
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

08/01/2013

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 342-2000 REVISION 0
SRP SECTION: 03.08.04 – Other Seismic Category I Structures
APPLICATION SECTION: 3.8.4
DATE OF RAI ISSUE: 04/21/2009

QUESTION NO. 03.08.04-12:

In DCD Subsection 3.8.4.4.1, the sixth paragraph (Page 3.8-56) states, "The R/B is analyzed using a three-dimensional FE model with the NASTRAN computer codes (Reference 3.8-13)."

The applicant is requested to provide the following information:

- (a) Were the upper bound and lower bound values of elastic modulus and shear modulus of concrete suggested by ASCE 4-98 (Subsection C3.1.3.1 in Page 63) used in the FE analyses? If not, provide the technical basis that shows your results for both the floor response spectra and the design of the R/B are conservative.
 - (b) Were the cracked sections of concrete considered in the analyses as suggested in Design and Analysis Procedure 4B of SRP 3.8.4 (page 3.8.4-10 of SRP 3.8.4 Revision 2, March 2007)? If not, provide the reason for not doing it.
 - (c) Provide information for the types of element used in the FE model.
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ANSWER:

This response replaces the previous response submitted via MHI letter UAP-HF-09360 dated July 3, 2009 (ML091900558).

- (a) The upper bound and lower bound values of elastic modulus and shear modulus of concrete suggested by ASCE 4-98 (Subsection C3.1.3.1 on Page 63) were not used in the FE analyses. The referenced section of ASCE 4-98 does not suggest that an analysis be performed for $1.25E_c$ and $0.75 E_c$. The referenced section of ASCE 4-98 acknowledges that the experimental data on "large-scale model shear walls" can have E values that vary between these two numbers. These two values of E_c , if applied to the whole structure, would result in frequency shifts of $\pm 12\%$. The referenced section then goes on to state that a broadening criterion of $\pm 15\%$ is sufficient to account for the unknown actual values of E_c . All ISRS calculations that

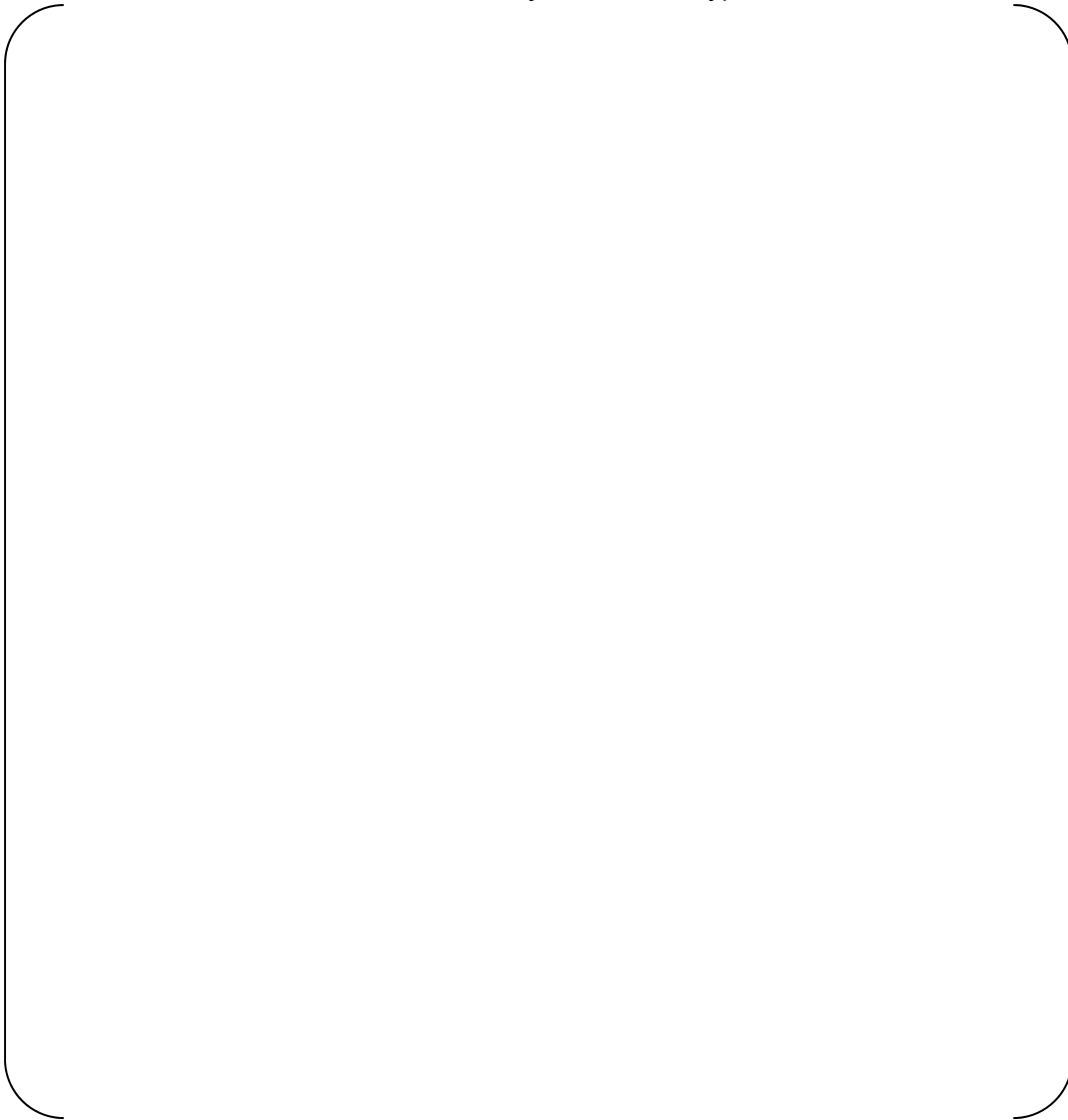
support DCD Section 3.7 were broadened by $\pm 15\%$. The design of the R/B Complex is conservative because cracked and uncracked stiffness properties are considered in the SSI analysis. See response to part (b) below.

(b) The cracked and uncracked stiffness was considered in SSI analysis. The results of the analysis can be found in Technical Report MUAP-10006, Rev 3. These results are summarized in Table 3.7.2-3 of the DCD.

(c) ANSYS Element Types

The ANSYS analytical model consists of three element types: Shell, Beam, and Mass as listed in Table 1.

Table 1, Summary of Element Types



Impact on DCD

There is no impact on the DCD.

Impact on R-COLA

There is no impact on the R-COLA.

Impact on PRA

There is no impact on the PRA.

Impact on Technical/Topical Report

There is no impact on the Technical/Topical Report.

This completes MHI's response to the NRC's question.