MINISTRY OF HIGHWAYS
ROAD DEVELOPMENT AUTHORITY
ENVIRONMENTAL AND SOCIAL DEVELOPMENT DIVISION
AND
RESEARCH AND DEVELOPMENT DIVISION

TERMS OF REFERENCE FOR ENGAGEMENT OF A CONSULTANT GEOTECHNICAL ENGINEER (CGE) TO CARRY OUT THE GEOTECHNICAL ASSESSMENTS FOR THE ENVIRONMENTAL IMPACT ASSESSMENT (EIA) & GEOTECHNICAL DESIGNS FOR RUWANPURA EXPRESSWAY – PHASE II and III FROM INGIRIYA TO PALMADULLA

1. Background

Government of Sri Lanka (GOSL) has identified the need of an expressway towards Sabaragamuwa province, which will act as a fast road link between Sabaragamuwa and Uva provinces with Colombo the economic capital of the country. This project is considered as one of the key infrastructure development projects in the country that needs to be implemented in the near future. With the above directive, RDA initiated a Feasibility Study (FS) in year 2016 to find out a suitable road corridor to construct the Ruwanpura Expressway considering present and future development scenarios of the country. The study also considered having minimum possible impacts on the environment including the social environment (i.e., minimum resettlement impacts to general public and land acquisition cost). This expressway project was officially called as "Ruwanpura Expressway Project" or REP.

Different route alternatives were studied during the FS conducted in 2016 and a final trace was selected to conduct detailed investigations. As per the final trace of the FS, the proposed expressway is to start from Kahathuduwa Interchange of Southern Expressway and end at Pelmadulla connecting with Pelmadulla – Nonagama (A018) road.

The expressway had a length of about 74 kilometers (km) and consisted of three (3) stages as;

- Phase I – Southern Expressway (Kahathuduwa) to Ingiriya, (Ch. 0+000 km – Ch. 26+300 km)
- Phase II – Ingiriya to Ratnapura (Ch. 26+300 km – Ch. 52+500 km)
- Phase III – Ratnapura to Pelmadulla(Ch. 52+500 km – Ch. 73+900 km)

As per the National Environmental Act (NEA) regulations, REP was categorized as a Prescribed Project so that RDA conducted and Environmental Impact Assessment (EIA) for the trace selected under the FS of 2016 seeking the environmental approval from Central Environmental Authority (CEA) who is the Project Approving Agency (PAA). However, due to location of the major parts of the Phase II and III of the expressways within the Central Fragile Area (CFA) of the country and considering the adverse impacts to the land use changes, possible urbanization around the interchanges in the CFA and impacts due to construction works, National Physical Planning Department (NPPD) being a key stakeholder of the project was not in a position to grant their consent for the EIA for Phase II and III of REP. As a result, the environmental approval was granted only for the Phase I of the REP in 2021.

In 2020, RDA under the guidance of Ministry of Highways took actions to revisit the FS in order to explore alternative routes for the Phase II and III of the REP having the least impacts to the CFA and avoiding tunnels, and accordingly the work was entrusted to the University of Moratuwa (UOM). As a result, UOM conducted a new FS and proposed a new trace having comparatively less impacts to the CFA and also avoiding tunnels. The new trace proposed by the UOM for the Phase II is deviating about 19km from the trace selected under the FS of 2016 and no change in Phase III.

The location map of the new trace is presented in figure shown below.

As per the new trace, length of the Expressway is 76+225 km and phases for the REP were revised as follows.

- Phase I – Southern Expressway (Kahathuduwa) to Ingiriya, (Ch. 0+000 km – Ch. 25+000 km)-Work already started.
- Phase II– Ingiriya to Kiriella (Ch. 25+000 km – Ch. 44+000 km) (diverted section- End Ch. 44+000 km can be slightly changed)
- Phase III– Kiriella to Pelmadulla (Ch. 44+000 km – Ch. 76+450 km) (Ch. 44+000 km and end Ch. 76+450 km can be slightly changed)

Therefore, in order to assess the environmental and social feasibility of the new trace and also to obtain the environmental approval from the CEA, RDA is planning to conduct a new EIA for the Phase II. Subsequently, the Basic Information Questionnaire (BIQ) was submitted to the CEA and the Terms of Reference (TOR) for the EIA was received from CEA on 04thOctober 2021 through the letter 08/EIA/Trans/07/2014 Vol. V.

