RAIO-0419-65223

April 15, 2019

Docket No. 52-048

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Supplemental Response to NRC Request for Additional Information No. 201 (eRAI No. 8975) on the NuScale Design Certification Application

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 201 (eRAI No. 8975)," dated August 25, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 201 (eRAI No.8975)," dated October 24, 2017

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) supplemental response to the referenced NRC Request for Additional Information (RAI).

The Enclosure to this letter contains NuScale's supplemental response to the following RAI Question from NRC eRAI No. 8975:

- 03.08.04-26

This letter and the enclosed response make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Marty Bryan at 541-452-7172 or at mbryan@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

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Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8975

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8975

Response to Request for Additional Information
Docket No. 52-048

eRAI No.: 8975
Date of RAI Issue: 08/25/2017

NRC Question No.: 03.08.04-26

10 CFR 50, Appendix A, GDC 1, 2, and 4, provide requirements to be met by SSC important to safety. In accordance with these requirements, DSRS Section 3.8.4 provides review guidance pertaining to the design of seismic Category I structures, other than the containment.

FSAR Section 3.8.4.4 indicates that the SAP2000 results (element forces, moments, stress contours, joint displacements and mode shapes) from the various non-seismic loads are used in conjunction with the results of the seismic analysis described in Section 3.7.2 to perform the design assessments for the seismic Category I RXB and CRB. The staff requests the applicant to clarify how the mode shapes obtained from SAP2000 are used in the aforementioned process. Also describe which computer program was used to perform the design assessment, including reinforcement requirements, and whether the ACI code member approach for design assessment was used. If yes, state it in the FSAR. If not, describe why not.

NuScale Response:

This supplemental response to RAI 8975 03.08.04-26 addresses the following staff feedback from the Tier 2, Sections 3.7 and 3.8 audit performed in December, 2018:

1) Include in the FSAR, capacity tables for critical sections including both 7 ksi concrete for exterior walls above grade and 5 ksi concrete elsewhere,

2) Include an augmented discussion of the element averaging process, and

3) Revise the in-plane shear check language in element-averaging tables.

The above items are included in the attached mark-up to FSAR, Appendix 3B.

Impact on DCA:

FSAR Tier 2, Appendix 3B, 3B.1.1.1, 3B.1.1.2 & 3B.2.7.1, and FSAR Tier 2, Tables 3B-4, 3B-5, 3B-6, 3B-9, 3B-12, 3B-22, 3B-45, 3B-55 & 3B-66 through 3B-94, and FSAR Tier 2, Figures 3B-15 & 3B-16 have been revised as described in the response above and as shown in the markup provided in this response.

- Pool wall
- NPM support skirt
- NPM lug restraint

The following critical sections are presented for the CRB:

Walls

- Wall at grid line 3 - Interior structural wall
- Wall at grid line 4 - East exterior structural wall
- Wall at grid line A - North exterior structural wall

Slabs

- Basemat foundation
- Slab at EL. 100'-0" - Slab at grade

Pilasters

- Pilasters at grid line 1

T- Beams

- T-Beam at EL. 120'-0"

RAI 14.03.02-1

Table 3B-55 and Table 3B-56 outline the critical sections and details for the RXB and CRB.

Section 1.2 contains architectural drawings of the RXB and CRB. Figure 1.2-10 through Figure 1.2-20 are for the RXB and Figure 1.2-21 through Figure 1.2-27 are for the CRB.

RAI 03.08.04-26S1

Table 3B-66 through Table 3B-94 provide section properties, reinforcement schedules, out-of-plane moment, and in-plane and out-of-plane shear capacities for critical sections in the RXB and CRB.

The concrete design process is organized by defining each wall, slab, pilaster, buttress and T-beam into several small zones on the structure and assigning identification names to these regions. The zone definitions are labeled according to the naming conventions below:

Wall Zone Definition Name: "A";"B";"C-D";"E-F"

where,

"A" = Building name

"B" = Grid line ID designation

"C-D" = Wall zone grid line ID range in the horizontal direction

The total area of the longitudinal reinforcing steel provided in an element is the sum of the steel required for (i) membrane tension, (ii) in-plane shear, and (iii) out-of-plane moment. The maximum compression in an element is a combination of flexural compression (out-of-plane moment) and membrane compression. A simplified approach is used for addressing combined effects of flexural and membrane compression. For the simplified method, the sectional area, defined by (b =12")*(a), provides for flexural compression. The net sectional area, defined by (b=12")*(h-a), is available for carrying membrane compression. The maximum membrane compressive stress is calculated to be (S_{xx} or S_{yy})/[12(h-a)]. The Whitney stress block defines parameters "a" and "h" as shown in Figure 3B-1. The maximum membrane compressive stress is less than the allowable compressive strength for membrane compression.

