GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

MINISTRY OF LOCAL GOVERNMENT RURAL DEVELOPMENT AND COOPERATIVES

LOCAL GOVERNMENT ENGINEERING DEPARTMENT

Program for Supporting Rural Bridges (SupRB)

TERMS OF REFERENCE (TOR)

FOR

DESIGN CONSULTANT (FIRM)

(Package No. SD-11)

February 2019

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1. Background:

1.1. The Government of Bangladesh has received a loan from the World Bank (WB) towards the cost of the program titled "Program for Supporting Rural Bridges (SupRB)" (hereinafter referred as 'the program'). The program will be implemented by the Local Government Engineering Department (LGED) through the Project Director's Office (PMU) and contract administration of civil works will be carried out by LGED District/Upazila offices. The program will be implemented in total 61 districts of the country, except three hill districts at a cost of USD $ 614million.

1.2. The program Components include (i) Major and minor maintenance of 85,000 meter of bridges; rehabilitation of 24,000 meter of bridges; Capacity Expansion (Widening) of 5000 meter of rural bridges; replacement or newly construction of 20,000 meter of bridges. (ii) Technical, fiduciary, procurement, social and environmental capacity improvement of LGED including design and implementation of climate resilient bridges and establishment and operationalize of Grievance Redress System (GRS). This program will provide continuous connectivity between agricultural production areas, growth centers and rural markets located in the program area and enhance earnings opportunities creating uninterrupted access to the commercial institution and basic services like health and education of the rural poor. The impact of the program will be reduced poverty in the intervention area.

1.3. A portion of program fund will be utilized for the services of a consulting firm for Climate-Resilient Detail Engineering Design of various bridges throughout the country. The maximum length of each bridge in this programme is 100m.

2. Objective of consulting services

2.1. The main objective of the assignment is to provide the Climate-Resilient Detail Engineering Design, preparation of Tender Documents for bridges using appropriate technology. The bridges are to be designed considering the availability of skilled manpower, construction material, condition of accessibility and other prevailing working conditions.

2.2. Conduct Digital topographical survey and Sub-soil investigation.

2.3. Implementation of the Land Acquisition, Resettlement and Livelihood Restoration Plan (if required).

2.4. Structural Evaluation of Existing Bridge and provide detail design for maintenance of bridges.

3. Scope of the work

3.1. General Requirement:

Services are to be provided by experienced professionals utilizing sound engineering knowledge and practices. The Consultant may utilize engineering, traffic and other data provided by related previous studies and reports but the responsibility for the accuracy of the data and its analysis and for all findings and conclusions shall rest with the Consultants.

3.2. Design Criteria:

Typical issues of design criteria/standards which should require consideration are listed below.

Sl. No.	Issues
1.	AASHTO LRFD 2012
2.	Guideline for Bridge Design of LGED – September, 2018
3.	Width standards, bridge carriageway, foot path (carriageway, paved shoulder, earth shoulder)
4.	Slopes and cross-falls
5.	Junction design
6.	Road safety
7.	Traffic Diversion Plan

3.3. Detailed Engineering Design

3.3.1. Design criteria for the design of bridge and ancillary structures are to be furnished in detail.

3.3.2. Detailed engineering design of the bridge and ancillary structures shall be prepared conforming to AASHTO specifications.

3.3.3. Width and length of the bridge, carriage way, vertical and horizontal clearance of the bridge, foundations and substructure should be in conformity with the international design standard and structural requirements.

3.3.4. Due considerations should be given to aesthetics of the structures suited to the ambient environment.

3.3.5. Before finalizing the structural design and setting final lay out of bridge, the EIA report of Concern Bridge must be considered.

3.3.6. It is noted that before preparation of final design of all bridges, the consultant shall must submit the Draft Final design to the design unit of LGED for the purpose of Vetting.

3.3.7. After receiving the concurrence of design unit of LGED, Final design & Drawing will be prepared by the consultant.

3.3.8. Some structure may be required to design by the co-ordination with the RAJUK\BWDB\RHD and also with their NOC.

3.4. Detailed Engineering Drawings

The design shall yield a comprehensive set of detailed drawings suitable for tendering and actual execution of the project. The drawings shall be conveniently sized for construction site and shall be drawn to suitable scales to provide clarity of comprehension. During the Preparation of Final Engineering Drawing, the aesthetic view of the bridge as well as the landscape of approach road must be considered and the Final Drawing of the bridge would be prepared on the basis of architectural point of view.

