

**República Democrática de São Tomé e Príncipe**

**MINISTÉRIO DO PLANEAMENTO, FINANÇAS E ECONOMIA AZUL**

Unidade – Disciplina - Trabalho

**Agência Fiduciária e de Administração de Projetos**

**Projeto Desenvolvimento do Setor dos Transportes e Proteção Costeira**

**Grant No.:** D 44 60 ST

**AssignmentTitle:**

Developmentofclimateresilienceofthetransport network, throughvulnerabilityassessmentandclimate-informedroadassets management in Sao tome andPrincipe

 **Reference No**.: **17/C/TCP/2019**

TheGovernmentoftheDemocraticRepublicofSao Tome andPrincipehasreceivedfinancingfromtheWorldBanktowardthecostoftheTransport Sector DevelopmentandCoastalProtection Project, andintends to applypartoftheproceeds for consultingservice to Developclimateresilienceofthetransport network, throughvulnerabilityassessmentandclimate-informedroadassets management in Sao tome andPrincipe.

Theconsultingservices (“theServices”) include:

## Vulnerability Assessment of Road Network;

## Climate Resilience and Adaptation Strategy for STP’s Road Network,

## Development of Guidelines for Vulnerability Assessment and Work Program of Priority Measures for Road Network;

## Recommendations for the development of a resilience Database to enhance the current RAMS used by Roads Department of STP for planning and decision-making

Theconsultingservicesis to beimplemented in eight (8) months, fromSeptember 2020 to April2021.

ThedetailedTermsofReference (TOR) for theassignment can beobtainedattheaddressor email givenbelow.

The Project AdministrationandFiduciaryAgency (AFAP) now invites eligibleconsultingfirms (“Consultants”) to indicatetheirinterest in providingtheServices. InterestedConsultantsshouldprovideinformationdemonstratingthattheyhavetherequiredqualificationsandrelevantexperience to performtheServices. Theshortlistingcriteria are:

* Must haveatleast 10 (ten) yearsofrelevantexperience in DetailedRoadEngineering Design andtechnicalspecifications;
* Solidknowledgeoftheinstitutionalandpolicyprocessrequired in theimplementationofclimatechangeadaptationmeasures;
* Must haveatleast 3 (three) contracts in road design projects in thelast 6 (six) years.

Key Experts willnotbeevaluatedattheshortlistingstage.

TheattentionofinterestedConsultantsisdrawn to Section III, paragraphs, 3.14, 3.16, and 3.17 oftheWorldBank’s “ProcurementRegulations for IPF Borrowers” datedJuly 2016 andrevised in November 2017 andAugust 2018 (“ProcurementRegulations”), settingforththeWorldBank’spolicyonconflictofinterest.

Consultantsmayassociatewithotherfirms to enhancetheirqualifications, butshouldindicateclearlywhethertheassociationis in theformof a joint venture and/or a sub-consultancy. In the case of a joint venture, allthepartners in thejoint venture shallbejointlyandseverallyliable for theentirecontract, ifselected.

A Consultantwillbeselected in accordancewiththeQualityandCost-BasedSelection (QCBS) method set out in theProcurementRegulations.

Furtherinformation can beobtainedattheaddressbelowduringofficehours: **08:30 to 12:00 and 15:00 to 17:00 hours (Sao Tome andPrincipe local time) Monday to Friday.**

Expressionsofinterest must bedelivered in a writtenform to theaddressbelow (in person, orby mail, orby e-mail) by**August11, 2020until 16:00 hours (Sao Tome andPrincipe local time).**

Agência Fiduciária e de Administração de Projetos

Attn: Mr. Alberto F. Leal, Coordinator

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**Consultancy Services to develop climate resilience of THE TRANSPORT NETWORK, through vulnerability assessment and climate-informed road assets management IN SAO TOMÉ e principe.**