3B.1.1.1 Averaging Demand Forces and Moments

The finite element models often show highly localized forces and moments that are not representative of the average demand forces and moments over the wall and slab sections. Therefore, the design zones with demand/capacity (D/C) ratio exceedances over a single finite element are averaged with adjacent elements to show a more realistic value. When necessary for averaging purposes of finite element analysis generated element forces and moments, the length of the failure plane considered is taken approximately 4 times the thickness of the element.

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An acceptable section cut length varies for different element forces, based on ACI code design provisions as well as the various applied forces. Critical section lengths vary depending upon the applied loadings, however element forces can be averaged over the critical section length, considering the fact that the forces or moments are redistributed to adjacent areas once the higher-stressed region reaches its strength limit.

For the in-plane shear stress check used to demonstrate acceptable wall and slab thickness, average demand shear stresses over the full available section length of wall or slab cross-sections are used. The cross-sectional areas used for the stress check also include the presence of pilasters and T-beams.

3B.1.1.2 Wall and Slab Design Forces and Moments

For each element in the analysis models, static forces and moments are obtained from SAP2000 analysis for non-seismic loads. The direction of the loads result in either compression (negative) or tension (positive) membrane forces due to the static forces and moments being monotonic. The forces and moments for SAP2000 analysis are listed below and are shown in Figure 3B-2 and Figure 3B-3.

- F11, F22 Membrane forces
- F12 In-plane shear
- M11, M22 Out-of-plane moment
- M12 Torsional moment
- V13, V23 Out-of-plane shear

Structural Material Requirements

The RXB design is based on the following material properties:

- Concrete
  - Compressive Strength - 5 ksi (7 ksi for exterior walls of the RXB above grade)
  - Modulus of Elasticity - 4, 031 ksi
  - Shear Modulus - 1,722 ksi
  - Poisson's Ratio - 0.17
- Reinforcement
  - Yield Stress - 60 ksi (ASTM A615 Grade 60 or ASTM A706 Grade 60)
  - Tensile Strength - 90 ksi (A615 Grade 60), 80 ksi (A706 Grade 60)
  - Elongation - See ASTMs A615 and A706
- Structural Steel
  - Grade - ASTM A992 (W shapes), ASTM A500 Grade B (Tube Steel), ASTM A36 (plates)
  - Ultimate Tensile Strength - 65 ksi A992, 58 ksi A500 Grade B and A36
  - Yield Stress - 50 ksi A992, 46 ksi A500 Grade B, 36 ksi A36
- Foundation Media

For a description of the soils considered in the design of the RXB, see Section 3.7.1.3.1.

Structural Loads

The structural loads for the RXB are discussed in detail in Sections 3.7.1 and 3.8.4 for seismic and non-seismic loads, respectively.

Structural Analysis and Design

- Design Computations of Critical Elements

  The design methodology of RXB related Critical Elements is discussed in Section 3B.1. Specific RXB Critical Elements analyzed are discussed in Section 3B.2.

- Stability Calculations

  Stability of the RXB is addressed in Section 3.8.5.4.1, Section 3.8.5.5, and Section 3.8.5.6.1.

Summary of Results

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See Section 3B.2.2 through Section 3B.2.7. The D/C ratios presented represent the bounding design values.

The buttresses in the RXB are designed for strong axis bending and strong axis shear only. This is due to the very long span in the weak axis direction (along the plane of the slabs) that prevents the buttresses from failing. Similarly, the buttresses cannot realistically fail in torsion due to the fact that they are embedded into the 5 foot thick RXB slabs. Therefore, torsion is also not considered.

3B.2.6.1 Buttress at EL. 126'-0"

The wall at grid line 1 has two buttresses. These are at elevations 126'-0" and 145'-6". The buttress at EL. 126'-0" is evaluated. The SAP2000 analysis model plan view is shown in Figure 3B-40, along with the frame element labels.

The reinforcement details are shown in Figure 3B-41.

