

## REQUEST FOR EXPRESSIONS OF INTEREST

### (CONSULTING SERVICES – FIRMS SELECTION)

**COUNTRY:** Federated States of Micronesia

**NAME OF PROJECT:** Climate Resilient Road Project (P172225)

**Assignment Title:** Road Network Vulnerability Assessment and Climate Resilient Road Strategy

**Reference No.:** FM-DOTCI-148484-CS-QCBS

The Federated States of Micronesia *has applied for* financing from the World Bank toward the cost of the Climate Resilient Road Project, and intends to apply part of the proceeds for consulting services.

The consulting services (“the Services”) include the climate change and natural hazard vulnerability assessment, and climate resilient road strategy. It is expected that the study will be completed within six (6) months of commencement and is expected to require approximately 20 person-months of professional input. The draft Terms of Reference (TOR) for the assignment are attached.

The Department of Transportation, Communications and Infrastructure (DoTC&I) now invites eligible consulting firms (“Consultants”) to indicate their interest in providing the Services. Interested Consultants should provide information demonstrating that they have the required qualifications and relevant experience to perform the Services. The shortlisting criteria are: (i) relevant experience: provide evidence of multiple similar projects especially in the core areas of infrastructure planning, feasibility studies, design and construction supervision, and capacity development in the similar environments; (ii) managerial: provide evidence of technical and managerial capability; (iii) corporate: provide evidence of strong corporate track record and financial standing.

The attention of interested Consultants is drawn to Section III, paragraphs, 3.14, 3.16, and 3.17 of the World Bank’s “Procurement Regulations for IPF Borrowers” July 2016 revised November 2017 and August 2018 (“Procurement Regulations”), setting forth the World Bank’s policy on conflict of interest.

Consultants may associate with other firms to enhance their qualifications but should indicate clearly whether the association is in the form of a joint venture and/or a sub-consultancy. In the case of a joint venture, all the partners in the joint venture shall be jointly and severally liable for the entire contract, if selected.

A Consultant will be selected in accordance with the Cost and Cost Based Selection Method (QCBS) set out in the Procurement Regulations.

Further information can be obtained at the address below during office hours 0900 to 1700 Pohnpei Time (Local Time).

Expressions of interest must be delivered in a written form to the address below (in person, or by mail, or by fax, or by e-mail) by **Friday, February 21<sup>st</sup>, 2020**.

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## **Terms of Reference (TOR)**

### **FSM Climate Resilient Road Project**

#### **Road Network Vulnerability Assessment and Climate Resilient Road Strategy**

##### *1. Background*

The largest nation in the Micronesian sub-region, the Federated States of Micronesia (FSM), is made up of four semi-autonomous states (Kosrae, Pohnpei, Chuuk, Yap) located between Palau and the Philippines to the west and the Republic of the Marshall Islands (RMI) to the east. Although its land area covers just 700 square kilometers, FSM consists of more than 600 islands scattered over an area of about 2.6 million square kilometers, including its Exclusive Economic Zone.[1]

As with other small island nations in the region, FSM faces significant challenges related to its small size, remoteness, geographical dispersion, environmental fragility and sensitivity to external shocks.[2] In particular, frequent natural disasters and climate change impose high costs and may even threaten the physical viability of some areas of both the main islands and more remote outer islands. Droughts, typhoons, storm waves, flooding and landslides all affect FSM. The climate in FSM varies considerably from year to year due to the El Niño Southern Oscillation (ENSO). In Pohnpei, El Niño tends to bring drier conditions during the dry season, but higher than average rainfall during the wet season, and La Niña tends to bring above average rainfall in the dry season. The West Pacific Monsoon affects the western states of Chuuk and especially Yap more than the eastern states of Pohnpei and Kosrae, tending to be farther east during El Niño resulting in more rainfall, and in a more western position during La Niña resulting in less rainfall.

