Technical Consulting Service on Generation of Coherency Model Suitable for Korean NPP Sites

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1. OBJECTIVES

The objective of this consulting service is to provide KEPCO E&C with the following scope of services related to development of methodology and procedure for generation of a coherency model considering the Korean nuclear power plant (NPP) site conditions. The coherency model to be developed will be used in the soil-structure interaction (SSI) analysis of seismic category I structures incorporating the effect of ground motion incoherency to compute the realistic high-frequency response of the structures.

2. SCOPE OF SERVICES

To achieve the above objective, the Contractor shall provide KEPCO E&C with the technical consulting services in the following tasks:

Task 1. Development of Methodology and Procedure for Generation of Coherency Model

This task includes development of methodology and procedure for the generation of a coherency model which is suitably specialized for the Korean NPP sites. Basically, the seismic category I structures in the Korean NPP sites are supported by a competent material more than or equal to the soft rock. For the development, the existing studies related to development of coherency model in the US and other countries shall be reviewed and provided. In addition to the review of the previous researches, the licensing experiences about the coherency model and its application to the incoherent SSI analysis shall be provided in this task. Based on these fundamental studies, the appropriate methodology and procedure to generate a coherency model to be applied to the Korean NPP sites shall be developed and provided. In this task, the effect of site characteristics, such as shear wave velocity profile and damping values, etc., shall be considered or mentioned in the coherency model development. Following items are included in this task:

- Previous researches related to the coherency model development (the US and other countries)
- Licensing experiences about the coherency model and incoherent seismic analysis
- Detail methodology and procedure for the generation of a coherency model suitable for the Korean NPP sites
- Effect of site characteristics on the coherency model

Task 2. Review of Dense Array Design, Installation of Instruments and Their Specification for the Earthquake Records

This task includes the investigation on installation, operation and management methods of the dense array in the US and other countries, the review of adequacy on layout design of the dense array to be performed by KEPCO E&C and on installation of instruments at the site for the record of earthquake motion. Through a study for the method of array installation, adequacy of array layout determined for the maximum dimension of seismic category I structure basemat shall be reviewed. Specifically, the configuration of instruments such as a shape, elevation, and grid spacing, etc. of the dense array shall be reviewed. The types and specification of instruments (accelerometers and velocity transducers) shall also be reviewed. Following items are included in this task:

- Investigation on installation, operation and management methods of the dense array in the US and other countries
- Study for the method of the dense array installation and adequacy of layout design considering the maximum plan dimension of seismic category I structure basemat, 390 ft × 350 ft
- Review of configuration of instruments (shape, elevation, grid spacing, etc. of the dense array)
- Review of types and specification of instruments, accelerometers as well as velocity transducers to measure the microearthquake

Task 3. Parametric Study for Coherency Model Extension to Other Sites and Applicability Review of Model to Program Codes of SASSI family

This task includes the feasibility study on the extended application of a coherency model developed for a specific site to other sites without measurement of earthquakes at other sites. By analyzing the information of the recorded data and site properties from the specific site where the dense array is located and site information of other similar sites, the extended application of the coherency model to other site shall be reviewed through a parametric study. A review on the applicability of developed (assumed) coherency model to the program codes of SASSI family such as ACS SASSI shall be performed in this task. Also, the directional or anisotropic effect in horizontal plane and foundation embedment effect on a coherency model shall be reviewed while performing the applicability review to the program codes of SASSI family.

- Feasibility study on the extended application of a coherency model developed for the specific site to other similar sites

- Review on the application of developed (assumed) coherency model to the program codes of SASSI family such as ACS SASSI

- Review of the directional or anisotropic effect in horizontal plane and foundation embedment effect on a coherency model through an investigation of previously proposed coherency models

Task 4. Technical Meetings

KEPCO E&C engineers will travel to the Contractor to take part in a kick-off meeting for the discussion of consulting service tasks and a final meeting for the review of the consultation report and educational instruction of technical details. In case that these face-to-face meetings are not available, conference call meetings or e-mail communications could be alternatives. The lead consultant shall participate in the meetings. The kick-off meeting shall be held at the stage of the consultation to be mutually agreed upon. In the meeting, KEPCO E&C will discuss technical issues focused on the clarification and details of consulting tasks with the Contractor. The final meeting shall be held after submission of a preliminary consultation report dealing with the review, discussion of the consultation report as well as providing the instruction of technical details regarding the development of methodology for coherency model generation, turning over the in-house program, etc. to the KEPCO E&C engineers.

- Kick-off meeting (2~3 days): Educational seminar about theoretical background and outline of incoherency of seismic motion, Explanation of technical details about consultation works

- Final meeting after submission of preliminary consultation report (4~5 days): Review, discussion, and modification (if any) of the preliminary consultation report, Instruction of technical details for the whole procedure of coherency model generation

Task 5. Issue of Consultation Task Report

The technical consultation task report that includes the results of Task 1 to Task 3 shall be submitted to KEPCO E&C. A preliminary consultation report shall be submitted to KEPCO E&C 2 weeks before the end of consultation. All comments issued by KEPCO E&C shall be resolve and incorporated into the final consultation task report. In addition, all of the analysis input, output files and digital data shall be submitted with the final consultation task report.

- Submission of final consultation task report*, in-house programs developed (if any) including source codes, input and output files (digital data).

* All the comments issued by KEPCO E&C shall be resolved and incorporated into the final consultation task report.

3. METHODS OF PERFORMANCE

Consultation Schedule

The contract period shall be 20 weeks from the Contract signing date (Execution Date).

Tasks	Weeks from the Contract																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Development of Methodology and Procedure for Generation of Coherency Model	◆									●										
2. Review of Dense Array Design, Installation of Instruments and Their Specification for the Earthquake Records								◆						●						
3. Parametric Study for Coherency Model Extension to Other Sites and Applicability Review of Model to Program Codes of SASSI Family												◆						●		
4. Technical Meetings		◆	●																◆	●
5. Issue of Consultation Task Report																	◆			●

* Schedule can be changed during the contract negotiation.

Submission of Preliminary Report

Method of Performance

The Contractor shall start the consultation service in accordance with the schedule shown as the above table, immediately after signing the Contract Agreement. If the schedule needs to be changed, the Contractor must discuss the schedule with KEPCO E&C and provide the changed schedule immediately.

All the tasks above should be performed based on technically acceptable and sound basis. The Contractor shall keep confidential all the results and information obtained from this consultation, and shall not divulge them to any third parties. KEPCO E&C will provide sufficient information and guidance, if any, so that the Contractor could perform the tasks. KEPCO E&C will review the results of each task and preliminary consultation task report which is prepared by the Contractor. KEPCO E&C will discuss the problems and issues

encountered during the execution of Task 1 to Task 3.

A kick-off meeting shall be held at the start of the consultation work at meeting facilities of the Contractor's office provided by the Contractor to explain and discuss the detailed information needed to perform Task 1 to Task 3. If an additional discussion is needed for the tasks, the Contractor or KEPCO E&C contacts with each other by e-mail or requests a conference call to the other party.

Deliverables

The final deliverables are a technical report which incorporates the KEPCO E&C's comments and all of the analysis input and output files including digital data produced through performing the tasks.