**Terms of Reference**

# BACKGROUND

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| Roads and bridges are key assets for Africa - they connect villages to economic centers, people to hospitals, children to schools and goods to markets facili­tating trade. Climate change is expected to increase disruption time of the network, shorten their rehabilitation life-cycle, and increase repair and rehabilitation costs. For Sub-Saharan Africa, it is estimated that climate change will threaten to increase road maintenance costs by 270% in the case of inaction. The proposed activity aims at conducting innovative climate vulnerability assessments for roads and bridges at the national level for Sao Tome e Principe (STP) to enhance the climate change resilience of the national infrastructure network. This entails a comprehensive methodology for assessing the impacts of climate change on long-lived infrastructure, and for identifying robust investment options that can improve the performance of that infrastructure over a wide range of future climate scenarios.As a small archipelagic state, STP is particularly vulnerable to climate-related hazards such as floods, coastal/river mouth flash floods, storms and drought episodes. These events are very likely to become more frequent and more intense due to global climate change, have significant impacts on critical sectors such as agriculture, fisheries, and also transport. Most of the national infrastructure (port, airport, the oil reservoirs, hotels) is located in low lying areas along the shoreline, and therefore, directly exposed to the elevation of the sea-level, which, in addition to increased consequences of coastal flooding, exacerbates the coastal erosion. Roads are usually located between this shoreline and the higher slopes, making them exposed to coastal erosion on one side and landslides or rockfalls on the other sides. The drainage systems (natural and human) are often either under-designed or poorly maintained, causing regular overflow and inundations. The developments in the coastal areas, often based on the plans developed during the colonial period, have not integrated those threats.  |

# OBJECTIVES

The Development Objective of the Technical Assistance is to:

* Develop an effective strategy to reduce climate and disaster risks for STP road network and improve its maintenance, by assessing vulnerability of the country’s roads to current disaster risks and future climate change impacts, improving climate resilience planning for future road investment and adapting road assessment management.

To achieve the Development Objective, this assignment will focus on the following four sub-objectives:

* Assessment of the vulnerability of road network assets and development of a prioritized work program of climate resilience measures for the same road network;
* Development of Guidelines for the Climate Change Vulnerability Assessment and Prioritized Work Program of STP’s Road Network Assets;
* Development of Guidelines for Climate & Disaster Resilience Audit of road engineering designs and pilot climate & Disaster resilience audit of a road engineering design, and
* Development of the Road Assets Management System with climate change data to improve planning and decision-making processes.

# scope of works

Several countries havealreadycarried out vulnerabilityassessmentsofroadinfrastructuresandmappingofvulnerableareasorhavemadeattempts. Allofthemhavebeenapplyingdifferentmethodologiessubject to theavailabilityof data in respective countries. Insteadofinventing a newmethodology, theConsultants are encouraged to reviewthosemethodologiesused in other countries and determine ifanyofthem can beadjusted to thecontextandreplicated prior to suggesting a newvulnerabilityassessmentmethodology for thisassignment.

## Task 1: Vulnerability Assessment of Road Network

**Sub-task 1.1: Data CollectionandConsultationsonclimateanddisasters:**TheConsultantwillgatherallavailablecurrentandhistoricalclimate, geological, hydrologicalandseismologicalinformationabout STP, includingprojectionsof future climateunderdifferentscenarios. TheConsultantwillcollectandcollateavailableinformationaboutclimatethreats, climateimpactsandclimateresilienceoptionsrelevant to roadsand bridges. This data mayincluderainfall, temperature, geologicalinformation, mudflow, landslideandseismological data. Historical data willprovideclues as to howcurrentroadinfrastructureassetsmaywithstand future climatestressors; whileprojectedclimateinformationwouldbeuseful to estimate future climateconditions to plan for.

TheConsultantwillholddiscussionswithNationalInstitute for Roads (INAE) andotherrelevantstakeholdergovernment agencies such as thoseinvolved in environmentalpolicymaking (e.g. DG Environment), meteorology (NationalInstitute for meteorology) ordisasterriskprevention (e.g. CONPREC) to get a perspectiveofthedifferenttypesofdisasterandclimatechangehazardsandtheirhistorical, presentand future occurrence, andrisklevels.

