REQUEST FOR EXPRESSION OF INTEREST (EOI)

The Coalition for Disaster Resilient Infrastructure Society (CDRIS) invites Expression of Interest (EoI) from eligible consulting agencies for a study titled **"Developing a Framework for National Risk & Resilience Assessments of Critical Infrastructure"** under its Work Programme 1: Technical Support and Capacity Development.

The objectives, scope of work, deliverables, reporting, and supervision, etc. are mentioned in the Terms of Reference (ToR) enclosed on Page 4.

Interested consultants should provide information in the format given at Annexure 1 at Page 15, demonstrating that they have the required qualifications and relevant experience to perform the services. The shortlisting and eligibility criteria are given at Page 2 and Section 23 of the ToR.

Consultants submitting an EOI may be required to make a presentation on their proposals before the shortlisting process. Shortlisted Consultants will be invited in the Request for Proposal (RfP) stage to submit their technical and financial bids. The final selection of the agency/consulting firm will be done based on the basis of Quality and Cost Based Selection (QCBS) method.

Interested consultants may obtain further information and may also give their comments on the objectives and scope of work at the email addresses below.

The EOIs should be submitted electronically to E-mail: DD.Admin@cdri.world by 1730 hrs (IST) on Feb 11, 2021 in PDF format.

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INFORMATION FOR THE CONSULTANT:

Client Name	Coalition for Disaster Resilient Infrastructure Society (CDRIS)
Brief description of the required services	**Develop National Risk & Resilience Assessment (NRRA) Framework (Transportation Infrastructure) – Phase I** This phase will outline the conceptual framework for NRRA, develop standard assessment tool and document the process in form of a guidebook and a training manual for undertaking future assessment studies in member countries, outline the design architecture towards establishing GIS enabled Decision Support System (DSS) Platform with facility for hazard risk database, infrastructure database, vulnerability information of select infrastructure class and asset type, assessment results and decision making suite, demonstrate the tool for type profile of representative transportation infrastructure system. For more details refer to the ToR.
List and description of expected outputs to be delivered	Deliverables are listed under Section 6 and 7 of the ToR.
Nodal person	Megha Punia Designation: Dy. Director- HR & Admin E-mail: DD.Admin@cdri.world
Location of work	New Delhi, India
Expected duration of work	6 months
Criteria for Preliminary Examination of EOI	- Relevant experience of the Agency - Relevant experience of the proposed Team Leader - Proposed Team Composition - Overall experience of the agency - Documents of registration / incorporation in country of origin - Agency not blacklisted by any Govt. institution
Criteria for essential eligibility / qualification	- The agency must have experience of at least 10 years in conducting similar studies for National/Sub-national Government or Agencies/Departments, Multilaterals and Bilateral agencies. - Demonstrated experience of developing frameworks on infrastructure resilience at global and national scale will be an added advantage.

	- Agency with prior experience in conducting technical studies on planning/ design/ standards/ mitigation/ damage assessment / resilience frameworks for transport infrastructure assets will be given priority. - Agency should have a team of experienced professionals from relevant fields relating to the subject matter of the proposed study. The agency should engage an adequate team of professionals having expertise on transportation infrastructure (roads, rails, airport, seaport, bridges and tunnels), disaster preparedness, emergency management, economic and financial analysis, design of DSS tools. - The agency should have a minimum average turnover of USD 1M (or equivalent) for the last 3 financial years. Academic and research institutions may be exempted. For more details, refer to Section 23 of the ToR.
Who can apply	- Proposals are invited from institutions/ organisations only.

Note: CDRIS or any of its designates reserves the right to cancel this request for EoI and/or invite afresh with or without amendments, without liability or any obligation for such request for EoI and without assigning any reason. Information provided at this stage is indicative and CDRIS reserves the right to amend/add further details in the EoI.

TERMS OF REFERENCE (TOR)

DEVELOPING A FRAMEWORK FOR NATIONAL RISK & RESILIENCE ASSESSMENTS OF CRITICAL INFRASTRUCTURE – PHASE I

1. Introduction and framing the context

Transportation systems are large scale man-made systems and form a vital part of the society's foundation of daily economic and social activity, produce a continuous flow of essential goods and services as well as touches aspects of jobs, health, commerce, education, culture and more. Transportation infrastructure (minor or major) are not just designed to satisfy specific societal needs but alter social change at a much broader level. The current transportation infrastructure (land, water, air) is a network of interdependent system that function collaboratively and synergistically to address nation's growth trajectory and associated priorities. This large-scale critical infrastructure (complex systems with several independent and interdependent nodes, hierarchy) passes traverses the country's landscape connecting practically all forms of the built environment.

