether the beneficiaries have received adequate training . The Consultant shall provide Training and Training Materials in, at least, the following procedures:

* Management of the Road Network Referencing System – control, verification, and dissemination to other stakeholders.
* Procedures to be followed to refine the RAMS application.
* Data Collection – planning, management, supervision.
* Data Evaluation – HDM-4, GIS, Excel.
* Data Quality Assurance – verification and checking of data.
* Management Reporting – reporting and presentation to senior management and executives.

1. Assist the MOPWH in the procurement of the RAMS software and hardware as follows:

Develop the required technical specifications, bidding document for supply and installation of RAMS software and hardware, including HDM4 model for the analysis, planning, management and appraisal of road maintenance, improvements, and investment decisions, including licensing, and training on the use of the model to enable RAMS processes, as well as data analysis and reporting. The procurement of the Software and Hardware will be undertaken by MOPWH separately from, and in parallel to this assignment

Assist in the evaluation of bids received for RAMS software and hardware as a result of the above bid invitation by the MOPWH.

1. Assist in the installation of RAMS software and hardware, quality control, implementation, operation and handing over of RAMS, including training and knowledge transfer on the use of RAMS software and hardware, including HDM4 model.

The procurement of the above software and hardware should not delay the assessment and the implementation RAMS project, nor the field data collection and analysis processes. Data collected should be temporarily and securely stored in the MOPWH’s server or the GoJ’s cloud.

**Data Collection**

The Consultant’s work under this TOR includes the data collection to survey (*2,000)* Kilometers pilot of Primary and Secondary roads under the responsibility of MOPWH (both sides of the road including shoulders). The Consultant shall also develop formal Data Collection procedures and protocols for collection of the following road data:

* Road Inventory, including road type and surface failure types, shoulder type and width, geometry, including horizontal and vertical alignment,
* Road Condition, including International Roughness Index (IRI), and other related data like potholes, cracks, raveling, bleeding, etc.,
* Road Classes, Distance Measurement, Road Centerline Data (GIS), Traffic, Drainage, etc., if any of those data aren’t available in MoPWH, the consultant has to collect the required data.
* The RAMS data collection will also include road construction and maintenance history and unit costs; pavement structure, strength, defects, traffic data, including volume, composition, loading and extent of overloading; maintenance treatment options and costs; road safety and improvements; GIS maps of effected area; current material and maintenance costs and climate data for each region. To the extent possible, the consultant shall make use of the available road data, including traffic count data, at the MOPWH. For the purpose of the pilot, and besides IRI data, all other data shall be collected by an experienced road engineer. The data collected should be limited to the 2,000km pilot. The data collection should be performed jointly by the consultant and RAMS Unit.
* All data shall be referenced by chainage and GIS maps and GPS coordinates.

Based on the collected road data under the pilot, the consultant shall design an integrated GIS using HDM-4 and prepare a rolling program of preservation works for different budget scenarios for planning and programming purposes. This exercise will serve as a demonstration of how the RAMS project should be applied network-wide, when the full road network data becomes available.

Full compatibility of the road database structure, software and hardware must be assured according to the requirements of RAMS. The RAMS database should have the following capabilities:

* Storage of road inventory, condition and traffic and asset information as collected under the assignment.
* Options for querying the road network data, preparing reports and mapping of input data and results of calculations.
* Storage and archival of historical data relating to reference system, inventory, assets and condition and traffic of roads.
* Definition of homogenous road sections based on road characteristics, condition, and traffic.
* Interface with the HDM-4 model for the economic evaluation of capital investment and periodic maintenance projects comparing several project alternatives (project feasibility analysis);
* Interface with the HDM-4 model for the preparation of a short and mid-term pavement maintenance and rehabilitation road works program, based on the condition data collected and economic evaluation of investment opportunities.
* Interface with a GIS;

The developed Data Collection procedures and protocols shall cover survey planning, scheduling, staffing, liaison, equipment, data definition, network referencing, field collection, measurement techniques, safety, and data management. Consultant shall also adopt Data Validation, Calibration and Quality Assurance guidelines to be provided by an independent Consultant, as needed from time to time.

In addition to the above, the Consultant shall provide training on these procedures to MOPWH’s RAMS Unit Engineers. This can be by providing on-the-job training as the subject tasks are being conducted, sharing material, manuals, etc., used by the consultancy to undertake the subject tasks.

The forms and templates for the collection of the above data shall be prepared by the Consultant, agreed with and approved by RAMS Unit.

The Consultant shall provide qualified staff, equipment, vehicle, and transportation needed to complete the field surveys. Any equipment used by the Consultant for the data collection task will remain the property of the Consultant. However, as part of the technology transfer, the Consultant is required to train the MOPWH's RAMS Unit staff on the use, maintenance, and calibration procedure of the data collection equipment.

**Survey Equipment**

The Consultant to use fit-for purpose equipment for data collection. However, the equipment selected must be capable of operating under the expected local conditions. The survey equipment used for data collection should be properly calibrated and fully functional at normal local highway speed on both urban/rural roads and expressways/highways included in the network and be capable of measuring on both bituminous and concrete pavements. It is required to use the latest version of the software released by the equipment manufacturer. The proposed system of automated data collection of defects to evaluate road pavement surface distress condition should contribute to decreasing the data collection works intensity, increase of results accuracy as well as exclusion of human factor during the evaluation.

