

Technical Consulting Service for Integration of Nonlinear Soil Domain and Structural Models for Dynamic SSI Analysis

2022. 12.



[APPENDIX A - SCOPE OF SERVICE AND METHOD OF PERFORMANCE]

1. OBJECTIVES

The objective of this consulting service is to provide KEPCO E&C with the following scope of services related to technologies on the integration of nonlinear soil domain and structural models for dynamic SSI analysis. KEPCO E&C is currently conducting technology development project concerning nonlinear seismic analysis of the nuclear power plant under earthquake condition exceeding current design basis. Although the elemental technologies for nonlinear 3-Dimensions soil domain and structure models are developed, the application of nonlinear dynamic SSI analysis to design or performance assessment with combined 3-Dimensions finite element model which includes soil domain and structure model using commonly applicable analysis program is almost impossible due to difference in nonlinear behaviors of the soil and structure. Thus, acquisition of unique integration method and framework for individual soil domain and structure model is essential to overcome this problem. The consultation results may be submitted to the project ordering agency (Korea Institute of Energy Technology Evaluation and Planning) and to the regulation agency (Korea Institute of Nuclear Safety).

2. SCOPE OF SERVICES

To achieve the above objective, the Contractor shall provide KEPCO E&C with the technical consulting services for integration of nonlinear soil domain and structural models for dynamic SSI analysis in the following Tasks:

Task 1. Integration of Nonlinear Soil Model and Nonlinear 3-Dimensions Finite Element Model of Structure

- Confirmations on the nonlinear soil model and nonlinear 3-dimensions finite element structural model
- Integration method of two domains (soil, structure) by interactive analysis method relating the interface elements of two domains
- Framework that facilitates the integration of various numerical models or experimental results for models
- Verification of the integration method by performing dynamic analyses in elastic range and comparing the results with the stand-alone model

Task 2. Integration of Nonlinear Soil Model and Nonlinear Frame Element Models of Structure

- Confirmations on the nonlinear soil model and nonlinear frame element structural models representing two horizontal and one vertical components
- Integration method of two domains (soil, structure represented by two horizontal and one vertical components) by interactive analysis method relating the interface elements of two domains
- Framework that facilitates the integration of various numerical models or experimental results for models
- Verification of the integration method by performing dynamic analyses in elastic range and comparing the results with the stand-alone model which includes only the unidirectional frame model and the soil domain

Task 3. Issue of Technical Consultation Report

The technical consultation report that includes the results of Task 1 and Task 2 shall be submitted to KEPCO E&C. All comments issued by KEPCO E&C shall be resolved and incorporated into the Final Technical Consultation Report. In addition, all of the analysis input, output files and digital libraries shall be submitted with the Final Technical Consultation Report.

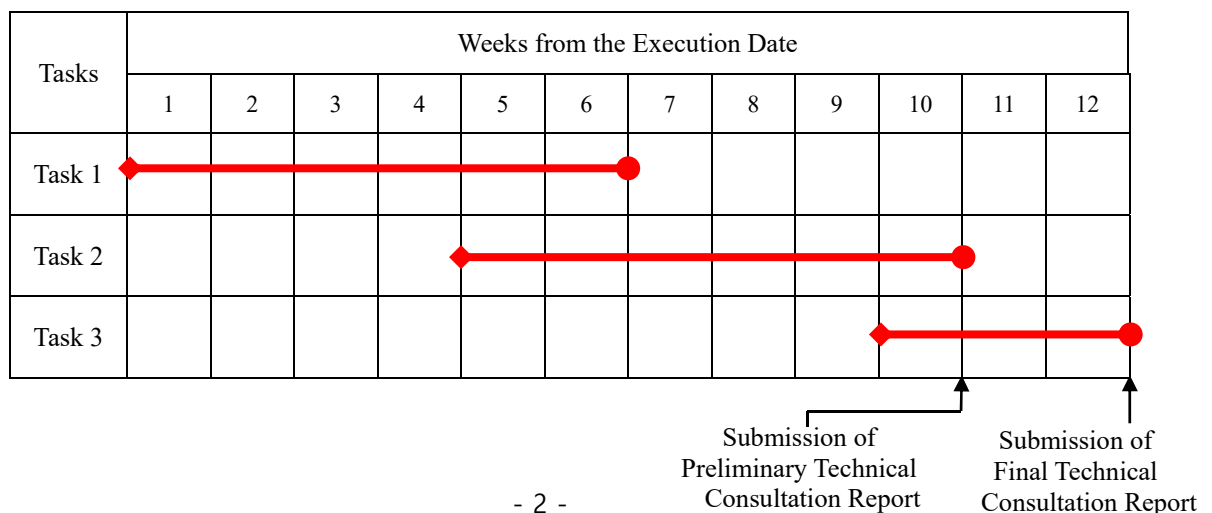
- Submission of Final Technical Consultation Report * including input and output files and digital libraries of Abaqus models

*All the comments issued by KEPCO E&C shall be resolved and incorporated into the Final Technical Consultation Report.

3. METHODS OF PERFORMANCE

Consultation Schedule

The contract period will be 12 weeks from the Execution Date.



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.

All the Tasks above shall 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 review the Preliminary Technical Consultation Report which is prepared by the Contractor and forward the comments on those. KEPCO E&C will discuss the problems and issues encountered during the execution of Task 1 and Task 2.

A kick-off meeting will be held within approximately two weeks after the start of the consultation work to explain and discuss the detailed information needed to perform Task 1 and Task 2. A final meeting will be held after the Preliminary Technical Consultation Report is submitted. At the final meeting, KEPCO E&C and the Contractor discuss the comments on the Preliminary Technical Consultation Report and supplement the Final Technical Consultation Report, and the Contractor transfers the technology related to the consulting Tasks and KEPCO E&C checks the analysis input and output files. The meetings will be held, at KEPC E&C's sole discretion, at Contractor's office or KEPCO E&C's office, or via video-conference. All expenses for the meeting are included in the Contract Price. If an additional discussion is needed for the Tasks, the Contractor or KEPCO E&C contacts with each other by e-mail and requests a conference call to the other party.

Deliverables

The deliverables are as follows:

- Preliminary Technical Consultation Report: within 10 weeks after Execution Date
- Final Technical Consultation Report: within 12 weeks after Execution Date
- Meeting Minutes for kick-off and final meetings: within 1 week after meetings

The final deliverables are a Final Technical Consultation Report which incorporates the KEPCO E&C's comments and all of the analysis input and output files including digital libraries produced through performing the Tasks.

Miscellaneous

After the consulting Tasks, the Contractor must discard all of the documents, data, etc. provided by KEPCO E&C.