

**Kingdom of Cambodia  
Nation Religion King**

**Ministry of Rural Development**

**Project Name: Cambodia Southeast Asia Disaster Risk Management Project 2  
(Project ID: P177185)**

**Terms of Reference**

**(Ref: MRD-CDRM2-QCBS-S04)**

**Improving Climate Resilience in Rural Road Asset Management**

## **I. Project Background**

1. Cambodia is highly vulnerable to a range of negative climate change impacts, including floods, storms and related engineering hazards. Climate change is expected to exacerbate the frequency and intensity of these impacts in Cambodia. In a high emissions climate change scenario, the 2020 World Risk Index ranked Cambodia as the 16th most disaster-prone country in its index of 181 countries. In this context, Cambodia's rural infrastructure will be increasingly vulnerable to climate-related disaster risks. Disrupted rural connectivity during flooding and other disasters threatens the livelihood of rural households and curtails access to basic services such as schools, hospitals, and markets.
2. In response to these challenges, the Cambodia Southeast Asia Disaster Risk Management Project 2 (SEADRM2) is designed to enhance climate-resilient rural road connectivity. This World Bank-financed project supports the resilient rehabilitation and maintenance of rural roads across various provinces. It also aims to bolster the capacity of the Ministry of Rural Development (MRD) and its provincial branches in fostering disaster resilience. This project encompasses civil works for the rehabilitation and reconstruction of approximately 676 kilometers of rural roads, coupled with consultancy services to embed climate and disaster risk considerations into the MRD's Rural Road Asset Management System (RRAMS). This consultancy will leverage the foundational work conducted by the Asian Development Bank (ADB), which initially developed RRAMS.

## **II. The Rural Road Asset Management System**

3. Consultancy Project CS2: "RRAMS" was a key element of the second Rural Roads Improvement Project (RRIP-II) undertaken by MRD with support from the Asian Development Bank (ADB), in association with the Strategic Climate Fund (SCF), the French government's Agence Française de Développement (AFD) and the Australian Department for Foreign Affairs and Trade (DFAT). Commencing December 2017, it had the overall aim of improving rural road network maintenance and rehabilitation decision-making, with the consequent provision of improved information-based budget requests to the MEF or Development Partners. This RRAMS has been set up based on access to a relevant database feeding into improved data analysis and reporting procedures.
4. Following Prakas 062/24, MRD established the RRAMS Unit under the Planning Section of the Department of Rural Roads. The RRAMS Unit is responsible for coordinating the annual collection of RRAMS data, the management of the RRAMS database, and the analysis of the RRAMS data in support of planning and prioritizing rural road maintenance and improvement works.
5. The RRAMS Unit is supported by the Rural Road Offices (RRO) under the Provincial Departments for Rural Development (PDRD) in the 25 provinces of Cambodia. The RROs are responsible for data collection and data entry into the RRAMS database. The RRAMS Unit is responsible for the subsequent data validation and the overall management of the RRAMS database. The RRAMS Unit is also responsible for data analysis, supporting the Planning Section in the planning and

prioritization of annual works programs and the preparation of annual budget requests. Lastly, the RRAMS Unit is responsible for regular reporting on the RRAMS and the status of the rural road network managed by the Department of Rural Roads (DRR).

6. As of February 2024, the RRAMS is in the phase of further operational enhancement to establish itself as an effective decision-making tool that aligns with MRD's strategic planning and budgeting processes. This advancement is part of ongoing efforts under a separate TA project – “the Rural Roads Accessibility Financing Strategy” – which also supports the operationalization of the RRAMS.

### III. Objective of the Services

7. Incorporating disaster and climate risk information into road infrastructure planning and maintenance is recognized as an important strategic objective for the sustainability of the rural road network. In the light of the current status of the RRAMS and the available resources, this objective can be achieved most effectively through a two-phase programme.
8. The objectives of the first phase, covered by these services, are:
  - (i) to define the climate-related risks and resilience of rural road assets and a methodology for assessing them; and
  - (ii) to determine how the functionality of the RRAMS can be adapted to incorporate climate resilience considerations into the planning and management of rural roads, including the prioritization of expenditure.
9. A proposed second phase, which is not part of this current TA, would focus on the application of vulnerability and resilience assessments to the MRD network, and on demonstration and mainstreaming of the procedures for climate strengthening of selected roads and assets that have been prioritized by RRAMS for maintenance, rehabilitation or upgrade.
10. Ultimately, these enhancements are designed to ensure that a Climate Resilience RRAMS (CR-RRAMS) becomes a more effective tool for integrating climate risk considerations with the other parameters currently used in RRAMS for rural road management and maintenance planning. Thereby, this will contribute significantly to the long-term durability, sustainability and safety of Cambodia's rural road infrastructure.