Transportation infrastructure is already experiencing negative and costly impacts from geo-hazard risks, extreme weather conditions leading to damaged roads and rail systems, bridges, airport, seaport, other forms of associated infrastructure. The interdependent infrastructure for transport includes a host of technology such as energy systems and ICT. De-coupling between core (physical asset) and enabling infrastructure has greater direct impacts and can further propagate to other systems resulting in wider consequences.

Road & Rail network, Airport & Seaport are highly susceptible to geo-hazards risks, hydro-meteorological risks, extreme weather events and climate change impacts. Frequent events (flooding, standing water, wildfire, extreme heat, freeze-thaw cycles, landslips, severe winds and cyclones) and high-intensity non-frequent events (major earthquake, tsunami) threaten long-term investments in transportation infrastructure made by the national, state, local governments and private sector. Risk assessment studies and global datasets indicate disaster events are projected to intensify in magnitude, duration, and frequency across the globe. It is imperative for Ministry/Department/Agencies of Transport to assess vulnerability and identify ways to mitigate and improve survivability of transportation assets and maintain continuity of services.

Building resilience is widely discussed topic in transportation asset management. Understanding risk to various category/class of assets is critical to business operations. One of the foremost steps is to assess and address vulnerability of the infrastructure at the system level. A GIS enabled system level analytical platform can build the ability of the transportation agencies to anticipate risk, prepare/adapt to the changing risk landscape, plan for prevention & mitigation measures, develop emergency response and recovery plans, and reinforce system and management gaps to minimize disruptions. In addition, the information available through the platform can provide a comprehensive view of the current assets, inform infrastructure planners and design engineers to outline the requirement for adaptive infrastructure design, address the concerns of asset managers on the economic viability of the assets as well as upgrade supervision and maintenance plan. For the policy makers, apart from raising awareness of the vulnerabilities and risks of the transportation system, the analysis can pave way to prioritize national wide critical infrastructure protection program.

2. Characterization of the infrastructure systems

The Coalition for Disaster Resilient Infrastructure focuses on infrastructure "systems" over individual infrastructure "assets" to help countries develop risk management frameworks for different infrastructure classes and associated development. These systems have national, regional and global dimensions (e.g. shipping, aviation) and the CDRI fosters collaboration to identify hotspots in the global infrastructure systems that may have cascading impacts. While CDRI has already picked up exclusive studies to address the vulnerability of the power infrastructure for cyclone hazards, the key focus of this initiative is Transportation (Roads, Bridges, Railways and Mass Transit Systems, Airport & Seaport).

Transport systems over Land, Air and Sea services across the globe. Each of the system consists a complex set of sub-systems including physical infrastructure, ICT systems for operations and control, institution and human resources for coordination and management. Apart from the movement of people, transport services also move essential goods. Overlap of transport network are formed geographically to cater to the regional socio-economic requirements. Interruption to the systems in an interconnected world can have immediate and far-reaching consequences on society and on the local economy. Severe damage to transportation system in countries with limited resources or in countries with high dependence on infrastructure systems need to critically evaluate the impact of the disaster events, plan for quick turn-around time for restoration of services.

This study will consider to critically understand the primary infrastructure exposure to risk factors from natural hazards and climate impacts. The scope of this Phase is targeted towards developing a framework, and therefore the consultants/study team will take into account of not only the core assets, but also focus on dependent infrastructure such as power system, ICT systems (communication and control), functional & operational management systems, emergency response systems etc.

3. Infrastructure vulnerability and resilience assessment

Transport system is vulnerable to extreme natural and weather events. Each infrastructure type has unique vulnerabilities and weakness is unique to elements undergoing stress due to the manifestation of the event. A sample of weakness include: Road transport is susceptible to geohazard movement, landslide can simply wash away or block a critical road section, whereas rails may buckle under extreme heat conditions and may require a different regime of maintenance during extreme heat weather conditions.

Assessing vulnerability in the context of transportation infrastructure, is a function of asset type, system's exposure to intensity of event, age and design considerations w.r.t national or international codes and standards, repeated exposure to events in the risk landscape, sensitivity and adaptive capacity/resilience.