3.5. Digital topographical Survey:

The detailed survey is to be carried out using high precision instrument i.e., Total Station, Level machine, GPS etc. Survey report shall include following information:

3.5.1. A north direction shall be prominently shown. The detailed survey to be carried out using high precision instrument i.e. Total station, Auto Level machine, GPS etc.

3.5.2. All the physical features, such as ponds, permanent structures, drains, hills, wells shall be shown at their exact locations.

3.5.3. One river/ channel/ khal cross section to be exclusively taken along the center line of the proposed bridge alignment and other sections at distances of 1, 2 and 4 times channel widths at upstream and at distances of 1 and 2 times channel widths at downstream. Spot levels on river cross section to be taken at 3.0m intervals or as necessary.

3.5.4. The length of each cross section should cover the full channel width plus same length of left & right banks.

3.5.5. Road cross sections to be taken along approach road at both ends of the proposed bridge. Four road sections at each end of the bridge @25m interval shall be taken. Spot levels on road cross sections to be preferably taken at 1.0m interval.

3.5.6. The bank line survey of both side of each bridge shall be carried out minimum 500m towards upstream and 500m towards downstream of the river course way and total area will cover 2.5 square Kilometer.

3.5.7. All details within the area as instructed by the client to be surveyed which shall show summarized information about road alignment, side slope, bridges, homesteads, government/ non-government offices, Important or historic buildings or structures, tress, electrical installations markets, community center and other public places.

3.5.8. HFL to be provided with reference to the PWD/SOB Bench Mark (BM).

3.5.9. All RLs to be taken with respect to SOB/PWD Bench mark available near by the bridge site and location of TBM to be clearly shown on the map. The R.L of SOB/PWD shall be marked on any permanent object near the bridge or a permanent object shall be installed near the bridge as per drawing supplied by the PD.

3.5.10. All survey data to be submitted in an appropriate electronic form suitable for inputting in to design software being used by the Engineer.

3.5.11. Survey data shall also be submitted in print format **(with seal and signature)** with suitable text in a **suitable scale** as required by the Engineer, showing all the topographical features surveyed, spot levels with x, y, z, such that these can be used to establish Digital Terrain model (DTL).

3.5.12. Three permanent spots near each bridge site shall be marked with Global Co-ordinates (Longitude & Latitude) and Elevation.

3.5.13. The Topographical information provided in Hydrological and Morphological Study report shall duly be incorporated in the Digital Topo Survey Map.

3.5.14. Digital photographs of daylight condition shall be provided which shall show, Canal/River/khal/approach/access road to the site and other important features around the site.

3.5.15. Co-ordinate (longitude & latitude) of both ends of all cross section of Roads and River/Canal/khal shall be shown on Topographic Survey Map. A satellite photograph (taken from Google earth) shall be provided and these co-ordinates shall also be identified properly on it.

3.5.16. Total job shall be carried out as per instruction by PD/ Executive Engineer/ Upazilla Engineer.

3.5.17. In addition to the above requirements if any other special parameters are needed for a particular project site that shall be invariably incorporated.

3.5.18. The drawings should include the following:

3.5.18.1. Location of the bridge in the Upazila Base Map.

3.5.18.2. Site Plan of proposed bridge including proposed approach road with ancillary works

3.5.18.3. Bridge Setting Lay-out plan with bench mark references, boring and test pit locations.

3.5.18.4. General view (plan elevation and sections) with necessary RLs and dimensions.

3.5.18.5. Cross Sectional/ Longitudinal details of the approach/ access road.

3.5.18.6. It is noted that the Digital topographical Survey must be done after informing concerned LGED field officials and must be signed by the respective Upazila Engineer and countersigned by the concern Executive Engineer, LGED.

3.6. Sub-soil Investigation Report:

The detailed survey is to be carried out using high precision instrument i.e., Total Station, Level machine, GPS etc. Survey report shall include following information:

3.6.1. The objective of the sub-soil investigation is to collect detailed sub soil information of the bridge sites to facilitate preparation of sound and cost-effective Design.

3.6.2. In order to prepare an appropriate and cost-effective design, the consultant will undertake sub-soil investigation at the selected bridge site. Bore holes should be made as par the instruction of the design unit of LGED or Project Director or Concern District Executive Engineer, LGED. Specific assignment to be carried out under the service include but shall not remain limited to the following tasks:

3.6.3. Prepare a work plan showing the time schedule for conducting sub-soil investigation and submit the same to the Procuring Entity through the Executive Engineer, LGED, District concerned.