FSM is particularly vulnerable to the impacts of climate change and is likely to suffer serious adverse environmental, social and economic losses as a result of climate change induced hazards.[3], [4] For example, in 2015, Typhoon Maysak wiped out 90 percent of key agricultural crops in Chuuk and Yap, affecting 29,000 people and causing US\$8.5 million in damages. Many people live within the coastal zone and are therefore vulnerable to climate related changes in precipitation, sea level, storms and coastal erosion. The negative impacts of climate change are already evident in FSM, for instance, saltwater intrusion from rising sea levels that damage crops and contaminate freshwater supplies and increasing extreme weather events such as typhoons. In addition, as drought and sea level rise are amplified by regional ENSO processes, formerly sustainable atoll communities now rely on imported food and water during times of stress. Exacerbated by sea level rise, extreme spring tides, known in FSM as 'King tides', are causing intense marine inundation that damages taro beds, soil, agro-forestry resources, and critical infrastructure along the coast, especially on low atoll islets.[5]

Projections under all global greenhouse gas (GHG) emission scenarios indicate that annual average air temperature and sea surface temperature will increase in the future. Based on the widely used Coupled Model Intercomparison Project, Phase 5 (CMIP5) models (included in the Intergovernmental Panel on Climate Change (IPCC's) Fifth Assessment Report), by 2050 the average temperature in FSM is expected to increase by 1.3°C in the high emission pathway, or by 0.78°C in the low emission pathway. In both scenarios, the intensity and frequency of days of extreme heat are projected to increase throughout the decades up to 2100. In addition, model projections show extreme rainfall days are likely to occur more frequently. The majority of the simulations estimate an increase of rainfall of greater than 5 percent by 2090 under the high emissions scenario.[6] In addition, sea levels near FSM have risen and will continue to rise throughout this century, with a projected rise in sea level in the range of 3 – 15 cm by 2030 under a high emissions scenario. This sea level rise combined with natural year-to-year changes will accentuate the impact of storm surges and coastal flooding.[7]

Similar to other Small Island Developing States, FSM is vitally dependent on access to well-functioning and reliable transportation systems. FSM's road network is of critical importance to the country's economic development. It provides for the day-to-day well-being of its people by increasing their access

to economic activities and social services. It is estimated that around 75 percent of the population lives within one km of the coast, and critical infrastructure - such as hospitals, schools, places of employment, tourist infrastructure, port facilities, airports, and roads—is located primarily in the coastal zone. The country's road network and users already suffer regular temporary – sometimes only for hours, but occasionally longer - breaks of serviceability as vulnerable links or locations can be frequently rendered impassible and journeys disrupted by flooding, debris deposit, culvert, bridge and/or pavement damage. Expected climate change effects - the combination of rising sea level and more intense typhoons – will place these coastal assets and communities at a higher level of risk.

The FSM road network faces a range of vulnerability issues, in particular: (i) coastal exposure to sea-level rise, storm surge, wave action during very high tides and typhoons; (ii) inland flooding and landslips during extreme rainfall events; and (iii) accelerated pavement deterioration due to extreme weather and rising water tables in some locations. The Government of FSM (GoFSM) plans to prepare a detailed assessment of vulnerabilities in road transport and develop a strategy for enhancing the climate resilience of the overall network for the same time-frame. GoFSM is working with donors to support its climate change initiatives and has requested the World Bank's assistance through the FSM Climate Resilient Road Project (FSMCRRP). This TOR pertains one of the key pieces of technical assistance under FSMCRRP, the preparation of the FSM Road Network Vulnerability Assessment and Climate Resilient Road Strategy, as further explained below.

## 2. *Objective*

The objective of this assignment is to prepare a Road Network Vulnerability Assessment and Climate Resilient Road Strategy for FSM's four states (approximately 360 km on the four principal islands of Chuuk, Pohnpei, Kosrae and Yap). This technical assistance will mainstream analysis of severe weather events and climate change) into road network planning and will enable a prioritized list of proposed investments in the network.