Location map of the selected trace for Phase II of REP and TOR is attached.

Environmental and Social Development Division (ESDD) of RDA was assigned to conduct the EIA in compliance with the TOR issued by the CEA, and to obtain the environmental approval from the CEA and Research & Development Division (R&D) was assigned to conduct the Geotechnical Designs for Phase II and III on behalf of the Project Management Unit (PMU) of the RDA.

ESD & R&D divisions have planned to complete the EIA & Geotechnical Assessments including the Designs in combining with the experts are to be hired for the specialized areas required for the EIA and Geotechnical Designs. Accordingly, ESDD shall obtain the expert inputs of a Consultant Geotechnical Engineer (CGE) who will work in association with the Team Leader (TL) of the EIA in order to complete the EIA and to obtain the environmental approval from the Central Environmental Authority. At the same time he/she will work with R&D division to provide the geotechnical designs.

This document presents the TOR for the services and inputs required from the CGE in carrying out the EIA study, preparation of EIA Report (EIAR) ,obtaining the environmental approval from the CEA in respect of the works associate with the ESD division, RDA and geotechnical studies, geotechnical designs, soft ground improvement techniques and designs, earth cut designs for identified locations in respect of the works associate with the R&D division, RDA.

2. Objectives of the TOR

- To specify the qualifications and experience required by the SGE in order to qualify for the said assignment,
- To specify the scope of work of the SGE under

  Part 1- Inputs connected to EIA work with ESD division

  i. Chapter 3 Physical Aspects, Chapter 4 Anticipated Environmental Impacts, Chapter 5 Proposed Mitigation measures, Chapter 7 Environmental Management Plan (EMP) with respect to Geotechnical assessments and available literature for conducting the EIA study, preparation of EIAR and obtaining the environmental approval from the CEA.
  ii. Geotechnical interpretation on reasonable Geotechnical assessments and available literature on 2 Tunnel locations with respect to the Geological structures prevalent in these 2 locations in association with the Consultant outsourced from University of Peradeniya for the Geological assessments.
  iii. Determining the adequacy or inadequacy for the 2 Tunnels on the merits of above ii.

Part 2- Inputs connected to Geotechnical designs work with R&D division

i. If Tunnels are adequate (finalized through part 1studies) carry out geotechnical study, additional geotechnical investigations if necessary and geotechnical designs for Tunnels with necessary recommendations for size, stability etc.
ii. Providing soft ground improvement techniques and earth cut designs for identified locations.
iii. Proposing foundations for Viaducts, Express way Bridges and Overpass Bridges.
iv. Submission of Final Geotechnical Design Report based on above.

- To mention the requirements stipulated in the EIA TOR forwarded by CEA (Ref. Appendix).
- To indicate the assistance provided by the RDA (ESDD, R&D and PMU, REP) for the studies during the assignment.
- To indicate the time allocation for the assignment and the financial disbursement related to the assignment of CGE.

3. Required Qualifications of the Consultant Geotechnical Engineer

PhD/M.Sc. in Civil Engineering with 15 years experience, out of which at least 8 years of demonstrated experience in geotechnical /civil engineering field or experience of related field in carrying out the Geotechnical assessments necessary in Environmental Impact Assessments (EIA) and/or geotechnical designs for road development and other projects..

4. Scope of the Service

In general, the Consultant Geotechnical Engineer to carry out the,

Part 1- Inputs connected to EIA work with ESD division

- Geotechnical assessments necessary in the Environmental Impact Assessment (EIA) and
- Geotechnical interpretation on reasonable Geotechnical assessments and available literature on 2 Tunnel locations with respect to the Geological structures prevalent in these 2 locations in association with the Consultant outsourced from University of Peradeniya for the Geological assessments.
- Determining the adequacy or inadequacy for the 2 Tunnels on the merits of above.
- Presenting the final outcomes of the study to the RDA top management.

Part 2- Inputs connected to Geotechnical designs work with R&D division

- If Tunnels are adequate (finalized through part 1studies) carry out geotechnical study, additional geotechnical investigations if necessary and geotechnical designs for Tunnels with necessary recommendations for size, stability etc.
- Analyze Borehole investigation reports carried out for the above sections and produce a standard Geotechnical report with on-the job involvement of R&D Engineers and providing guidance to them.
- Detailed analysis and discussion on interpretation of the findings of the investigation work presenting the Project's geotechnical issues and recommendation for embankments, foundation designs for structures, and as appropriate to the Project. Geotechnical software packages like GeoStudio, Plaxis to be utilized, and laboratory testing to be conducted as applicable.

