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RELIABILITY-BASED DESIGN WITH USING NUMERICAL ANALYSIS

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Design codes based on reliability have been developed around the world, such as Eurocode (Europe), AASHTO LRFD (U.S. and Canada) and so on, thus reliability-based design will become the mainstream of structural and geotechnical design practice. Namely, in the near future, all structures have to be designed by satisfying the target reliability. The movements of design scene mean that the reliability estimation will be also required, even though it is the design with using numerical analysis. Therefore, the authors have proposed a practical reliability estimation scheme [1 to 3].

In this paper, the concept of the proposed scheme, as shown in Figure 1, as well as the application example to seismic verification and risk-based retrofit planning of an existing structure are described. Figure 2 shows the procedure of the example. The uncertainties of geotechnical parameters, numerical analysis reproducibility and limit state are considered, and effective stress dynamic FEM analysis is adopted as a numerical analysis in this example. Besides, Seismic Probabilistic Safety Assessment (S-PSA) has been important to influential infrastructures for accountabilities of public investment recently, because of the facts that several earthquakes of smaller occurrence probability than the design one, 5% in 50 years for instance, caused tremendous damage to human life and social economy. Hence, both cases with using a deterministic design earthquake wave and with considering the uncertainty of seismic intensity at the target area [4] are introduced in this example. Figure 4 shows the failure probability of shear collapse of a gate pier column in dam axis cross-section as one of the analysis results.

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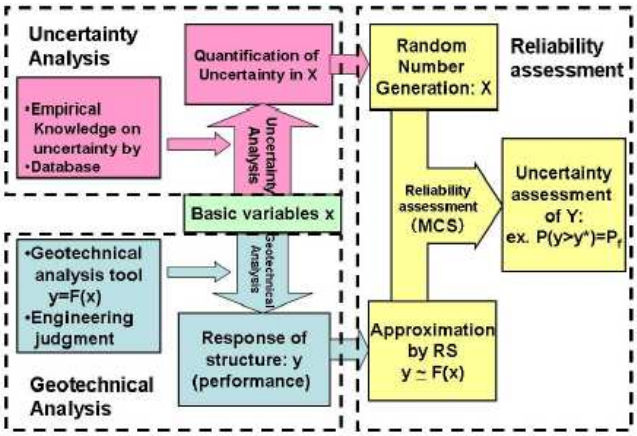

Figure 1. Proposed RBD scheme.

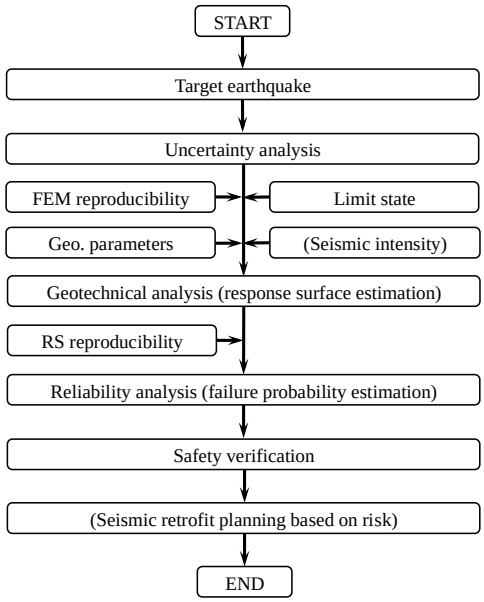

Figure 2. Procedure of the example.

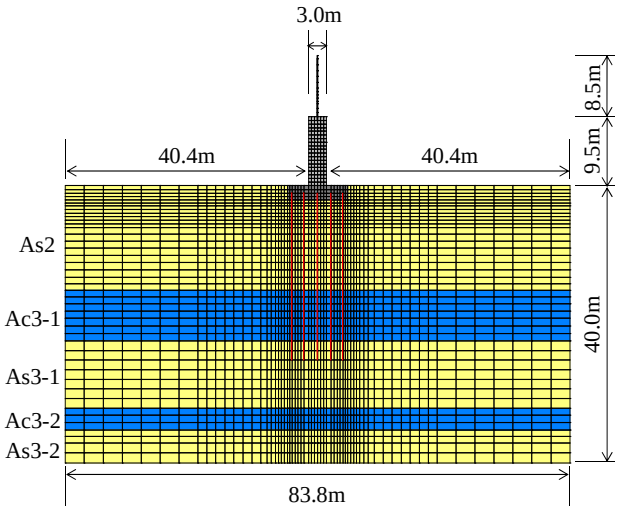

Figure 3. A FEM mesh adopted in the example.

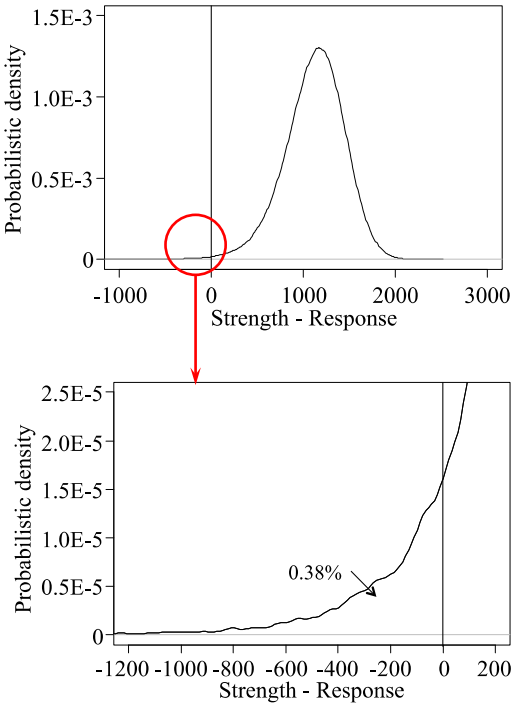

Figure 4. Failure probability of shear collapse of gate pier column.