### IV. Scope of the Services

11. These services comprise the first phase in a stepped approach to incorporating the consideration of climate-related resilience into the management of rural roads and maintenance planning. The scope comprises two distinct stages:
  - a. *The preparation of a framework and methodology for defining and assessing the climate-related resilience of rural roads.* The conceptual framework will relate the climate-related hazards (such as flooding, erosion, landslides), exposure (frequency, extent, severity) and vulnerability of the road assets to climate-related risks, and define a measure of climate-related resilience for a rural road. The methodology will involve the definition of high-level climate and road parameters to be used in assessing or rating climate resilience at a road level, taking account of the availability of data in RRAMS and available secondary sources, as well as general practicality for rural road network planning.
  - b. *Trial application of the methodology using available data to quantify the relevant climate and road parameters and the resilience rating, and adaptation of the RRAMS prioritization algorithm.* The trial application will use existing road and

flooding data extracted from RRAMS for selected provinces, with hazard and exposure data from available secondary sources (such as flooding maps, climate records, climate projections, and others). The analytical processes to assess the climate-vulnerability of the roads will be applied in a trial application separate from RRAMS. Recommendations will be made on how RRAMS could be adapted to include Climate Resilience in the database, analytical processes and prioritization algorithm.

These general activities will be implemented under a series of Tasks, as follows.

### **Task 1: Background**

12. Review the status of the RRAMS database, the data structure, analytical processes and reporting capabilities, in the light of the project ToR and recent upgrade work<sup>1</sup>. Identify and review the availability of historic and future climate, hydrology and geohazard data for Cambodia and the form of data suitable for integration into a RRAMS. Assess the availability, format and potential for updates of digital terrain and downscaled climate and flood hazard models, together with likely costs.
  13. Identify and review relevant RRAMS project reports<sup>2</sup> as well as other related Cambodian, regional and international technical information on climate and disaster risk management relevant to road asset management systems. Comment on the ToR in relation to these reviews and update the proposed working methodology and recommend any programme adjustments.
- ➔ *Present an Inception Report containing a final methodology for achieving the TA targets along with a detailed project program agreed with MRD. This program should allow for appropriate on-the-job training and mentoring.*

### **Task 2: Methodology for climate resilience assessment**

14. Prepare a methodology for evaluating the climate resilience of rural road infrastructure which is relevant for strategic applications and for the planning of improvements to rural road assets, to be compatible and to be integrated in future within the existing RRAMS. This should be based on a conceptual framework for high-level climate risk assessment of rural road network assets, linking current and future climate threats to hazard exposure and vulnerability of the road links. The framework should identify the interaction of:
  - a. Key relevant hazards (e.g., flooding, flash flooding, landslides)
  - b. Exposure (frequency, magnitude and extent)
  - c. Vulnerability (critical impacts, e.g. erosion, collapse, surface disintegration, structural weakening, impassability (functional state), etc.) and
  - d. Interaction of these three vectors to quantify climate-related risks and to define a measure of resilience.
15. Issues to be considered and classified for an initial climate and disaster risk categorization could include, but may not be limited to:

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<sup>1</sup> Development of Rural Roads Accessibility Financing Strategy and Support for Operationalization of the Rural Roads Asset Management System. Sheladia Inception Report February 2024.