  In this respect:

  - Analysis of the behavior and propose countermeasures of road embankment over soft grounds.
  - Analysis of stability and propose counter measures for cut slopes.
  - Analysis of geotechnical capacity of sub soils and propose foundations for Viaducts, Express way Bridges and Overpass Bridges.
- Field inspection and identify soft ground improvement locations.
  The consultant will inspect the site with R&D division Engineers and identify the locations

where soft ground treatments should be specifically applicable.

- Providing soft ground improvement techniques and earth cut designs for identified locations. The Consultant will guide R&D Engineers to provide suitable methods and detail design for such locations.
- Present the final outcomes of the study to the RDA top management
- Geotechnical assessments, analysis and approach should be used to determine the impacts and to make necessary remediation measures on the stability of the earth fills, and possibility of slope failures in earth cuts of the project.
- Geotechnical interpretation should be used to evaluate, analysis and approach for the adequacy of Tunnels at 2 locations identified with any repercussions and mitigation solutions.

The methodology should include but not limited to the following steps.

- Obtaining the project objectives and scope from ESD/R&D divisions of RDA.
- Defining the project options which form the basis of the Geotechnical assessments and designs.
- Defining the base case against which the options are compared.
  - Use of Engineering classification of rock mass in Tunnel design and predict Tunnel supporting system with respect to Rock type, weathering stage of rock, faults, joints, structures presenting in the rock, presence of Ground Water in the rock, fall axis, strike and dip vs the tunnel alignment.
  - Defining the geomorphological and geological investigations further required in selection of the best alignment for making construction drawings.
- Affirming the feasibility of having Tunnels, if feasible recommending the most appropriate type, size and orientation of the Tunnel/s including other details related to air venting, draining etc.
- Reviewing the stability of tunnels against spalling ground, seepage, moving of rock mass etc.
- Identifying the incremental costs and benefits (pros and cons) that might be expected.
- Assessing and making necessary recommendations for stabilizing the overburden against any possible instability due to vibration that may cause in drilling of Tunnel.
- Assessing and making necessary recommendations for early recharging of Water Table.
  - If Tunnels are not anyway feasible, making recommendations for appropriate cut angle, berm width, single cut height, drains, and stabilization methods etc.to avert the possible erosion failures and instability of the highly erodible Central Fragile Area located in the surrounding.
- Obtaining necessary endorsement from NBRO for the recommendations made by the Consultant Geotechnical Engineer.
- Preparing the Final Geotechnical Design Report for future use summarizing the findings of above.
- CGE is expected to deliver the inputs necessary for both Part 1and Part 2 during the initial period nearly 5 month, in order to complete the EIA and to complete Part 2 during the balance time after getting the CEA approval for the submitted EIA.
  - In consultation with the Team Leader (TL) of the EIA, CGE's inputs may be delivered to the levels (perhaps Chapters wise as suit with the process of compiling the EIA) in order to complete the EIA within the given timeline.

To facilitate the above scope of work the CGE will be provided with following facilities by ESDD, R&D and PMU of RDA.

- The final trace of the Phase II and III of REP in KML formats and hard formats (with adequate resolution) with defined start and end points; locations of links, entry and exit ramps, tall gates etc.
- Feasibility report or any other relevant report which includes following information;

1. Design and construction related information including different options considered for construction of the highway (alternative route, design, technology and construction techniques),
2. Bore Hole and other Investigation reports available.

- All relevant maps or row data to prepare maps as indicated and required to fulfill the information requirement of the EIAR.
- Reports on hydrological impact assessment, studies on landslide impacts report etc.
- And any other information related to preparation of EIAR as requested by CGE.

Immediately after signing the agreement with RDA, the prospective CGE should study all available information provided by RDA or obtained by other sources and provide a list of further details in case he needs so, to carry out the required studies related to Ruwanpura Expressway Phase 2 and 3.

5. Time Schedule

Time duration for the said assignment is 9 (Nine) calendar months from the date on which the contractual agreement is signed between both parties (RDA and CGE), unless otherwise extended due to unavoidable externalities as mutually agreed by both parties.

Consultant Geotechnical Engineer who will work in association with the Team Leader (TL) of the EIA may issue the details to suit with the level of the process of the EIA in order to complete the EIA within the given time line.