## 3. *Scope of Activities*

The Consultant will conduct the following activities:

### **A. Climate Change and Natural Hazard Vulnerability Assessment**

1. Based on existing GoFSM data and knowledge and consultations with relevant authorities, as well as visual inspection and drive-over surveys, identify geographical areas – and major road assets within those areas - with higher hazard and exposure risks (this section should be brief and only comprise up to 5% of the input of the total assignment):

- Through further consultation and natural hazard risk information, identify and define existing and likely future key hazard events (e.g. extreme rainfall, landslides, storm surge, king tides, etc.) and potential impacts (blockages, wash outs, overtopping etc.) on the four principal islands of FSM.
- Assess demographic and socioeconomic data and identify areas with high densities of population, especially the poor or other vulnerable people.
- Assess existing data and Government development plans and identify the location of (i) critical services and (ii) major economic activities, existing and planned.
- Undertake a critical assessment of the economic potential of high-risk areas and rank these on a rigorous (but appropriate in the context of FSM) methodological analysis that the Consultant proposes.
- Drive-over surveys of all primary roads should include Go-pro or similar GPS-linked and GIS-compatible video and still photo sequences, as well as International Roughness Index (IRI) profiles, to supplement primary network mapping in (iii)(d) below. All data (including video and photos), surveys, models and profiles will need to be delivered to GoFSM in a format compatible with its systems so that the Government can make use of it and update for future analysis.

ii. Utilize the information from point (i) above to identify priority geographical areas that are vulnerable to existing and future disaster risks in line with the categories set out in the table below (this section is envisaged to comprise about 10% of the input of the total assignment):

	Hazard Frequency and Severity		
Exposure and Vulnerability[8]		High	Low
	High	First priority areas	Secondary priority areas
	Low	Secondary priority areas	Third priority areas

a. Hazard may be assessed using the established methodology of hazard mapping, or any other methodology that the Consultant proposes that is appropriate in the context of FSM. The Consultant should identify the effect of different climate change scenarios on future levels of hazard.

b. Exposure and vulnerability should consider the size of population, the level of poverty, concentration of critical social services and major economic activities, among other indicators that the Consultant proposes that are appropriate in the context of FSM.

c. To better equip GoFSM decision-makers under deep uncertainty of climate change impacts, utilize best available data and climate change projections (using at least two of the four Representative Concentration Pathways) to model and assess hazard, exposure and vulnerability.

iii. Assess the likely severity and frequency of hazard event impacts for all major links of the road network. For example, this may entail estimating the amount of typhoon-induced storm surge inundation caused at different sections of the road network by modelling the scenarios, frequency (based on a catalogue of such events), and potential outcomes. In addition to other relevant resources, the analysis may propose using latest results from the Pacific-Australia Climate Change Science and Adaptation Planning Program, the Pacific Catastrophe Risk Assessment and Financing Initiative, and other relevant climate change scenario/models to forecast possible impacts of severe weather events on the road network (this section is envisaged to comprise about 15% of the input of the assessment). This assessment will require the Consultant to:

a. Map out the existing transport network and assess existing and forecasted traffic data that will help identify critical transport links for local socioeconomic development.

b. Identify the transport links that were disrupted in recent severe weather events or considered to be susceptible to disruption during disaster.

c. Identify critical transport links that could serve as important means of escape, access to emergency relief or for the transport of agricultural or other economic assets.

d. Prepare GIS linked maps of the primary road networks to visually illustrate at-risk areas, as well as critical transport links and locations of critical services and facilities.

iv. Assess the impact of loss of connectivity and access in priority areas and the impact on the overall network based on the experience of recent severe weather events (this section is envisaged to comprise about 15% of the input of the total assignment):

a. Review existing data and conduct key informant interviews or focus groups and assess the extent of the loss of connectivity and basic access.

b. Model and assess the impact of such loss of connectivity and access on the lives and livelihood of vulnerable population and overall economic activities.

v. While conducting in country assessments, provide capacity building to relevant GoFSM road sector staff (federal and state) on all tools used to assess network vulnerability to ensure the sustainability of this activity so that Government can update the vulnerability assessment as needed after the project closes.