**Management Information System (MIS)**

The consultant work shall include assessment of the existing computer, GIS and Information Technology (IT) infrastructure and recommendation for fit-for purpose computer and system requirements and accessories, including HDM-4, to be procured by the MOPWH to ensure proper control and performance in the programming, planning, and budgeting of the MOPWH. The work will also include recommendation of specifications to enable the MOPWH to invite tenders for the procurement, delivery, maintenance, security, licensing and warranty of computer systems software and hardware to cover LAN, HDM-4, GIS, FMS, backup systems and Internet connections.

**Timeline**

It is envisaged that the above works will take **6 (SIX)-months**, including assessment, data collection, supporting the MOPWH in procurement of software and hardware, setting RAMS standards, system design training and capacity building.

**Staffing Requirement**

The following staff positions are preliminary, to give an indication of the qualification and professional experience needed to successfully implement the RAMS project. If applicable, Consultant to estimate the time to be spent in the field, in Jordan, and time spent at home country.

|  |  |
| --- | --- |
| **Position** | **Qualifications / Experience, for both Data Collection and RAMS.** |
| Team Leader / Project Manager | **Advanced University degree.** Experience in road assets and infrastructure management and road asset planning. The desirable qualification is Master in Transportation Engineering with at least 15-years’ experience. |
| Data Collection Specialist  (Road Engineer) | University degree. Experience in highway engineering projects including road and pavement condition data collection systems. The desirable qualification is a bachelor’s degree in civil engineering with at least 10 years’ experience. |
| Data Processing/Analyst Specialist | University degree. Experience in data processing of road, traffic and pavement inventory and condition data including location referencing with particular reference to automated data acquisition systems in similar conditions. The desirable qualification is Bachelor with at least 10 years of experience. Experience in HDM4 is a plus. |
| GIS/Mapping Specialist | University degree. Experience in data processing and conduct assurance of GPS surveys and GIS based road management systems. The desirable qualification is Bachelor with at least 8 years of experience. |
| Institutional Development Specialist | Advance University degree. Ten (10) years, proven experience in institutional development, support in the development of roles and responsibilities of RAMS Unit and its staff, assess and recommend capacity building needs and institutional structure that strengthens RAMS Unit for better planning and management of RAMS. |
| Road Asset Management Specialist  (HDM-4 Specialist) | Civil Engineer or Economist. Minimum of ten (10) years’ experience in the implementation of a RAMS on this scale at National or State Road Agencies and on Life-Cycle Analysis. Experience in Economic Modeling, and the use of latest version of HDM4 is mandatory. |

**Deliverables and Terms of Payment**

The following reports shall be submitted in two hard copies, and one electronic format. The reports are to be provided in English.

|  |  |  |
| --- | --- | --- |
| **Deliverable** | **Timeline** | **Payment (tentative, to be finalized at negotiations)** |
| Inception Report, including detailed project plan | Within 2 weeks of contract signature | 10% after submitting the last report – month 5 |
| Monthly Progress Reports, 1, 2, 3, 4 and 5 | Monthly |
| RAMS Software and Hardware Specifications and Procurement Plan | Within 2-months of contract signature | 20% |
| RAMS Administration manual, including data collection and data quality assurance plan and audit. | Within 4-months of contract signature | 20% |
| Final Report, including annexes for:   * Road reference system covering the primary and secondary road network; * Road database and systems Analysis; * Recommendation for system configuration and selection of users; * Road database structure; * Guide on Road Data Collection and Management; and * Guide to Pavement Condition Survey and Evaluation. | Within one month of completion and acceptance of RAMS. | 50% |

**Services to be provided by MOPWH**

The RAMS Unit Manager will be responsible for the day-to-day technical and administrative management and implementation of the RAMS project on behalf of the MOPWH and will be the first point of contact for the Consultant for technical and management issues. The MOPWH will provide suitably furnished office space within the RAMS Unit for the Consultant, including (free-of-charge) electrical power, lighting, and internet access as and when needed. The MOPWH will grant the Consultant access to data, maps, and reports for the purpose of RAMS data collection.

**Annex 1- Jordan Road Network Classification and Inventory (2018)**

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| --- | --- | --- | --- | --- | --- |
| **Region** | **Governorate** | **Primary, Km** | **Secondary, Km** | **Rural, Km** | **Agriculture, Km** |
| North | Irbid | 236 | 335 | 332 | 2830 |
| North | Ramtha | 36 | 22 | 20 | 135 |
| North | Al Mafraq | 520 | 260 | 580 | 850 |
| North | Jarash | 95 | 108 | 235 | 670 |
| North | Ajloun | 50 | 90 | 35 | 700 |
| North | **Sub. Total** | **937** | **815** | **1202** | **5185** |
| Middle | Amman | 306 | 190 | 529 | 267 |
| Middle | Al Balqa | 215 | 136 | 287 | 400 |
| Middle | Al Zarqa | 303 | 149 | 164 | 590 |
| Middle | Madaba | 131 | 120 | 1084 | 475 |
| Middle | **Sub. Total** | **955** | **595** | **2064** | **1732** |
| South | Al Karak | 295 | 175 | 207 | 820 |
| South | At Tufaileh | 260 | 163 | 160 | 530 |
| South | Ma'an | 560 | 217 | 590 | 190 |
| South | Al Petra | 5 | 39 | 27 | 222 |
| South | Al Aqaba | 322 | 172 | 51 | 40 |
| South | **Sub. Total** | **1442** | **766** | **1035** | **1802** |
|  | **G. Total** | **3,334** | **2,176** | **4,301** | **8,719** |

**Jordan Road Network Map**



**Annex 2. List of proposed pilot roads (2,000Km)**