<sup>2</sup> Sheladia Associates, 2021. Rural Roads Improvement Project II. CS2: Rural Road Asset Management Project Completion Report Final for Ministry of Rural Development, Asian Development Bank, Manila  
Sheladia Associates, 2021. Rural Roads Improvement Project II. CS2: Rural Road Asset Management Business Plan, for Ministry of Rural Development, Asian Development Bank, Manila  
Sheladia Associates, 2021. Rural Roads Improvement Project II. CS2: Rural Road Asset Management User Manual, for Ministry of Rural Development, Asian Development Bank, Manila  
Sheladia Associates, 2021. Rural Roads Improvement Project II. CS2: Rural Road Asset Management System Architecture and System Design of Rural Road Asset Management System (RRAMS), for Ministry of Rural Development, Asian Development Bank, Manila

- Current and future climate indices (e.g. overall rainfall, maximum 1-day rainfall).
  - Relevant hydrological hazards (such as floods, intense rainfall).
  - Relevant geohazards (such as earthwork failures, erosion and landslides).
  - Exposure to hazards (e.g., flooded sections, frequency, duration)
  - Vulnerability (e.g., likelihood of various types of damage, loss of functionality, etc.)
  - Road corridor environment (e.g. topography, land use, social infrastructure).
  - Road function and overall use (traffic, population served, network criticality, access, access redundancy).
  - The role of road class (T1, T2, etc.) in defining resilience (e.g., road elevations, standards of drainage, etc. may factor)
  - For quantifying climate-related resilience, consideration may be given to a star-rating approach (similar to road safety) as resilience is multi-dimensional and not readily quantifiable.
16. Propose sources for data sets, digital models or remote sensing to populate the data required for quantifying the proposed parameters. Disaster and climate hazard and risk input data should be GIS-based as much as possible and compatible with existing RRAMS mapping and reporting procedures.
17. Develop appropriate procedures and materials for training in the above procedures.

→ *Prepare a short Technical Note and presentation on the outcomes from Task 2*

### **Task 3: Trial Application of Climate Resilience Assessment**

18. It is proposed that the trial application will cover the seven project provinces<sup>3</sup> to the extent that road-related data is available in the current RRAM database (road T1 and T2, primarily) and that the geospatial data is available for required climate-related, topographical and flooding information. New field data collection is not anticipated, however limited representative ground truthing fieldwork should be undertaken. Currently, data cleaning is being undertaken by the PRDs and these results should be incorporated in the RRAMs data to the extent they are available. The scope of the trial is relatively wide in order to test the practicality of applying the methodology across the rural road network for road management and budget planning purposes.
19. Review the existing RRAMS multi-criteria analysis (MCA) algorithm for road maintenance prioritization and recommend an adaptation for including the climate resilience measure into the prioritization process. Recommendations should also be made for any improvements to the existing algorithm and the prioritization process for maintenance planning.
20. Compile the data required for the trial application and apply the analytical processing required for assessing the climate-related resilience of the trial network in a stand-alone application separate from RRAMs covering the selected provinces. For this, the modified MCA, including the Climate resilience aspects, would be incorporated in a stand-alone copy of RRAM (CR-RRAM). Test and refine as required the proposed climate-upgraded multi-criteria analysis (MCA) algorithm and related road prioritization and road resilience screening assessment in the trial application to demonstrate that road maintenance and rehabilitation priorities take account of the relevant climate environments.
21. Undertake a demonstration workshop with MRD and PRD staff to evaluate the proposed climate resilience assessment methodology and the results of the trial application.

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<sup>3</sup> The SEADRM2 project provinces comprise of: Banteay Meanchey, Pursat, Battambang, Siem Reap, Kampong Speu, Kampong Chhnang, Tboung Khmum, and Kampong Cham.

→ Prepare a short Technical Note and presentation on the outcomes from Task 3.

#### **Task 4: Expansion of Climate Resilience Assessment**

22. In the light of lessons learnt from the trial application, expand the compilation of data and assessment of climate resilience to the rural road network in all provinces of Cambodia, to the extent that the required road-related data is available in the existing RRAMs and the secondary sources for the climate-related data are available in suitable geospatial format. The results should be presented in tabular and map formats. The climate resilience assessment would be extended to all provinces, limited by the availability of road data in RRAMS.
23. Make recommendations for the next phase on: (i) further data collection and data cleaning of road-related data in RRAMs to make it functional and reliable for climate resilience applications; (ii) compilation and processing of climate-related data for the assessment of climate resilience; (iii) adaptation of the RRAMS software for incorporating climate resilience into road maintenance planning for rural roads as well as identified improvements to the prioritization process.
24. Provide training/workshop to MRD key stakeholder that will be engaged in further RRAMS work (RRAMS group) on the CR-RRAM trial application, specifically on: (i) training on how to compile the climate-related data and climate-related resilience; and (ii) training for expanding the application, the objectives, use and how to make use of the results.
25. Submit a Final Project Report and presentation, together with a guide to the assessment of climate resilience for rural roads in Cambodia.