**Sub – task 1.2: Socio-economic data collectionandreview:**TheConsultantwillcollectandreviewthepertinentdemographicandsocioeconomic data, to identifythedifferent poles ofinterestofthe network, eitherbecauseoftheir social, economic, cultural oroverallimportance for the country. HencetheConsultantwill

* Identifyareaswithhighdensitiesofpopulation, includingthemostvulnerablepeople, themostlikely to beimpacted in case of a disaster
* Collectandreviewtheexisting data andGovernmentdevelopmentplansandidentifythelocationofcriticalservicesand major economicactivities, existingandplanned (including hospital, gasreservoir, civil protectionbuildings, ports, major markets, schools);
* Undertake a criticalassessmentofthe socio-economicpotentialofhigh-riskareasandranktheseon a rigorousmethodologicalanalysisthattheConsultantwillpropose.

**Sub-task 1.3: Inventoryofroadassets**TheConsultantwillidentifyrelevantroadinfrastructureassets (including bridges andculverts) for vulnerabilityassessmentand determine whichcharacteristicsoftheseassets are mostcritical for thisvulnerabilitystudy. Theinventoryisexpected to includeassetswhich are susceptible to disasterrisksandclimatechangeimpactsgiventheirlocation, configurationand use in thetransportation network.

**Sub – task 1.4: Assessmentofcriticalityofthedifferentroadassets:**TheConsultantwillmap out theexistingroad network andassessexistingandforecastedtraffic data thatwillhelpidentifycriticaltransport links for local socioeconomicdevelopment. TheConsultantwillidentifythetransport links thatweredisrupted in recentsevereweathereventsorconsidered to besusceptible to disruptionduringdisasters. TheConsultantwillalsoassesstheimpactoflossofconnectivityandaccess to criticalservicesandfacilitiesonthe lives andlivelihoodofvulnerablepopulationandoveralleconomicactivities. In addition, theConsultantwillidentifycriticaltransport links thatcould serve as importantmeansof escape, access to emergencyreliefor for thetransportofagriculturalorothereconomicassets. GIS-basedmapsshouldbeprepared to illustrateat-riskareas as well as criticalconnectivity links andlocationofcriticalservicesandfacilities.

**Sub-task 1.5: Assessment of the vulnerability of road assets to climate changeimpactsand natural hazards based on a multi-criteria analysis:** TheConsultantmayproposeand, aftervalidationwiththeclientandconsultationwiththeWorldBank, use anymethodology for assessmentof natural hazardanddisasterrisksthatisappropriate in thecontextof STP. TheConsultantwill prepare tools to assessthevulnerabilityof single roadassets to currentand future climateevents, includingmethodologies for determiningtheadequacyofexistingand future roadassets to resistoradapt to climateimpacts. Thisassessmentwillincludethevulnerability as individual elements, butalsothevulnerability as partofthesystem.

TheConsultantisexpected to prioritizethevulnerableassetsusing a multi –criteriaanalysis. TheConsultantshould determine a numberofcriteriaofdifferent ranking to assessthevulnerabilityandimpactofclimatechangesand natural hazards to roadassets. Exposure/Vulnerabilitywouldconsidertheconnectivity/criticallyandthe link withthesizeofpopulation, thelevelofpoverty, concentrationofcritical social servicesand major economicactivities, amongotherindicatorsthattheConsultantproposes (basedonthe data collected in previoussub-tasks) that are appropriate in thecontextof STP. TheConsultantshouldcarry out consultationswiththeclientandotherstakeholders to agreetherespective ranking andweightsoftheindicators. Itisexpectedthatthechosenindicatorswillinclude socio – economicmetrics. Basedonthecollectedinformation, theConsultantshould prepare GIS-basedvulnerabilitymapsandidentifyareaswithhigherhazardsandexposure/vulnerabilityrisks in STP.

**Sub-task 1.6: Assessmentofthevulnerabilityoftheroad network.** In thissub-task, theConsultantwillpropose a methodology to evaluatetheriskofthesystem as a whole, withestimationofitsweaknesses.