3.6.4. Mobilize and start sub-soil investigation work with prior written information to the Project Director/ Executive Engineer/ Upazilla Engineer.

3.6.5. The sub-soil investigation equipment shall be checked by Laboratory Technician of LGED HQ or Executive Engineer's Laboratory Technician as specified by the Project Director, LGED. [Dimension of SPT Spoon, Cutter Drilling Road, Shelby tubes & Auto release hammer etc.]. They will also check the Liquid Limit of Bentonite Powder (LL>350) & its mix ratio (4%-6%) with water for preparation of Slurry.

3.6.6. The borehole layout plan and R.L of Borehole top should be shown in the Digital Topographical survey map in x, y, z Co-ordinate. The 'z' co-ordinate shall be in respect to SOB/PWD BM.

3.6.7. Sub-soil investigation work will have to be conducted by using **Wash Boring** or **Rotary drilling m**ethod. The diameter of exploratory boring should be minimum of 100mm.

3.6.8. For each bridge 2 Bore holes should be made on the ground surface (abutment location) and 3 Bore holes should be made under water (Pier location) or as specified by the Project Director.

3.6.9. Take at least 3 (Three) digital Photo graph of each Boring operation in presence of LGED's representatives and the firm's Engineer.

3.6.10. For each bore hole, minimum depth of boring shall be 50m or more as per instruction of Design Unit, LGED H/Q. If poor quality soil encountered (say SPT value <20) the depth of bore hole shall be extended up to 60m or more as per instruction of Design Unit, LGED H/Q.

3.6.11. SPT shall be taken @1.5m interval along with collection of disturbed and undisturbed soil sample.

3.6.12. If clayey soil encountered at any depth during boring, undisturbed soil samples must be collected with the help of shelby tubes.

3.6.13. Following laboratory test must be carried out:

3.6.13.1. One Unconfined compression test for each cohesive soil (C) layer for each bridge.

3.6.13.2. One Direct shear (Ø) test for each Non-cohesive soil layer for each bridge.

3.6.13.3. Three Grain size analysis, Natural Moisture Content for each bridge.

3.6.13.4. One Liquid Limit, and Plastic Limit test for each clay layer for each bridge.

3.6.14. For each bridge submit draft Soil Test Report (2 copies) with all necessary data, information, bore log, photograph, analysis, comments with result mentioning soil bearing capacity. Bore log shall Contain N-Value, soil type, Water table Level (RL). EGL (SOB/PWD BM) of Bore hole Top and Date & time of commencement & completion of each borehole shall be mentioned clearly.

3.6.15. A power point presentation by the firm may be held at LGED HQ for review and comment.

3.6.16. For each bridge final soil test report (4 copies) including the comments from LGED authority shall be submitted within 10(ten) days after comments on draft report.

3.6.17. Lowest Ground Water Table (GWT) should be measured at each abutment location and mentioned in the Draft and Final Report

3.6.18. All the boring operation must be conducted in presence of the representative of Executive Engineer of LGED of the concerned district and all the field records of boring will be signed by the representative of XEN, LGED.

3.6.19. The firm must communicate with LGED Design Unit to know the pile bearing load and to confirm the capacity of soil and field record must be sent to PD office instantaneously through E-mail: during boring

3.7. Implementation of the Land Acquisition, Resettlement and Livelihood Restoration Plan (if required)

During submission of the land acquisition plan following information must be incorporated

3.7.1. By the help of concern District Executive Engineer, LGED, the Consultant will prepare land acquisition plan.

3.7.2. The Consultant will submit land acquisition details (Dag no., mouza, khatian and other necessary information verified by Upazila land office and showing the same in mouza map of concern Bridge site).

3.7.3. Type of land. Name of the actual owner of the land with detail address and the quantity of the land.

3.7.4. Tentative compensation cost like re-settlement cost/land value/erection of trees and other infrastructure etc.

3.7.5. If any anomaly is seemed during the execution phase of the bridge, land acquisition plan and other related activity have to revised by consultant without any additional payment. Consultant have to do their job within specific time period quarantined by the client.

3.8. Structural Evaluation of Existing Bridge:

3.8.1. The Consulting firm will evaluate the information provided by the Client regarding existing bridge or culvert. Evaluation must be done in terms of type, functionality, geometric configuration, and deficiencies related to safety and performance etc. The consulting firm will analyze the structural integrity of those structures and design retrofitting/ rehabilitation/ underpinning work, prepare BoQ to meet the requested design standard.

