Justification for Considering Generic "Soft Soil" Subgrade Stiffness in Site-Specific Structural Evaluations

- NA3 site specific structural evaluations are based on results of NASTRAN static analyses that considered same generic uniform "soft soil" subgrade stiffness properties as those used in DCD
- ESBWR DCD RAI 3.8-13 justified the use of generic "soft soil" subgrade stiffness properties for DCD NASTRAN static analyses:
  - Evaluation was based on comparisons of results from analyses of RB/FB NASTRAN model with generic "soft soil" (Vs = 300 m/sec) and "hard rock" (Vs = 1,700 m/sec) subgrade stiffness using DCD seismic loads
  - Comparisons showed that model with "soft soil" subgrade stiffness provides results that envelope results obtained from model with "hard rock" subgrade stiffness
  - Few exceptions were observed where results from model with "hard rock" subgrade stiffness were slightly higher
  - Design based on consideration of "soft soil" conditions is conservative because max./min. moments used for design of basemat reinforcement were always governed by "soft soil" subgrade model results

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For discussion purposes.

Justification for Considering Generic “Soft Soil” Subgrade Stiffness in Site-Specific Structural Evaluations

- Generic “hard rock” (Vs = 1,700 m/sec) subgrade stiffness properties considered in DCD are very close to properties of subgrade at NA3 site with best estimate Vs = 1,589 m/ sec (per DCD Table 3A.3-2)
- Use of generic “soft soil” subgrade properties for NA3 site-specific structural evaluations is justified based on comparison of results from NA3 site-specific analyses of RB/FB NASTRAN model with generic “soft soil” subgrade stiffness with results presented in ESBWR DCD RAI 3.8-13
- Site-specific evaluations indicate large design margins for RB/FB basemat at NA3 site that bound any uncertainties related to subgrade stiffness effects

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Justification for Considering Generic "Soft Soil" Subgrade Stiffness in Site-Specific Structural Evaluations

- Consistent with approach used in DCD RAI 3.8-13, justification is based on comparisons of results for bending moments Mx and My along basemat cross sections A-A and B-B due to following 2 loads combinations:

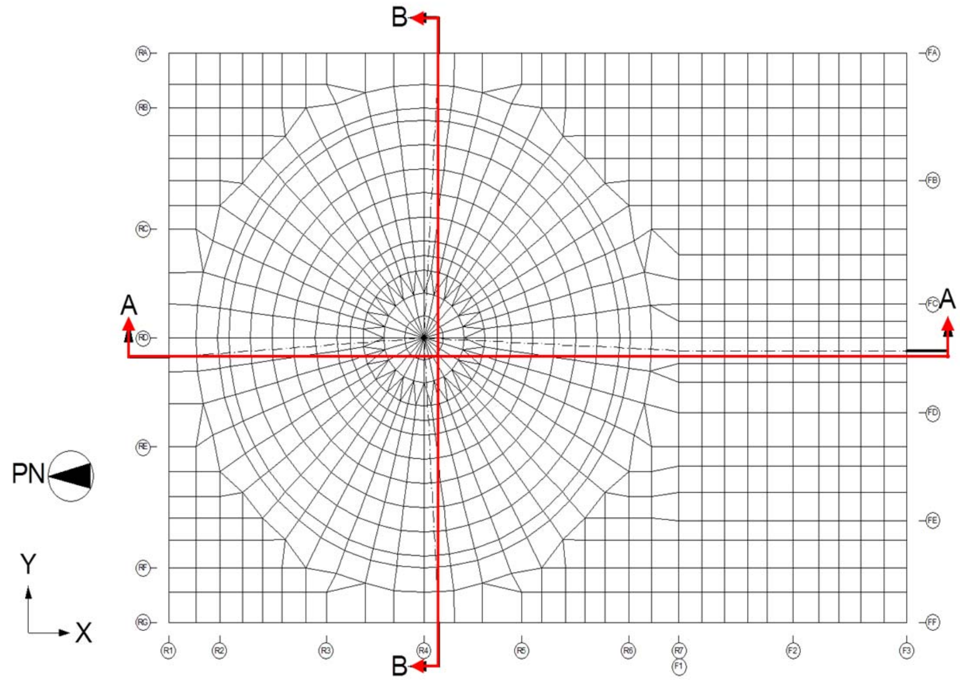
  1. $D + E_{NS} + 0.4\ E_V$
  2. $D - E_{NS} + 0.4\ E_V$

  where:

  D is Dead Load

  E_{NS} is NS SSE load

  E_V is vertical SSE load



Justification for Considering Generic “Soft Soil” Subgrade Stiffness in Site-Specific Structural Evaluations