#### **V. Technical Cooperation**

26. In addition to this TA, there are other ongoing and planned MRD rural infrastructure initiatives related to, or concerned with, CRM or DRM. These include, but are not restricted to, the following:
  - RRAMS Operationalization - As a part of Rural Roads Accessibility Financing Strategy and Support for the Operationalization of the Rural Roads Asset Management System. (World Bank-financed under the Roads Connectivity Improvement Project)
  - Identification and Prioritization of Rural Resilience Investment Options and Natural Hazard/Climate Change Coping Mechanisms in Cambodia. (TA under SEADRM2).
  - RID4CAM: Rural Infrastructure Development Programme (KfW-managed) with road condition and traffic surveys to populate the RRAMS.
27. It is essential that the Consultants for this CR-RRAMS TA cooperate and move forward in coordination with these other TA initiatives, under guidance from the RRAMS Unit and other appropriate MRD units or departments, in order to ensure maximum technical impact and minimum overlap.

#### **VI. Outputs, timeline, and schedule of payments**

28. The output from this TA will be a demonstration of the assessment of climate resilience of the rural road network in Cambodia, and recommendations on how climate resilience could be incorporated into the RRAMS, supported by appropriate guidelines and knowledge transfer.
29. The contract period for the Assignment is expected to be **12 months** from the date of commencement of the services.

30. The Consultant shall be procured on a Lump Sum basis (payment against milestones). This will include all technical consulting fees and expenses, workshop facilitation expenses (including Khmer-English interpretation/translation), travel-related costs (including for workshop participants), and any other administrative fees related to the Assignment.
31. The Consultant shall be paid at relevant report submission milestones according to the expected implementation schedule as follows:

<b>Item No.</b>	<b>Output Description / Milestone</b>	<b>Expected Deadline</b> (no. of months from the date of contract signing)	<b>% of Lump Sum</b> (to be paid at Milestone)
<b>1.</b>	An inception report with a proposed workplan.	1	<b>10%</b>
<b>2.</b>	Concise Progress Report on Task 2	5	<b>25%</b>
<b>3.</b>	Concise Progress Report on Task 3	10	<b>35%</b>
<b>4.</b>	Final Technical Report and Training Materials	12	<b>30%</b>

32. Besides, a provisional sum of 50,000 USD shall be included in the contract for eventual surveys, depending on the data quality and the needs for data collection to complete the pilot trial. The Consultant shall provide a short technical explanation of the proposal and cost estimate for the approval of PMU before using any of the provisional sums.

## VII. Required Qualification of the Firm and Key experts

33. The following requirements are a broad description of the likely expertise needed for this consultancy Assignment.
34. The Consulting firm is expected to carry the following minimum requirements:
- Firm with at least ten years business experience, appropriate and sufficient capabilities, resources, and experience to execute the full scope of services to a high quality;
  - Maintain proven record in completing at least 2 similar assignments successfully;
  - Familiarity in CRM-DRM and climate change adaptation, preferably in Cambodia and Southeast Asia;
  - Collaborate with national firms, consultants or associates familiar with the local legislation, regulations, and other relevant local knowledge;
  - Availability of dedicated team comprised of international experts (with relevant experience in Cambodia or a country with similar context) and national experts (with the relevant expertise, qualifications and work experience); and
  - Experience managing similar services under multilateral funded projects.
35. The following key expertise is required for the assignment.
- Team Leadership
  - Road Asset Management
  - Hydrology
  - Disaster Risk Assessment
  - Climate Resilience
  - Information Technology
  - Knowledge Management
  - GIS-Based Data Management

36. The following is a suggestion as to how the core technical team could be constituted, although the Consultants should propose long and short-term experts in the Technical Proposal as they consider may be needed to fulfil this TOR and to execute the scope of services. The Consultant is encouraged to engage a diverse team within the context of a ‘best team approach’.