6. Expected deliverables

Following deliverables are expected from the Consultant Geotechnical Engineer during the specified time period.

- Chapter 3 Physical Aspects, Chapter 4 Anticipated Environmental Impacts Chapter 5 Proposed Mitigation measures and Chapter 7 Environmental Management Plan (EMP) for Draft final EIA based on Geotechnical assessments.
- Geotechnical interpretation on 2 Tunnel locations, determining the adequacy or inadequacy.
- Inputs in Final EIA after incorporating CEA and stakeholder comments.
- Proposed methods and designs for Soft ground treatment and earth cut slopes in the locations which are identified during field inspection.
- Proposed foundations for Viaducts, Express way Bridges and Overpass Bridges.
- Defining the geomorphological and geological investigations further required in selection of the best alignment for making construction drawings.
- Affirming the feasibility of having Tunnels, if feasible recommending the most appropriate type, size and orientation of the Tunnel/s including other details related to air venting, draining etc.
- Reviewing the stability of tunnels against spalling ground, seepage, moving of rock mass etc.
- Identifying the incremental costs and benefits (pros and cons) that might be expected.
- Assessing and making necessary recommendations for stabilizing the overburden against any possible instability due to vibration that may cause in drilling of Tunnel.
- Assessing and making necessary recommendations for early recharging of Water Table.
- If Tunnels are not anyway feasible, making recommendations for appropriate cut angle, berm width, single cut height, drains, and stabilization methods etc.to avert the possible erosion failures and instability of the highly erodible Central Fragile Area located in the surrounding.
- Obtaining necessary endorsement from NBRO for the recommendations made by the Consultant Geotechnical Engineer.
- Submission of Final Geotechnical report for the Section II & III with recommendations.
- A summary report of activities completed when submitting a claim for payment. This summary report shall include key activities carried in completion of the task for which the claim is made.
- The Consultant is expected to exercise with utmost care during the process to avoid any accidents at site and any unfair situation, and if the Consultant will be found

responsible for any faults/conflicts, no claims will be accepted by RDA on this regard.

7. Payments

Payments shall be made to the CGE as detailed in the table below.

Task	**(A) Outputs/Reports on EIA to be handled by ESD division of RDA**	**(B) Outputs/Reports on Geotechnical studies & designs to be handled by R&D division of RDA**	**Tentative duration to complete the task**	**Percentage of payment eligible**	**Cumulative Payment Ceiling (% of Total cost)**
Task 1	Advance payment		**After the contract agreement**	**5%**	
Task 2	Completion of field reconnaissance		**1 week**		
Task 3	Collection of relevant secondary data and compilation with reasonable Geo-Technical Assessments.	B3-1 Submission of field inspection report. B3-2 Completion and Submission of Draft Geotechnical Investigation report. B. 3-3 Submission of proposed additional investigation details if necessary for design works.	**2 weeks**	**35%**	**40%**
Task 4	Completion of Draft Final EIAR based on reasonable Geotechnical assessments and submission to ESDD/R&D/ PMU,RDA Determining the adequacy or inadequacy for the 2 Tunnels	B 4-1Analysis of data and evaluation of existing and proposed surface/ stability conditions. B.4-2 Geo-Technical recommendations based on reasonable Geotechnical assessments for improvements/ structures (Tunnels/slope stability methods, Soft ground improvements etc.) B.4-3 Submission of interim Design Report.	**6 weeks**	**20%**	**60%**
Task 5	Presenting the EIAR to TEC		**1 day**		
		Presenting the interim report for Geo-Technical Recommendations.	**1 day**	**5%**	**65%**
Task 6	Attending to comments, requests made by TEC and submission of Final EIAR to ESDD/R&D PMU,RDA		**3 weeks**	**10%**	**75%**
Task 7	Attending any public comments and attending to queries made by public during public disclosure of EIAR	B6-1, B7-1, B8-1 Submission of Draft Geotechnical design Report to R&D, RDA.	**6 weeks**	**5%**	**80%**
Task 8	Addressing public and stakeholder comments made during public disclosure and technical evaluation and preparation of the addendums to the EIAR.		**3 weeks**	**10%**	**90%**
Task 9		Submission of Final Geotechnical report Including all Geotechnical designs to R&D,RDA and present it to RDA higher management	**15 weeks**	**10%**	**100%**
		Total Duration	9 Month		