Resilience from infrastructure point of view is the ability of a system to react, recover from undesired events with minimal effects on structural stability and preserve the functionality. Modern infrastructure systems are complex systems and are represented by different elements with functional interdependencies between infrastructures of the same type or different sectors. In addition, recent events have pointed towards geographical, cyber interdependencies, new threat and risks as dominating areas for operations.

The term Exposure refers to the hazard in a given area and experiencing the effects based on the magnitude, severity and frequency of the event; Sensitivity refers to the performance of the asset when exposed to the

event; and Adaptive Capacity/ Resilience refers to the system's ability to cope with the onset of the event or the future event and deliver its functional objective with minimal or no disruption (*adaptive design is part of the newest design regime which caters to future risk*).

The study aims to develop a suitable framework for transportation sector and in the later phases the framework will support to undertake nationwide risk and resilience assessment. The study will review proven methodologies of risk assessment for critical infrastructure (transport systems) and ***through a representation*** define system depiction or boundary for analysis (local to global), identify criticalities and interdependencies – network analysis, vulnerability analysis for various threats and disruptions, resilience analysis indicating the proactive adaptation/mitigation scenarios (*considering to meet target service and functional levels, indicate how the infrastructure can be upgraded to enhance internal resilience measures, indicate the process to arrive at quantifying the fiscal cost for adaptation/mitigation measure – such as cost to modify design or change in operations and maintenance*) that can be adopted along with actions for specific investment strategies for various stressors.

The study will introduce to a suite of decision support tools, showcase the process for the representative sample of the infrastructure type to further enable CDRI to launch the assessment framework as a functional tool / platform to undertake assessment studies in the subsequent phases.

Vulnerability and resilience analysis will form the core of National Risk and Resilience Assessment and hence consultants are suggested to bring together cross disciplinary team of specialists for development of the proposed assessment framework.

CDRI will establish a core technical advisory committee (TAC) from member countries and subject experts to contribute to provide overall guidance and approval of the deliverables.

4. Objective

National assessments of the resilience of infrastructure systems enable national governments to visualize and measure disaster and climate risks in critical infrastructure sectors, to assess the social and economic cost of infrastructure failure, asset loss and service interruption, to agree to resilience targets and to identify the most cost-effective investments to strengthen resilience. CDRI intends to undertake a complete multi-sector risk and resilience assessment of infrastructure systems, with transportation infrastructure as an early priority in 2021-23.

The study is outlined in two phases. Phase I will include developing a conceptual framework and a model for conducting vulnerability, risk and resilience assessment for the transportation infrastructure (Primary Order Roads – National Highways, Bridges over National Highways, Railways including Rail Bridges, Road Runnels and Rail Tunnels, Airport and Seaport); demonstrate the application of the methodology for risk and resilience assessment through a representative sample (Roads & associated bridges, Airport and Seaport). The framework will be further applied to undertake assessment of transportation assets in CDRI Member Countries on request.

The study should meet the following three objectives:

1. Define the systems approach of modern transportation systems and dynamics of the networks and interplay within the system and outside the system

2. Develop an overall risk and resilient assessment framework / standard methodology highlighting supportive elements of the infrastructure system and the tools required for the analysis.
3. Vulnerability and Resilience analysis is at the core of defining the performance of the infrastructure systems. The proposed National Risk and Resilience Assessment (NRRA) framework and associated toolbox will serve as a guiding document for CDRI to launch assessment in member countries

5. Assessment Approach & Phasing of the Study

The approach is to design a comprehensive risk and resilience assessment framework for transportation infrastructure, through drawing lessons from global, regional scale assessments across the globe. **The framework** shall serve as a guide for stakeholders in member countries involved in the decision making of designing of new transportation systems/hubs as well as upgrading of existing ones. The framework will bring together the classical data assimilation method for hazard assessment including climate change impacts, assessing vulnerability of transportation infrastructure and its assets, assessing adaptation/resilience options and decision-making priorities. The adopted framework will be routed for national scale assessment for CDRI member countries.

This concept note outlines a suggestive process for assessment, and the indicative outline below is not treated as a framework. The consultant shall develop the framework and on approval by the TAC will release the guideline/document. The framework will further guide assessment of select transport infrastructure in Phase II.