3.9. Detail Structural Design:

3.9.1. Suggestion for best suitable Bridge approaches.

3.9.2. Detail construction specification.

3.9.3. Detail foundation and structural design in accordance with topographical report, sub-soil investigation report, hydro-morphological study report (if required) etc.

3.9.4. Detail Electrification of bridge.

3.9.5. Detail slope protection work.

3.10. Estimate Preparation:

Detail Estimate of all works (Main bridge, relief structure, river training work, approach/access road, land acquisition and resettlement cost, road safety cost, environmental management plan implementation and monitoring cost, Bar Bending schedule etc.)

3.11. Tender Documents Preparation:

The Consultant shall prepare the pre-qualification and tender documents for construction contract of the bridge following PPR-2008 and the environmental issues must be considered in Preparation of tender documents.

4. Reporting and key deliverables requirements

The reporting requirement shall be as per below:

(i) **Inception Report**: The Consultant shall submit and present an **inception report** within one month after signing the contract. The report will include the consultant's proposals on the detailed implementation arrangements and the planned activities based on the initial assessment. The report will also include a detailed work program and approach towards the assignment. The report needs to be finalized within 15 days after receiving the comments from LGED.

(ii) **Detail Engineering Design Report:** The consultant shall submit the draft detail **engineering design** including all survey reports for all bridges. The report needs to be finalized within 15 days after receiving the comments from LGED.

(iii) **Monthly Report:** The consultant will submit monthly report which must reflect all the activities undertaken during the month of report. Report must contain the target and achievement.

(iv) **Quarterly Reports:** The consultant shall furnish quarterly progress reports on physical and financial progress and also on implementation progress including achievements and problems faced, if any, and the measures to overcome the constraints. The quarterly reports shall be factual and concise with recommendations for the subsequent quarter.

(v) **Annual Reports**: The consultant shall furnish to LGED an annual report covering all activities in the last 12 months. In addition to summarizing key facts and issues presented in the 4 quarterly reports for the reporting period, the annual report should include the Consultant's views on the strengths and weaknesses of the project implementation arrangement and remedial actions to be taken if any.

(vi) **Midterm Review Report**: This report will consolidate the annual reports and focus on issues during implementation of the program.

5. Time schedule

Duration of the assignment will be 48(forty eight) months. It is expected to start from September 2019.

6. Professional staffing inputs

All the Consultant's personnel shall be fluent in (i.e. writing, reading and speaking) the contract language, which is English. In addition, all the key staff described herein, shall be computer literate regarding word processing and spread sheets, with at least one staff member must have working computer knowledge with full time accessibility.

The Consultant shall provide competent personnel for the services, who shall be managed by the Team Leader and who will represent the Consultant in performing the services. The team shall comprise the following experts showing Table 1and 2 but not be limited to:

Table 1: Key Experts (To be Evaluated)

Sl. No.	Position	Qualifications & Experience	Number of position	Person-Months per position	Person-Months
1	Senior Bridge Engineer cum Team Leader	Educational Qualification: - B.Sc. in Civil Engineering or equivalent degree from any recognized University/ Institution. M.Sc./ ME in Civil Engineering (Structural) is preferable. Experience & adequacy for the assignment: - Minimum 15 years of overall experience after graduation in Civil Engineering out of which at least 12 years of specific experience in the relevant field of assignment i.e. planning and performing structural analysis and design of different type of bridges. - Candidates having knowledge in the design of continuous and long span segmental bridges will be given preference. - Shall be well conversant with latest standard code of practice e.g. AASHTO, ACI & IRC etc. for analysis and structural design of bridge and other related structure as stated above. - Preference shall be given to candidates having working experience on Midas Civil, CSI Bridge/ SAP2000, Staad.Pro, LARSA 4D, RM Bridge.	1	48	48
2	Geotechnical Engineer	Educational Qualification: B.Sc. in Civil Engineering or equivalent degree from any recognized University/ Institution. Masters in Geotechnical Engineering will be preferable. Experience & adequacy for the assignment: - Minimum 12 years of overall experience after graduation in Civil Engineering out of which 10 years work experience in Geotechnical Engineering or related field.	1	36	36