**Outputs fromTask 1:**

(i) Resultsofthevulnerabilityassessmentof STP road network,

## Task 2 Climate Resilience and Adaptation Strategy for STP’s Road Network

TheConsultantwill prepare a ClimateResilienceandAdaptationStrategy for Cabo Verde’sroad network basedontheanalysisfromtheriskassessment. Itwill (i) outlinea general climatechangeadaptationpolicyframeworkandobjectives for theroad sector; (ii) recommend a programofpriorityinvestmentsandotherinterventionsatspecificrisklocations; and (iii) proposespecificpolicyreformsrequired to provide a foundation for climatechangeadaptationand to addressdisasterandclimate-relatedrisks in theroad sector. Thiswillbeachievedbythefollowing:

**Sub-task 2.1**Identifypotentialadaptationoptionsthatrespond to theriskassessmentandthat are technicallyfeasibleandappropriate in thecontextof São Tomé andPrincipe. Theanalysisshouldinclude:

1. Specificinterventionsathigh-risklocations; and
2. Measuresthat can betakenat a nationallevel to reducevulnerabilitiesandenhancetheresilienceoftheroad network, as described in thefollowingtasks.
3. Identificationofexpectedoutcomes as a resultoftheproposedpotentialadaptationoptions, ontheoverallvulnerabilityofthesystem
4. Estimationoftheircosts, bothconstructionandmaintenancecosts

**Sub-task 2.2**Develop a prioritizedprogramofinvestmentsatspecificlocations to improve theresilienceoftheroad network and define the general natureofeachoftheproposedinvestments. Thepriorityinvestmentsshouldbegroupedinto time bands, such as short-term (1-5 years), mediumterm (5-10 years), andlong-term (10+ years), consideringtheurgencyoftherequired response, the design lifeoftheproposedinvestment, and a cost-benefitanalysisofeachinvestment. TheConsultantshouldpropose a methodology to dealwiththeuncertaintyrelated to climatechangeprojections.

**Sub-task 2.3** Reviewcurrentroadplanning processes, theinstitutionaland legal framework for theroadsandtraffic sector (e.g. relevantlegislation), nationalroadconstruction standards, maintenance (routine, periodic, andemergency) methods, andrelated processes andassesstheiradequacy in the light ofprojectedclimatechangeand natural hazardvulnerability. TheConsultantshouldrecommendsuitablereforms, such as (butnotlimited to):

1. Embeddingconsiderationofclimatechangeanddisasterrisk management issuesintoallroadplanning processes;
2. Updatingroad design standards;
3. Employingnewapproaches to roadmaintenancethat take intoaccountclimatechangeand natural hazards; and
4. Mainstreamingclimatechangeadaptationanddisasterrisk management intotheroad sector frominfrastructureandoperationalperspectives.

**Sub-task 2.4** Reviewtheinstitutionalframework as relevant to theimplementationofthedisasterandclimateresiliencestrategy, andrecommendspecificreformsneeded to:

1. Improve management oftrafficandroadaccessduringandfollowing natural disasters; and
2. Enhancequick response procedures to ensurethatroads are repairedandrestoredquicklyfollowingsevereweatherdamage.

**Outputs fromTask 2:**

1. Adaptationprogram for STP road network
2. Proposedreforms for standards andprocedures to improve climatechangemainstreaming in theprocess

## Task 3. Development of Guidelines for Vulnerability Assessment and Work Program of Priority Measures for Road Network

Basedonthemethodologyused in thevulnerabilityassessment, theConsultantwill prepare a clear andpracticalmethodology for updatingthevulnerabilityassessmentofroad network that can bereplicated in the future, withoutthefullmodelling. ThisGuidelinesisexpected to comprise step-by-step principles for identificationandprioritizationofclimatethreats/natural hazardanddisasterrisksandimpactswhich INAE can use for anyoftheirroad classes. TheGuidelinesshoulddescribe:

* Typeandformatof data needed for theclimatechangevulnerabilityassessmentofroadassets in STP, includingproposedforms (paperandelectronic). The data shouldbecompatiblewiththeroadassets-based management system
* Recommendedmethods for mapping, preferably GIS-basedones, ofinfrastructureassets in vulnerableareas, andinventoryofcriticalassetsthat are susceptible to climatechangeimpacts;
* Recommendedmethods for monitoringofassetcondition in conjunctionwithenvironmentalconditions (e.g., temperature, precipitation, winds) to determine ifclimatechangeaffects performance;
* Methodology for prioritizationofriskareasandassetsandidentificationofhighriskareasandhighlyvulnerableassets; theprioritizationmethodologyshouldbebasedon a multi-criteriaanalysis, withvariouscriteriaofdifferent ranking to assessthevulnerabilityandimpactofclimatechangehazards to roadinfrastructure in STP;
* Methodology for thedevelopmentof a workprogramofpriorityclimateresiliencemeasures for vulnerableroadassets/atriskareas.

**Outputs fromTask 3:**

1. Guidelines for climatechangevulnerabilityassessmentandworkprogramofpriorityclimateresiliencemeasuresoftheroad network in STP.

Task 3: ClimateResilienceAuditofRoadEngineering Design

ThisTaskwillfocusontheprovisionofguidance for INAE to ensurethatclimateresilienceandadaptationmeasures are implementedatprojects/contractslevels. Usingtheinformationobtainedfromthetaskabove, theConsultantisexpected to prepare a clear andpracticalGuidelines (methodology) for climatechangeresilienceauditofroad designs andexistingroads. TheresultsofTask 1 shouldinformtheConsultantwhichassets are highlydisruptiveand time critical[[1]](#footnote-2)thattheybecomethecenterof a climateresilienceaudit. ThisGuidelines Manual shouldcomprise a step-by-step guide to check for climatechangeadaptationmeasures in theengineering designs. TheGuidelinesshouldbedeveloped in a formatthattheycouldbeapplicablenotonly for auditsofnew designs butalso for climateresiliencemonitoringandinspectionofexistingroads, as well as potentialmaintenance/retrofittingexercises. TheGuidelinesshouldalsoincludethefollowing:

* Guidanceon design, construction, maintenance for climateresilienceofvulnerableroadsandstructures;
* Guidanceonhydrologicalcriteria to betakenintoaccount in the design of bridges anddrainagestructures;
* Guidanceonengineeringandbioengineeringmeasures to counterclimateanddisasterimpactsonpavements, surfacing, bridges, earthworksanddrainagestructures.

TheproposedGuidelines for roadengineering design auditsshouldbediscussedandvalidatedwith INAE engineersandotherstakeholdersandshouldbeprepared in a formatready for anofficialapprovalbytherespectivegovernmentauthority in STP.

**Outputs fromTask 3:**

(i) Guidelines for climateresilienceroadengineering design audit in STP;

Task 4: EnhancementofRoadAsset Management SystemwithClimateChange Data

To improve itscapacity to implementtheadaptationstrategy, INAE needs to enhanceitsRoadAsset Management System (Database). Thistask, to enhancethe RAMS shouldbelargelyinformedbythepreviousTasks: whattypeandformatof data and for whichassetsshouldbecollected, andwhatcollectionmethodsshouldbeused. TheConsultantwillprovidetherecommendationsonthefollowing:

* Data typeandformatand for whichassets: TheConsultantwill define the data to becollectedat a projectand network levels, andwill define thestructureofthe data in a formateasilyconvertibleinto a geodatabase for compatibilitywithINAE’scurrent RMS hostedonanArcGIS server.
* Data collection: TheConsultantwill define the data collectionmethods, frequencies, responsibilities, budget andtheprocedures for updatingthedatabase.
* Data analysisandresultsreporting: TheConsultantwill define themethodology to analyzethe data andreportresults to facilitatetheselectionofthemostsuitableadaptationmeasuresandinformRD’smulti-yearandannualplanning processes.