The overall assessment approach under Phase I and Phase II is broadly described as follows:

Phase I

1. **Develop National Risk & Resilience Assessment Framework (Transportation Infrastructure**) - this phase will outline the conceptual framework for assessment, develop standard assessment tool & guidebook, put together a training manual for assessment, provide a architecture to establish GIS enabled Decision Support Platform with facility for hazard risk database, infrastructure database, vulnerability information of select infrastructure class and asset type, assessment results and decision making suite, demonstrate the tool for type profile of representative transportation infrastructure system.
2. **Outline Scoping Report for Phase II** (in the context of India).

Phase II

3. **Country wise Scoping Report for Assessment and defining the study scope** – this section shall develop details for asset type, geographical scope, priority network for Roads and Bridges, priority Airport and Seaports and relevant assets for assessment.
4. **Collate existing Hazard, Climate & Exposure Data, build Hazard & Exposure data for missing information** - this part shall provide data on all prevalent hazards and climate data (storm surge, inland flooding, sea level rise, extreme temperature and precipitation) in the country. For hazard & climate data that are missing, the same shall be developed for analyzing the risk. The database will also compile an inventory of all transportation infrastructure assets to be evaluated (metadata will collate all information on the asset, engineering parameters, business parameters etc). All hazards likely to impact the infrastructure shall be analyzed. Variable resolution grid (on GIS platform) shall be adopted to bring together all key hazards for a select land feature. A wider range of hazard analysis (accounting for multi-hazard) with different return periods will form part of the hazard catalogue to establish future stressors on the infrastructure. The hazard layer will account for standard return period for various events prevalent in the country/region. Input choice for select parameter of hazard shall be developed as part of the decision tool.

5. Modelling infrastructure vulnerability – this part of assessment will bring together a combination/ spectrum of assessment methods (including engineering assessment from codes/standards and resilience perspective) for estimating the risk. Modelling shall take into account the infrastructure vulnerability to various type of risks (geohazard, hydro-meteorological, climate impact). , consider resilience building options and provide a cost-benefit analysis. Vulnerability assessment shall encompass damage function for the main system and its associated enabling systems, operations, economical losses & services. Methodology highlighted in the framework (National Risk & Resilience Assessment Framework (Transportation Infrastructure) will be drawn for assessment. The risk model will draw in data from existing hazard modelling results, climate change projections (IPCC or National level), engineering assessments of infrastructure backed with field studies/observations (from past failure investigations, disaster events).
6. Assessment results and Decision support platform – the platform shall provide data of all individual assets analyzed as part of the national risk and resilience assessment and decision support will be available at spatial and temporal scales. The direct costs associated with the impact of hazard to improved infrastructure will be estimated. Both direct physical damage and downtime shall be considered. This step will consider resilience building options for the infrastructure system and its components. Cost-benefit analysis for various set of mitigation options (proposed enhancement design, adaptive designs, preventive measures) shall be undertaken. Quantification in terms of cost for adaptation/resilience measures against various stressors will be incorporated as part of the assessment results to aid decision making. Decision platform can be made available to various stakeholders in member countries for development planning, assets management, performance monitoring, operations and maintenance plan, emergency management etc. The platform shall give option for users to choose potential resilience pathways for safeguarding assets.
7. Financial Analysis – this analysis will be undertaken for select infrastructure type and its sub-categories. The life cycle cost of investing in resilience (structural/design improvements) will be calculated by comparing the cost of implementing the improved design with the estimated damage costs for the improved design versus the damage costs for the existing condition. This data will be used to determine the following based on the direct (structural damage) costs and downtime: (a) Cost-analysis for implementation of improvements for individual category of infrastructure, (b) Life cycle improvements associated with resilient measures. In order to obtain a measure of the efficacy of resilient measures, a conceptual life-cycle cost analysis (LCCA) for a typical infrastructure type shall be conducted.

Expected Outputs (Phase I and II)

The national risk and resilience assessment report aims to provide a sharp overview of the infrastructure risk issues and opportunity to build resilience in the transportation sector. The report and the decision support platform is primarily targeted at the decision makers in the public and private sector so as to increase their awareness of relevant issues in risk management of critical infrastructure, motivate further assessment of all national, sub-national and local assets, and prioritize investments to strengthen critical infrastructure systems. In addition, the assessment will target the decision makers in the public and the private sector to broaden their perspective from technical to socio-economic factors (or vice versa) and from single systems to a 'system of systems' point of view. The assessment tool can facilitate the creation of a new approach for integrating adaptation /resilience measures into large scale infrastructure development projects. development processes.