**B. Climate Resilient Road Strategy** (this strategy is envisaged to comprise about 55% of the input of the total assignment). Based on the Vulnerability Assessment, the Consultant will then prepare a Climate Resilient Road Strategy that will: (i) outline a general climate change adaptation policy framework and objectives for the roads sector; (ii) recommend a program of priority investments and other interventions at specific risk locations; and, (iii) propose specific policy reforms required to provide a foundation for climate change adaptation and to address natural hazard vulnerability in the roads sector. This will be achieved by the following:

i. Identify potential adaptation options that respond to the assessed vulnerabilities and that are technically feasible and appropriate in the FSM context. The analysis should include:

a. Specific interventions at high-risk locations; and,

b. Measures that can be taken at a national level to reduce vulnerabilities and enhance the resilience of the road network, as described in the following tasks.

ii. Using multicriteria analysis (methodology to be proposed by the consultant), develop a prioritized program of investments at specific locations to improve the climate resilience of the road network while also enhancing road safety, environmental and social performance. This will include robust economic analysis (e.g. informed by a cost-benefit analysis, economic internal rate of return and net present value calculations, non-market valuation and other such tools), and weighted criteria for the non-financial aspects of prioritization. The priority investments should be grouped into time bands such as short-term, medium-term (i.e. before 2030), and long-term (i.e. 2030 to 2050) taking into account the urgency of the required response and the design life of the proposed investment.

iii. Prepare tools to assess the vulnerability of road assets to current and future climate events, including methodologies for determining the adequacy of existing roads to resist climate impacts; and that also consider road safety, State EPA laws and regulations as well as land acquisition and access, and resettlement impacts for existing and new roads in each State under State land laws. The tools must be compliant the World Bank ESF and World Bank Group EHS Guidelines., including standards and guidelines relating to road safety. The tools must demonstrate that each of the identified key hazard types and risk levels (e.g. extreme rainfall, landslides, storm surge, king tides, etc.) in FSM were considered for their impact on different systems' assets—built (infrastructure), natural and social—as well as those systems with cross cutting influences, e.g. economic and institutional systems. Demonstrate that the level of vulnerability of the assets within these different systems was assessed and determined for its severity, and that an adaptation strategy and action plans can subsequently be designed accordingly. Deliver the tools in an accessible format to the Government so that it could continue to make use of them and update the assessments as needed after the project closes.

iv. Review current road planning processes, the institutional and legal framework for the roads and traffic sector (e.g. relevant federal and state legislation, including land access and easements), national and state road construction standards, road safety, maintenance (routine, periodic and emergency) methods and regimes, and related processes and assess their adequacy in the light of projected climate change and natural hazard vulnerability. Recommend suitable reforms, such as (but not limited to):

a. Embedding consideration of climate change and disaster risk management issues into all road planning processes;

b. Updating road design standards;

c. Employing new approaches to road maintenance that take into account climate change and natural hazards; and,

d. Mainstreaming climate change adaptation and disaster risk management into the roads sector from infrastructure and operational perspectives.

v. Review the institutional and legal framework as relevant to the implementation of Climate Change Adaptation and Disaster Risk Management, and recommend specific reforms needed to:

- a. Improve management of traffic and road access during and following natural disasters.
- b. Enhance quick response procedures to ensure that roads are repaired and restored quickly following severe weather damage.
- vi. While conducting in country assessments, provide capacity building/training to relevant GoFSM road sector staff (federal and state) on all tools used to assess network vulnerability to ensure the sustainability of this activity so that Government can update the vulnerability assessment as needed after the project closes.