- Maximum and minimum values of Mx and My moments due to 2 load combinations are calculated for 2 cross-sections using RB/FB NASTRAN analyses results using:
  a. Generic “soft soil” subgrade stiffness and DCD seismic loads
  b. Generic “hard rock” subgrade stiffness and DCD seismic loads
  c. Generic “soft soil” subgrade stiffness and NA3 seismic loads
- Allowable bending moment capacity (Mu) of basemat cross sections presented in response to ESBWR DCD RAI 3.8-93 S03 (dated May 24, 2007) are used to illustrate distribution of basemat reinforcement
- Allowable positive and negative bending moment capacities (Mu) were calculated in Appendix A of DCD RB/FB stability report 26A6652 Rev. 4 (will be available for audit) considering single reinforced section and using following simplified equation:

$$Mu = A_s 0.9 f_y \frac{7}{8} h$$

where: A_s is rebar area, f_y is rebar yield stress; and *h* is basemat thickness

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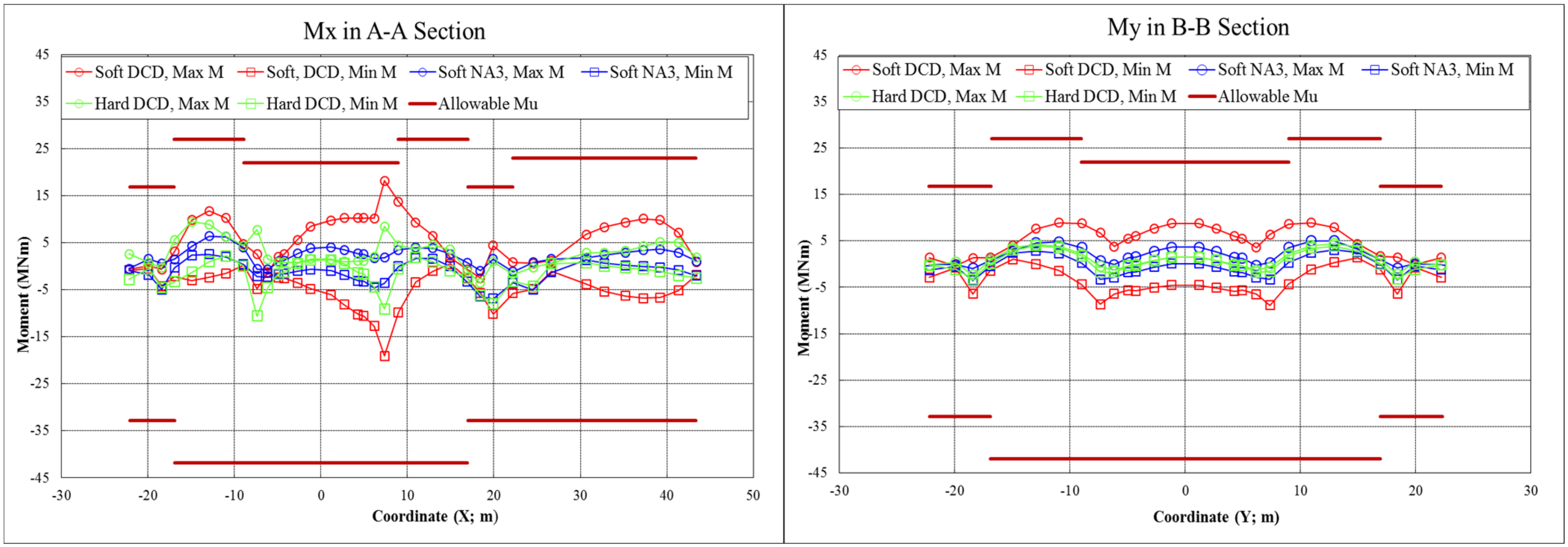
Dominion

Justification for Considering Generic "Soft Soil" Subgrade Stiffness in Site-Specific Structural Evaluations

- Comparisons of bending moment results show that:
  - Consideration of soft soil subgrade stiffness is conservative
  - Distributions of moment demands on RB/FB basemat due to DCD and NA3 site-specific loads are similar
  - DCD standard design moment demands envelope NA3 site-specific demands with large margins



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Dominion

Justification for Considering Generic “Soft Soil” Subgrade Stiffness in Site-Specific Structural Evaluations

Results of NA3 site-specific evaluations show large (> 50%) available design margins for RB/FB basemat at NA3 site that will envelope any possible subgrade stiffness effects on results of site-specific structural evaluation.

RB Basemat (RB design report WG3-U71-ERD-S-0004, Rev. 1)

Element Group	Action	Max. D/C	Margin
Basemat	Concrete Stress (P-M)	0.500	50 %
	Rebar Stress (P-M)	0.474	53 %
	Concrete Comp. Stress	0.122	88 %
	Transverse Shear	0.463	54 %

RCCV Basemat (RCCV design report WG3-T11-DRD-S-0001, Rev. 1)

Element Group	Action	Max. D/C	Margin
Basemat	Concrete Stress (P-M)	0.461	54 %
	Rebar Stress (P-M)	0.516	48 %
	Concrete Comp. Stress	0.153	85 %
	Transverse Shear*	0.041	96 %

FB Basemat (FB design report WG3-U97-ERD-S-0004, Rev. 1)

Element Group	Action	Max. D/C	Margin
Basemat	Concrete Stress (P-M)	0.356	64 %
	Rebar Stress (P-M)	0.304	70 %
	Concrete Comp. Stress	0.156	84 %
	Transverse Shear	0.356	64 %

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For discussion purposes.

Dominion