6. Scope of Work – Phase I

The scope is to design a comprehensive risk and resilience assessment framework for transportation infrastructure, through drawing lessons from global, regional, national/sub-national scale & sectoral assessments across the globe. The framework shall serve as a guide for stakeholders in member countries involved in the decision making of designing of new transportation systems, transportation hubs as well as upgrading/strengthening of existing ones. The framework should broadly outline the classical data assimilation method for hazard assessment including climate change impacts, methods to assess vulnerability of transportation infrastructure and its assets, assessing adaptation/resilience options and decision-making priorities. The adopted framework will be routed for system level assessment (primary order infrastructure) in CDRI member countries.

This consultancy must support through their experience and expertise on assessing disaster and climate risk to transport infrastructure, vulnerability assessment as well as designing standards and regulations to make infrastructure resilient. The consultant will be preparing the framework and upon the approval by the Technical Advisory Committee / inputs and comments from the key infrastructure stakeholders (Ministry/Departments, user agencies, DRM institutions), will apply the framework/ assessment process for a representation transportation infrastructure asset (demonstration must be provided for following infrastructure: Roads, Railways, Bridges, Tunnels, Airport & Seaport). The demonstration / piloting the framework shall provide a positive feedback to improvise and finalize the framework.

The scope includes the following tasks:

Task 1: Developing a robust framework and tool for national risk and resilience assessment of transportation infrastructure (with focus on Roads, Railways, Bridges, Tunnels, Airport & Seaport) The task will outline framework for risk assessment, detail explanation of analytical procedures and standards along with benchmarking best practices across the globe.

Task 2: Application of the framework and demonstrate the tool through representation transportation asset for each type: Roads, Railways, Bridges, Tunnels, Airport & Seaport. For the representation/pilot Infrastructure, data collation should broadly outline the details for asset type, geographical scope of priority network (for Roads, Tunnels, Bridges, Airport and Seaport); screening of hazard information, vulnerability, and past damage trends of the asset; suggested methodology towards estimation of infrastructure damage and risk, cost benefit analysis (strengthening/upgradation or replacement costs) and maintenance costs.

Task 3: Develop guidebook and training manual for risk and resilience assessment. Develop standard assessment techniques, outline procedure/guidelines and tools for risk and resilience assessment.

Task 4: Provide architecture & system configuration of GIS enabled Decision Support System for National Risk & Resilience Assessment (in the context of multiple countries). Elaboration on the design of the decision support platform should include technology stack, system configuration and the institutional arrangement/training/capacity building requirements for commissioning the system.

Task 5: Outline Scoping Report for Phase II (in the context of India and through consultative process with key nodal Ministry and Departments)

7. Expected Outcomes

In addition to the deliverables for the above key tasks (Task 1 to Task 5), consultant will provide to CDRI a comprehensive operational framework document and tools for conducting National Risk & Resilience Assessment in Transport Sector.

8. Validation of data and recommendations

- Consultants should follow well defined quality control and assurance procedures.
- Involvement of expert reviewers during report finalization.
- Workshops for consultations and dissemination of findings and recommendations.
- Approval of outputs by TAC

9. Project Management

The Client for this project is the Coalition for Disaster Resilient Infrastructure (CDRI) Society. The Consultant shall report and communicate the status and products of the project to the CDRIS's representative via a written Project Management Report (PMR) on the first business day of each month after the project's initiation. There will be quarterly Project Meetings following project initiation. An inception report should be provided at the first Project Meeting. The quarterly report and the PMRs should be communicated in English language. The Consultant will propose a standard form for the PMR in their proposal.

The Consultant will closely interact and report to the Client's team and TAC that will accept the deliverables. The Consultant is encouraged to appoint a focal or contact person who can be competently consulted on this undertaking on a regular basis, preferably in the same time zone as the Client.

10. Language and documentation

Language: The working languages for this project shall be English. All final deliverables shall be in English.

All Project Reporting shall be delivered in English in both electronic format (Microsoft Word and Adobe pdf) and as bound printed volumes. The Project Report shall include final copies of all technical reports. Numerical results (shape files, spreadsheets, etc.) only need to be provided in an electronic format. The tool should be available on a appropriate software open source platform.