**Outputs fromTask 4:**

(i) Recommendationsfor thedevelopmentof a resilienceDatabase to enhancethecurrent RAMS usedbyRoadsDepartmentof STP for planninganddecision-making processes.

Task 5: KnowledgeDissemination Workshop

TheConsultantwill organize a knowledgedissemination workshop to beattendedbyRoadsDepartmentandotherrelevantstakeholders in STP. Atthe workshop, theConsultantwillpresenttheresultsofthevulnerabilityassessmentandworkprogramofprioritymeasures for road network, as well as demonstratehow to use thedevelopedassessmentmethodologies for thevulnerabilityassessmentandworkprogramofprioritymeasuresdevelopmentandtheclimatechangeengineering design audit. Duringthestudy, theConsultantwillholdseveral workshops to presentpreliminaryresultsofeachtask to seek feedback andrecommendationsof INAE andotherstakeholders, prior to thefinalizationofitsmain outputs.

**Output fromTask 5:**

Reportpresentingtheresultsofthedissemination workshop.

# ESTIMATED LEVEL OF EFFORT

ThelevelofeffortrequiredfromtheConsultantiscurrentlyestimatedat 6 months. In addition, theConsultantisexpected to ***submitthree hard copies andthree USB copies ofeachreport in both Portuguese andeitherEnglishorFrench.***

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| **Deliverables** | **Requirement** |
| Inception Report | The Inception Report shall be submitted within 4 weeks since the contract commencement. The Inception Report shall summarize the findings related to the existing data and the relevant literature review, presenting an understanding of the assignment and the objectives. It should present an overall approach and detailed program, work plan and completion schedule for the services. It should also discuss constraints and challenges identified by the Consultant and ways to address them in order to timely and effectively deliver the assignment |
| Interim Report 1 | Interim Report 1 shall be submitted within 3 months since the contract commencement. The report shall present outputs from Task 1 which will include the following:(i) Results of the vulnerability assessment of STP road network, and (ii) Work Program of Priority Climate Resilience Measures for the same road network. |
| Interim Report 2 | Interim Report 2 shall be submitted within 4 months since the contract commencement. The Report will present outputs from tasks 2 and 3 the scope of works, which will include the following:* Guidelines for climate change vulnerability assessment of and work program of priority climate resilience measures for the road network in STP;
* Guidelines for climate resilience road engineering design audit in STP;
* Recommendationsfor the development of a Climate Change Database to enhance the current RAMS used by Roads Department of STP for planning and decision-making processes.
 |
| Draft Final Report | The Draft Final Report shall be submitted no later than 5 months since the contract commencement, and incorporate Bank’s comments as well as the feedback received from the RD and other stakeholders on the previous Interim Reports. The Report shall present the revised outputs for Tasks 1, 2, 3, and 4. |
| Final Report | The Final Report should address comments on the Draft Final Report and feedback from the knowledge dissemination workshop. The Final Report should be submitted within 1 week after receiving the feedback from the Dissemination workshop and World Bank’s comments and no later than one week before the expiration of the contract for these services. |

# All the data collected, acquired or produced during this consultancy will be transferred to the Government of São Tome and Principe in a standard format, with completed metadata.

# REQUIRED SKILLS/ EXPERIENCE

Theassignmentisexpected to beexecutedby a firmor a team ofConsultantswiththefollowingcompetencies:

* DetailedRoadEngineering Design andtechnicalspecifications;
* Climatechangehazardassessmentandadaptation;
* Extensiveinternationalexperienceonroadprojects;
* Solidknowledgeoftheinstitutionalandpolicyprocessrequired in theimplementationofclimatechangeadaptationmeasures;
* Excellentability to consultwithkeydecisionmakersandstakeholders in theroad sector, relevantministries, municipalities, environmental agencies, NGOs, andcommunities; and
* Fluencyofthe Portuguese languageisrequired.