#### 4. Deliverables

1. **Inception Report** that summarizes the initial result of the literature review and the study plan, including an expansion of their methodology and approach (delivered as part of the firm’s technical proposal) that contains, but is not limited to, the short list of priority areas, to be submitted within *half (0.5) a month* of the commencement of the assignment.
2. **Mid-term Report** that provides the summary of findings and preliminary conclusions of the full scope of activities above (i.e. Section 3 of this ToR), to be submitted within *two and a half (2.5) months* of the commencement of the assignment.
3. **Draft Final Report** that builds upon the Mid-term Report by providing detailed analysis on all aspects of the full scope of activities above (i.e. Section 3 of this ToR), addresses all written and oral stakeholder comments from the Mid-term report, provides stylized datasets, summarizes the conclusions and policy recommendations of the study and presents all data and information obtained under the assignment. At this stage, the report will include the prioritized investments based on the multi-criteria analysis, in both narrative and matrix format. In addition, all underlying data and models are to be delivered to GoFSM alongside the Draft Final Report. To be submitted within *four and a half (4.5) months of the commencement of the assignment.*
4. **Presentation and Stakeholder Consultation** through an in-country workshop on the conclusions and policy recommendations presented in the Draft Final Report. The presentation should be delivered in PowerPoint, and soft and hard copies of the Draft Final Report made available to all participants.
5. **Final report**, addressing all stakeholder comments on the Draft Final Report and from the presentation and consultation with stakeholders (as well as any updates to the underlying data and models to be delivered to the client), within six (6) months of the commencement of the assignment.

#### 5. Team Composition & Qualification Requirements for the Key Experts

Consulting firms are encouraged to develop their own methodology as well as the staffing plan, level of effort and work approach to accomplish the ToR. This technical assistance assignment will require the firm to staff an appropriate mix of highly qualified international and local staff that includes but is not necessarily limited to the eight key experts noted below. Where key experts proposed by firms do not have experience in Pacific or small island countries, it is expected that they would be assisted by non-key experts with such experience. It is up to the firm to propose which of the staff on its team is Team Leader, among the positions: Senior Economist; Senior Road Engineer; Climate Change and Disaster Risk Assessment Specialist. That individual will have overall responsibility for the direction, technical excellence and successful completion of the project and must have at least 15 years of Project Management experience having leadership qualities in addition to the requisite qualifications of one of the key staff positions noted below.

Key Staff	Qualifications	Experience
1. Senior Economist	Master’s degree in Economics required, PhD preferred	At least 12 years of experience in micro-economics. Experience with statistical modeling;

		designing, implementing household, commercial properties, etc. surveys; and performing complex econometric analysis strongly preferred. At least 3 years of experience in similar studies, preferably in Pacific Island Countries.
1. Senior Road Engineer	1st degree in civil engineering, with post-graduate qualification in roads-related discipline. Full membership of national or international professional institution	20 years or more experience in the field of road engineering, out of which minimum 7 years post-graduate experience in roads and drainage design in small island states, preferably in the pacific region would be an advantage. Some CCA and/or DRM-related project experience preferred
1. Climate Change and Disaster Risk Assessment Specialist	Master's degree in climate sciences, urban planning, or related field is required	Minimum of 10 years of experience working on climate change and natural disaster assessment, mitigation and remediation; at least 5 of which should be with a developing country or emerging nation, preferably in a small island country.
1. Lawyer / Policy Specialist	JD, LLB, LLM or equivalent preferred. Alternatively, individuals with Master's degree in relevant discipline with at least eight years' experience in policy and legal reform and regulatory issues may also be considered.	At least eight years' experience in policy and legal reform and regulatory issues. An international legal counsel with experience in FSM road policies and legislation or assisted by an FSM lawyer with knowledge of FSM road policies and legislation is essential.
1. Engineering Hydrologist	Bachelor's degree in Hydrology, Physical Geography, Earth Science, Engineering, or Environmental Science required with a strong focus on hydrology. Preferably a Master's degree.	At least 7 years' relevant experience in engineering hydrology including 3 years of experience of hydrodynamic analyses and modelling, flood risk assessment with hydrologic modelling software. Some CCA and/or DRM-related project experience preferred
1. GIS/Mapping Specialist	Bachelor of Science or Engineering Degree required	Minimum of 5 years of GIS experience and experience working with various data formats such as CAD, GPS, etc. Knowledge of environmental resource management,

		transportation, or geography strongly preferred.
1. Environmental Specialist	At a minimum a Bachelor's degree in science or engineering discipline (Biology, Chemistry, Geology, Environmental, Civil or Chemical Engineering)	At least 10 years of experience in positions requiring proficiency with the analysis and application of environmental regulations; skills in the application of environmental and technical concepts is also required. At least 3 years' experience in similar studies preferable in Pacific Island countries.
1. Social Development Expert	Master's degree in a relevant field such as sociology, anthropology, urban planning, or other social sciences.	At least 10 years relevant social development experience and proven track record in working on projects covering a broad range of resettlement and social development issues. Experience working in Pacific Island countries preferred. Having good knowledge of World Bank policies and framework for social development.