**International Specialists**

Team leader/RAM specialist (I-1)	8 months
Climate risk – hydrologist (I-2)	4 months
Rural Road Engineer - geotechnical (I-3)	2 months
GIS / IT specialist (I-4)	4 months

**National Specialists**

Road Engineer/asset management specialist (deputy TL) (N-1)	12 months
Data manager/GIS specialist (N-2)	8 months
Knowledge Transfer/Training specialist (N-3)	3 months
IT specialist (N-4)	12 months

37. The following key qualifications are required for the experts.

***I-1 International Team Leader (Senior Highway Engineer or Transport Planner)*** with a minimum 10 years of experience in the road sector and with maintenance practices internationally, preferably South-East Asia. Substantial experience in the development and/or operation of road asset management systems is required. A professional engineer or equivalently qualified, with a minimum of a BSc academic degree (Civil) or equivalent, and experience in road network inspection and surveys, applying road asset management, planning and programming tools under externally financed projects would be expected;

***I-2 International Hydrologist / Climate Risk Specialist*** with a minimum 10 years of experience on hydrology and / or climate risk and adaptation in infrastructure projects and a minimum equivalent education comparable to MSc in Civil Engineering or equivalent. Proven experience in climate risk assessments, infrastructure vulnerability modeling and experience in employing GIS and similar tools. Experience in Cambodia or ASEAN is desirable;

***I-3 International Rural Roads Engineer***, with at least 10 years of experience in local/rural roads management, drainage and geotechnical engineering. A BSc or higher degree in Civil Engineering, preferably with the focus on roads, drainage structures, geotechnics or climate / disaster risk management. Experience in road database and RRAM systems under externally financed projects is preferred.

***I-4 International GIS / IT Specialist*** with at least 5 years of experience in development and operation of GIS Systems, and spatial analysis. A BSc or higher degree in IT, preferably with the focus on GIS. Experience in Road Management Systems and / or Climate vulnerability mapping is an added advantage.

***N-1 National Rural Roads Engineer, Asset Management Specialist (Deputy TL)***, with at least 5 years of experience in local/rural roads management, maintenance and operation. A BSc or higher degree in Civil Engineering, preferably with the focus on roads. Experience in road database dases, GIS and/or RRAMS under externally financed projects is essential.

**N-2 National GIS /Data Management Specialist** with at least 5 years of experience in development and operation of GIS Systems, and spatial analysis. A BSc or higher degree in IT, preferably with the focus on GIS. Experience in Road Management Systems and / or Climate vulnerability mapping under externally financed project is an added advantage.

**N-3 National Training Specialist** with at least 5 years of experience in the infrastructure or road section. A BSc or higher degree in Civil Engineer or related field. Experience in Training and capacity development with development of training plan, courses and implementation of trainings is mandatory.

**N-4 National IT Specialist** with at least 5 years of experience in development and operation of GIS Systems, data bases and spatial analysis. A BSc or higher degree in IT, preferably with the focus on GIS and data base management. Experience in Road Management Systems and / or Climate vulnerability mapping is an added advantage.

Key Staff shall be complemented by supporting staff, as Accountant / Project Administrator, Secretary, Translators, Drivers, etc. All staff shall be fluent in the English language.

Adequate Project Backstopping Staff for the services shall be identified and proposed by the Consultant. Back stoppers shall be senior professionals employed by the Consultant with relevant project experience which provide backup support to the core implementation team on technical, financial and administrative issues as required.

## VIII. Reporting, feedback and invoicing

38. In order to satisfactory complete the tasks of this assignment the following deliverables are expected, amongst others:

1. Inception Report
2. Task 2 Concise Technical Report
3. Task 3 Concise Technical Report
4. Final Report and Presentation/Training material

39. The Consultant will report to MRD. Chhayheang Teang, SEADRM2 Project Manager, will be the point of contact for all project issues.

40. The Final Report and all Training Materials will be prepared in English and Khmer. All other deliverables shall be prepared in English with summaries provided in Khmer.

41. All deliverables are to be prepared as a draft version and finalized upon review by the Client. The Consultant shall allow at least ten (10) business days for the Client to review all preliminary/draft outputs, and fifteen (15) business days to review the final outputs. The Consultant will need to integrate these feedback periods into the project planning and milestones.