11. Geospatial data and documentation standards

The minimum requirements to be followed for all geospatial (GIS) data are:

- Vector data: Geospatial vector data must be delivered in ESRI Shape File format and SpatiaLite database format. Additional formats may be used with approval. Styling information should be provided in SLD format. All files must include projection parameters.
- Raster data: Geospatial raster data must be delivered in GeoTIFF. Additional formats may be used with approval. Styling information should be provided in SLD format. All files must include projection parameters.

Metadata: Detailed documentation needs to be provided for each data set. The metadata must include description, source, contact, date, accuracy, restrictions. A description of the attribute name and attribute values needs to be provided for vector and tabular data sets. The metadata will be delivered in an XML format following ISO 19139.

All spatial data should meet OGC http://www.opengeospatial.org/standards. All data should be geo referenced and projected in WGS 84 UTM zones. Metadata documentation shall be produced in an approved format compatible with the Federal Geographic Data Committee. FGDC-STD-001-1998. Content standard for digital geospatial metadata (revised June 1998). Federal Geographic Data Committee. Washington, D.C.

12. Licensing

All data procured and developed for this project will be done on behalf of the CDRI. The intent is that the data shall be licensed to allow for free use and distribution in a manner that follows the Open Database License (ODbL). The license includes the right of the CDRI (and sub-licensees) to freely use and distribute data, through the following means:

- Hazard, risk and vulnerability assessments.
- Research into the natural and built environment.
- Extraction of derivatives (including, but not limited to, slope and roughness) and geographical features (including, but not limited to, infrastructure footprints, fault traces and other geomorphic features). Extracted derivatives and features will be the intellectual property of CDRIS.
- Presentation in reports and presentations.
- Presentation, distribution, and analysis through the internet.

13. Software and Tools requirement

All software and tools developed under this ToR shall be open-source and tested for all major web browsers. All software produced under this ToR will be in English.

14. Public Information

All work products created or produced by the Consultant under the Terms of Reference (TOR) shall be considered Public Information, and in a legal sense treated the same as information generated by public entities. The Consultant will not own work products created under the TOR, nor possess particular or exclusive usage rights to those work products, and may not use the work products in any manner apart from the TOR except as provided by public policies governing the use of open data.

15. Confidentiality

The Consultant must ensure the protection and confidentiality of information and data created according to the TOR that is considered private and/or legally protected.

16. Security

The Consultant must ensure the security of data and information in accordance with existing regulation in this area.

17. Fairness, standards, and professional ethics

The methods and procedures used in producing information and data consistent with the TOR should follow prevailing scientific standards, techniques and professional ethics regarding objectivity and independence.

18. Standards of quality

Information and data created according to the TOR should follow internationally accepted standards and practices.

19. Documentation

The Consultant must provide documentation of the methodologies used to generate data created or produced under the TOR, including metadata for all data files.

20. Delivery

All data and work products created under the TOR shall be transmitted in their entirety and in a timely manner to the Client via commonly used electronic formats appropriate to the information or data. In addition to the formats defined above, other data examples include: tabular data should be transmitted in Microsoft Excel, DBF or CSV format; textual information should be transmitted in Microsoft Word or TEXT format.

21. Implementation Modalities and Duration

The consultancy will be carried out by contracting the services of National, Regional or International entities (Team of Consultants) with proven track records and experience in risk assessment. The duration of the consultancy is 6 months.

22. Essential & Desirable Experience/Qualification of the Consultancy Firm

- Core team with minimum qualification as Master's degrees in Civil Engineering, Transportation Engineering and Disaster Risk Management.
- At least 20 years of relevant experience in infrastructure planning, design and standards
- Experience of conducting evaluations of integrated programme with a focus on resilience transport infrastructure, and multi hazard conditions will be given preference.
- Strong knowledge on hazard analysis, hazard modelling and hazard impact assessment on transportation assets, vulnerability assessment of transportation infrastructure
- Experience in various analytical studies related to risk modelling and guidance on resilience building of infrastructure assets
- Sound Knowledge of Transport Engineering: Road, Railway, Airport & Seaport.
- Hydrological, Geological & Geotechnical, Earthquake Engineering skills
- Familiarity with international and nationally application of design standards in infrastructure design
- Proficiency in developing assessment frameworks and competence to develop analytical tools
- Excellent written and spoken communications skills in English
- Familiarity and technical knowledge of Transport Infrastructure and skills development in an integrated system approach, as well as practical experience of Return on Investment, Value for Money analysis tools and techniques
- Competence to undertake financial analysis for the effectiveness of the adaptation/mitigation and resilience measures
- Previous proven experience of conducting evaluations particularly for resilience focused programs
- Core Team members to have demonstrated inter-personal and analytical skills with an extraordinary level of diplomacy and tact while dealing with numerous stakeholders
- Strong organizational, research, and oral presentation skills