#### **6. Administrative Personnel and other Technical Staff**

The Consultant shall have its own office and field staff to assist in the Services. The staff provided shall be experienced and be capable of performing their allotted duties. In particular for:

1. office administration and clerical personnel; and
2. field assistants for team members in carrying out field work, etc.

#### **7. Client's Input**

Data to be made available to the Consultant by GoFSM through DoTC&I will include, but not necessarily be limited to:

- Rainfall history information (daily, annual, maximum per day) within the studied area (from north and south meteorological stations)
- IDF curves (intensity-duration-frequency curve) for rain locally available
- Available reports previously done on roads drainage in country
- Water level series at all existing river gauges located within the studied area (if available)
- Discharge measurement series at all existing gauges within the studied area (if available)
- Information about rain drainage problems that occurred on studied roads during storm
- Storm water typical details in studied roads
- Geological maps of the country in order to know the properties of the soil in the studied area and information about the rate of infiltration of the soil
- General contour maps of studied islands (in order to determine catchment areas and calculate storm water rain flow)
- Photos of drainage system in studied roads

- Environmental controls adopted in country for storm water drainage outlets (if available)
- Climate change effects on country climate and rainfall
- Technical specifications for road drainage
- Water table information on studied area (if available)
- Photos of studied roads and main defects in them
- Pathologies/ distress existing on the roads (types and degrees of severity). Information about the main problem encountered by local people on the studied roads
- State EPA laws and regulations
- Available Updated Traffic Data
- Any Road Safety Audit Report(s)
- All relevant Land Transport Acts and regulations as well as climate change focused infrastructure strategies

The Client will provide unimpeded access to relevant information that it may hold to assist the Consultant in this project on “as available” basis

#### **8. Duration and Level of Effort**

It is expected that the study will be completed within six (6) months of commencement and is expected to require approximately 20 person-months of professional input.

#### **9. Counterpart Facilities**

##### **A. Counterpart personnel**

DoTC&I will provide a local liaison officer, who will liaise with local communities and vulnerable persons on matters concerning the project field work and related matters.

##### **B. Office accommodation and logistics**

The consultant shall be responsible for providing all accommodation, computing, and drafting equipment and software *etc.* The consultant will be responsible for all land transportation arrangements during the project.

[1] An Exclusive Economic Zone is a sea zone prescribed by the United Nations Convention on the Law of the Sea (UNCLOS) over which a state has special rights regarding the exploration and use of marine resources, including energy production from water and wind.

[2] Systematic Country Diagnostic, Report No. 102803, World Bank, January 20, 2016.

[3] In acknowledging that a variety of definitions may be used for the terms risk, hazard, vulnerability and exposure, the following definitions are used for this ToR. Risk refers to the likelihood that a bad outcome occurs to an exposed asset (e.g., bridge failure) within a specified period because of the effects of natural effects (e.g., tropical cyclone induced storm surge). Hazard refers to when the effects of the natural events reach or exceed specified levels at a certain location within a period (e.g., storm surge exceeding 1 meter). Vulnerability refers to the propensity of an asset to be damaged by the effects of an event. Exposure refers to when assets are in harm’s way.

[4] FSM Country Profile. World Bank Group Climate Change Knowledge Portal. 2018.

[5] Climate Change in the FSM – Food and water security, climate risk management, and adaptive strategies. University of Hawaii. 2010.

[6] FSM’s Second National Communication to UNFCCC on adaptation

[7] Current and future climate of the Federated States of Micronesia. Pacific Climate Change Science Program. 2011.

[8] Refer to footnote 3 for definitions of risk, hazard, vulnerability and exposure.