Consultingfirms are encouraged to developtheirownmethodology as well as thestaffingplan, levelofeffortandworkapproach to accomplishthe TOR. Thistechnicalassistanceassignmentwillrequirethefirm to staff anappropriatemixofhighlyqualifiedinternationaland local staff. Anexampleofpossiblekey team membersmayinclude a numberof, butnotnecessarilylimited to, the staff notedbelow. Wherekey experts proposedbyfirms do nothaveexperience in smallisland countries, itisexpectedthattheywouldbeassistedby non-key experts withsuchexperience. Itisup to thefirm to proposewhichofthe staff onits team is Team Leader, amongthepositions: RoadEngineer; DisasterRiskAssessmentSpecialist; ClimateChangeSpecialist; Economist. That individual willhaveoverallresponsibility for thedirection, technicalexcellenceandsuccessfulcompletionoftheprojectand must haveatleast 15 yearsof Project Management experiencehavingleadershipqualities in addition to the requisite qualificationsofoneofthekey staff positionsnotedbelow.

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| **Key Staff** | **Qualifications** | **Experience** |
| 1. Economist
 | Master’s degree in Economics required, PhD preferred. | At least 10 years of experience in micro-economics. Experience with statistical modeling. At least 3 years of experience in similar studies, preferably in small island countries. |
| 1. Road Engineer
 | 1st degree in civil engineering, with post-graduate qualification in roads-related discipline.  | 15 years or more experience in the field of road engineering, out of which a minimum 7 years of post-graduate experience in roads and drainage design in small island states. Some Climate Change Adaptation and/or Disaster Risk Management-related project experience preferred. |
| 1. Climate Change Specialist
 | Master’s degree in climate sciences, urban planning, or related field is required. | Minimum of 8 years of experience working on climate change; at least 3 of which should be with a developing country or emerging nation, preferably in a small island country. |
| 1. Disaster Risk Assessment Specialist
 | Bachelor’s degree in Civil Engineering, Urban Planning, Geology or other relevant Disaster Management subject required as well as a relevant post graduate qualification. | Minimum of 8 years of experience in the fields of natural disaster assessment, mitigation and remediation; at least 3 of which should be with a developing country or emerging nation, preferably in a small island country.  |
| 1. Engineering Hydrologist
 | Bachelor’s degree in Hydrology, Physical Geography, Earth Science, Engineering, or Environmental Science required with a strong focus on hydrology. Preferably 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. 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 8 years of experience in policy and legal reform and regulatory issues on road sector. |
| 1. GIS/Mapping Specialist
 | Bachelor of Science or Engineering Degree required. | Minimum of 8 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, Civil or Chemical Engineering). | At least 8 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 small 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 8 years of 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 small island countries preferred. Having good knowledge of World Bank polices and framework for social development. |

# Estimated Schedule

Itisexpectedthatthestudywillbecompletedwithineightmonthsofcommencement.

# Management and Logistical Support

TheConsultantwillreportdirectly to INAE and AFAP

***Thelogistics (Displacementsandoffices), willbetheconsultantresponsibility.***

1. Data andInformation:Theclientwillprovideunimpededaccess to relevant data andinformation to assisttheConsultant in thisprojectonan “as available” basis. Thisincludesmaps, executionprojects/designs, listofurgentworksandrespective contractual pieces, andaccess to theroaddatabase. ThedocumentsproducedbytheConsultantincludingreports, drawings, software, data, models etc. willbethe exclusive propertyoftheRoadInstitute.
2. Counterpartpersonnel:TheGoSTPwillprovide a local liaisonofficer, whowillliaisewith local communitiesandvulnerablepersonsonmattersconcerningtheprojectfieldworkandrelatedmatters. TheRoadInstitutewillalsofacilitatecontactswithrelevantstakeholders.
3. Office accommodationandlogistics:Themissionwill take place in theRoadInstituteheadquarters, duringwhichtheRoadInstitutewillfacilitate a room for theConsultant’swork. TheConsultantshallberesponsible for providingallaccommodation, computing, software, anddraftingequipment, etc. TheConsultantwillalsoberesponsible for alllandtransportationarrangementsduringtheproject.
4. Capacitybuilding:TheConsultantwill do theirbest to passonknowledge to theRoadInstituteengineersandother staff by training andadvising in a hands-onmanner.