- Publications and contributions to national and international discussion platforms / global reports on infrastructure resilience

23. Staffing requirement

Expected Key Experts and requisite expertise, qualifications, and minimum experience is indicated in the table below. CVs of the Key Experts will be used for evaluation of Technical Bids. Any additional CVs will not be considered for evaluation. The Consultant is free to propose a staffing plan and skill mix necessary to meet the objectives and scope of services. The CDRI reserves the right to seek more details regarding the qualifications and experience of the key experts.

Team Composition	Expertise	Qualifications	Minimum Years of relevant work experience
Team Leader/ Project Manager	Project and/or Operations leadership experience in transport infrastructure sector with work related to disaster risk management, government advisory, and policy and planning.	PhD or Masters in Transportation Engineering / Management	20 years
Infrastructure expert (Deputy Team Leader/Deputy Project Manager)	Planning and design of transportation infrastructure and related assets, expertise in global and national benchmark standards, technology selection and deployment, risk assessment, feasibility studies	PhD or Masters in Infrastructure Planning /Engineering / Management	15 years
Disaster and climate risk management expert	Risk assessment of infrastructure, disaster risk reduction, emergency planning and resilience.	PhD or Masters in Civil Engineering / Disaster Management	10 years
Disaster risk Finance / Economics expert	Financial management and advisory services on loss assessment, cost-benefit analysis, financial risk management.	PhD or Masters in Finance and Management / Economics	10 years
Tool development expert	Experience in developing complex decision support tools / software to harmonize planning and engineering design, value engineering /financial analysis for infrastructure	Masters in Civil engineering / IT / Computer Science	10 years
GIS and risk analysis expert	Experience in producing GIS based maps and analysis used for infrastructure planning and risk analysis at national and sub-national levels.	Masters in GIS and Remote Sensing Applications	10 years

24. Facilities to be provided by the Clients

The Client would provide the following support to the selected Consultant:

- Indicate publicly available information relevant to the assignment.
- Introduction for the Consultant to support initiation of engagement with the relevant entities.
- Designation of a focal person from CDRIS for supporting liaison with the relevant entities.

25. Implementation arrangements

After the inception stage the Consultant shall prepare a detailed schedule and task-flow diagram, which depicts the interrelationship of various tasks in the assignment and depicts how they lead to the completion of the different tasks. The Team Leader/Project Manager of the Consultant will be the principal contact and will be expected to be available during project implementation. The Consultant is encouraged to appoint an additional contact person (Deputy Team Leader) who can be competently consulted on this undertaking.

The Consultant shall be responsible for all aspects of performance of services as set forth in the Components of this TOR.

26. Ownership and Confidentiality of Data and Work Products

The ownership of the raw data collected by the Consultant during the course of the study and the deliverables including documents, maps, images, processed data, etc. will rest with CDRIS. The Consultant will keep the data and work products/outcome documents confidential. Dissemination of the outputs/outcomes/reports/framework/tools will require express permission of the CDRIS.

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ANNEXURE 1 –

Format for submitting consultant information

1. Name of the Organisation / Agency
2. Address, Phone, Email
3. Name and contact details of nodal person
4. Year of establishment of agency
5. Registration / incorporation details
6. Self-certification for not being blacklisted/debarred by any Govt. Institution
7. A brief write-up about the agency.
8. Year-wise annual turnover details for the last 5 financial years (from 2015-20) with supporting documents
9. Any documents in support of above or eligibility criteria mentioned in the EoI
10. Overview of proposed team lead and composition based on an understanding of the TOR
11. Overview of proposed methodology as per Section 6 and 7 of TOR
12. List of completed projects of similar nature and brief description of services performed:

Name of Client	Title of Project	Sponsoring agency / authority	Date of award and date of completion	Cost of project	Remarks and brief description of relevance to current project.

13. Any documents or reports supporting the profile of the consultant.

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