Sl. No.	Position	Qualifications & Experience	Number of position	Person-Months per position	Person-Months
		- Experience in GIS applications - Experience with watershed modelling methodology and tools. - Experience working with large datasets, their uncertainties and limitations. - Advanced statistical background (PCA, etc.) - Familiarity with GIS mapping systems. - Familiarity with statistical graphing packages. - Experience with computer code languages such as R, C+, C# is considered an asset.			
3	Hydraulic Engineer	<u>Educational Qualification:</u> - Graduate in Hydrology, Physical Geography, Earth Science, Environmental Engineering or Environmental Science. Preference will be given for Masters or equivalent degree. <u>Experience & adequacy for the assignment:</u> - Minimum 12 years of overall experience after graduation - Minimum 10 years work experience on hydrological and drainage studies. - A comprehensive understanding of hydrology and climate change science and a knowledge of climate change impacts on water quality, stream flow, and hydrological responses and feedbacks in riverine terrain dominated by floodplain processes. - Preferably should have experience in planning and design of river training structure networks for protecting an industrial environment. - Advanced knowledge of hydrologic modeling - Experience with the use of hydrologic models in complex terrain, and understanding of hydrologic models in complex terrain, and understanding of hydrologic model (e.g. SOBEK, DHSVM, HEC-HMS, HBV, MIKE-II)	1	36	36
4	Bridge Design Engineer (Mid-Level)	Educational Qualification: - B.Sc. in Civil Engineering or equivalent degree from any recognized University/Institution. Preference will be given to candidates having M.Sc./ ME in Civil Engineering (Structural). Experience & adequacy for the assignment: - Minimum 10 years of overall experience after graduation in Civil Engineering out of	3	48	144

Sl. No.	Position	Qualifications & Experience	Number of position	Person-Months per position	Person-Months
		which at least 8 years of specific experience in the relevant field of assignment i.e. planning and performing structural analysis and design of different type of bridges. - Candidates having knowledge in the design of continuous and long span segmental bridges will be given preference. - Shall be well conversant with latest standard code of practice e.g. AASHTO, ACI & IRC etc. for analysis and structural design of bridge and other related structure as stated above. - Preference shall be given to candidates having working experience on Midas Civil, CSI Bridge/ SAP2000, Staad.Pro, LARSA 4D, RM Bridge.			

Table 2: National Non-Key Experts

(CVs to be evaluated on pass/fail basis during negotiation)

Sl. No.	Position	Qualifications & Experience	Number of position	Person-Months per position	Person-Months
	Junior Bridge Design Engineer	Educational Qualification: - B.Sc. in Civil Engineering or equivalent degree from any recognized University/Institution. Experience & adequacy for the assignment: - Minimum 5 years of overall experience after graduation in Civil Engineering out of which at least 2 years of specific experience in the relevant field of assignment i.e. performing structural analysis and design of different type of bridges.	6	48	288
2	Junior CAD Specialist	Educational Qualification: - Diploma in Civil Engineering or equivalent degree from any recognized Institution. Experience & adequacy for the assignment: - Must have minimum 6 (six) years of overall experience after diploma in Civil Engineering out of which at least 5 (five) years of specific experience in the relevant field of assignment i.e. CAD standards, PC application software and drafting/engineering practices and methods,	8	48	384

Sl. No.	Position	Qualifications & Experience	Number of position	Person-Months per position	Person-Months
		drawing different type of bridges, viaducts, flyovers etc.			

7. Support staff

The consultant team will provide minimum number of support staff to carry out their tasks and fulfill their responsibilities effectively and efficiently within the stipulated time.

8. Counterpart support

- All officials under the PMU and Design Unit of LGED will be the key government's counterpart officials. The existing staff of LGED at HQ, Division, Region, District, and Sub-district level will also work as the counterpart staff.
- Both the counterpart government officials at PMU and Design Unit of LGED set-up will provide all kinds of assistance to the consultant team in rendering their services.
- The executing agency (LGED) will provide the consultants with suitable office space, if available, only. LGED will provide project data and reports available with it to the consultant.
- Office furniture, hardware and software, lighting, electricity including consumption bill, air conditioning, communication and other consumables will be at the cost of the consultant.
- Any non-consumable items purchased under this consultancy package shall be handed over to LGED after completion of the contract.
- The Client will coordinate with the LGED field office to assist consulting firm in field related activities during field visits.
- The Client will provide necessary GIS maps, Upazila base maps, records on rivers (if available), road database, manuals, guidelines, norms and standards etc.
- The Client will provide all out support during the period to carry out liaison with other govt./non-govt./semi-govt./autonomous organizations.

9. Institutional Arrangement

The Consultant team will work at Design Unit of LGED HQ under supervision of Superintendent Engineer (Design) to support Design unit. Team Leader will responsible for reporting to Project Director as well as Superintendent Engineer (Design).