# Payment Schedule

Thefollowingpercentagepaymentswillbemadeonapprovaloftherespectivereports

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| **Deliverables** | **Percentage of contract price to be paid** |
| Inception Report | 10% |
| Interim 1 Report | 25% |
| Interim 2 Report | 25% |
| Draft Final Report | 20% |
| Final Report | 20% |

# Useful Publications

Thefollowing are thematerialswhichtheConsultants are recommended to revieworconsultwhenstartingthisassignment:

* Ingerop, NOVEC, ACTERRA Environment Climat (2015). AdaptationofRoads to ClimateRiskandClimateChange in Morocco. Final Report.
* E. Jenelius, Road Network VulnerabilityAnalysisofArea-coveringDisruptions: A Grid-basedApproachwith Case Study. Transportation Research Part A 46.
* E. Jenelius, T. Peterson, and L.-G. Mattson (2006). ImportanceandExposure in Road Network VulnerabilityAnalysis. Transportation Research Part A 40.
* M. D. Meyer (2006). Design Standards for U.S. TransportationInfrastructure: TheImplicationsofClimateChange. GeorgiaInstituteofTechnology: Atlanta, Georgia.
* M. D. Meyer, A. Amekudzi, and J. P. O’Har (2010). TransportationAsset Management SystemsandClimateChange: AdaptiveSystems Management Approach. *Transportation Research Record: JournaloftheTransportation Research Board.*
* S. Muzira, M. Humphreys, and W. Pohl. 2010. Georhazard Management in theTransport Sector. Transport Note TN-40. WorldBank: Washington, DC.
* . DisasterRisk Management WorkingPaper Series No. 9. WorldBank: Washington, DC.
* S. Sadek, R. Ramadan, and H. Nagi (2005). A GIS-basedLandslideHazard Framework for RoadRepairandMaintenance. AmericanUniversityofBeirut.

Some Presentations

* AdaptingRoadInfrastructure to Climate Extremes andChange: ExperiencefromSmallPacific Island States. September 2015.Presentation.
* Bhutan: ImprovingTheResilienceandAffordabilityofRoadsand Bridges. Presentation. 2015. WorldBank: Washington, DC.
* PreventionisBetterthan Cure: BioengineeringApplications for ClimateResilientSlopeStabilizationofTransportInfrastructureAssets. Presentationby A. Faiz, B.H. Shah, A. Faiz. 2015. *FirstInternational Conference on Surface TransportationSystemResilience to ClimateChangesand Extreme WeatherEvents.* Washington, DC.
* PrioritizationofTransportInfrastructureInvestmentsunderthe Belize ClimateResilienceInvestment Project. Presentation. 2016. WorldBank: Washington, DC.
1. For example, the UK HighwayAgency’sClimateChangeRiskAssessmentidentifiedthefollowingvulnerabilities as “beinghighlydisruptiveand time criticalwithhighlevelofconfidence in theappraisal: (i) FirstTier: pavementskidresistanceand, identifyingbestwaysofinvestingresourcesandinvestmentresourcesandinvestmentappraisals; (ii) SecondTier: windactions (loads) applied to superstructures, designs for increasedscour for foundations, pavement material integrity, strategicgeographicimportanceof a region, network resilience, budgeting, andstaffing; and (iii) ThirdTier: Pavementmaterialsspecificationandconstructiondetails, design ofpavementfoundations, design ofbearingsandexpansionjoints, surfacewaterdrainage, attenuationandoutfalls, pavementmaintenance, andflooding.” M. D. Meyer, A. Amekudzi, and J. P. O’Har (2010). TransportationAsset Management SystemsandClimateChange: AdaptiveSystems Management Approach. *Transportation Research Record: JournaloftheTransportation Research Board*. [↑](#footnote-ref-2)