RAI 03.08.04-11

A summary table of the design check results for the beams at elevation 126-0" is presented in Table 3B-21. This summary table shows the maximum D/C ratios within each design check zone. The D/C ratios are less than 1.0 and therefore the buttress is acceptable. The bounding static, dynamic (seismic), and final design forces and moments are shown in Table 3B-21a and Table 3B-21b.

3B.2.7 NuScale Power Module Bay

The NPM bays are 3-walled compartments located in the reactor pool and are designed to house the NPMs during operation. Each bay is 20'-6" wide in the north-south direction and 19'-7" deep in the east-west direction, and extends from the pool floor at EL. 25'-0" up to EL. 125'-0". The bottom of the bay is the RXB foundation slab. The walls which make up the bay are 5 feet thick reinforced concrete. The top of the bay is capped with the Bioshield during operation. The bay provides restraints to prevent the NPM from moving laterally. Restraint is provided via a NPM skirt restraint located at EL. 25’-0" and lug restraints located on the three bay walls at EL. 71'-7".

3B.2.7.1 West Wing Wall

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The west wing wall is one of the walls at grid line 4. The SAP2000 analysis model elevation view is shown in ~~Figure 3B-42~~Figure 3B-14, along with the shell element labels. The west wing walls have the refueling pool on one side and an NPM located on the other. (See Figure 3B-52). Because of this location, it experiences the highest forces of the NPM bay wing walls.

RAI 03.08.04-26S1

Reinforcement drawings and section details are presented in ~~Figure 3B-43 and Figure 3B-44~~Figure 3B-15 and Figure 3B-16.

RAI 03.08.04-11, RAI 03.08.04-26S1

A summary table of the element-based design check results for the wall at Grid Line 4 is presented in ~~Table 3B-22~~Table 3B-8. This summary table shows the maximum

D/C ratios within each design check zone. All design check zones have no D/C exceedances. The bounding static, dynamic (seismic), and final design forces and moments are shown in Table 3B-8a and Table 3B-8b. Based on the above results and evaluations, the west wing wall is acceptable.

3B.2.7.2 Pool Wall

The portion of the pool wall that supports the NPMs is part of the wall at grid line B. This is an interior wall of the RXB that is 5 feet thick. The SAP2000 analysis model elevation view is shown in Figure 3B-45, along with the shell element labels.

Reinforcement drawings and section details are presented in Figure 3B-46 and Figure 3B-47.

RAI 03.08.04-11

A summary table of the element-based design check results for the wall at grid line B is presented in Table 3B-23. This summary table shows the maximum D/C ratios within each design check zone and highlights the YZ plane shear exceedance. The bounding static, dynamic (seismic), and final design forces and moments are shown in Table 3B-23a and Table 3B-23b. Table 3B-24 shows the element averaging for that exceedance. Table 3B-25 provides a summary of D/C ratios after averaging.

RAI 03.07.02-20, RAI 03.08.04-10S1, RAI 03.08.04-31

3B.2.7.3 NuScale Power Module Passive Support Plates~~Ring~~ Assembly

RAI 03.07.02-20, RAI 03.08.04-10S1

The base of the NPM is located at the bottom of the RXB pool at EL. 25'-0". There are up to 12 NPMs located in the RXB pool in their respective bays. The pool floor liner in the NPM bay is made of half-inch thick stainless steel, whereas the wall liner is made of quarter-inch stainless steel.

RAI 03.07.02-20

The NPM is vertically supported for the dead load and seismic loads acting downwards at the base, but free to move up vertically for any uplifting forces (such as seismic load acting upwards and buoyant forces due to the water in the reactor pool). The NPM is also laterally restrained against seismic forces at the base.

RAI 03.07.02-20

The details of the NPM base support are shown in Figure 3B-48 through Figure 3B-50. The NPM base support includes the following:

RAI 03.07.02-20, RAI 03.08.04-10S1, RAI 03.08.04-31

- The skirt of the NPM is supported on a donut-shaped, 5 3/4 in. thick embed plate. The embed plate extends beyond the donut shape at four quadrants to support 4 passive plates. In each quadrant, the embed plate has two 8 in. openings to accommodate concrete placement and consolidation. The central opening and the additional 8 openings are to be sealed by welding a stainless

RAI 03.08.04-26S1

Table 3B-4: Element Averaging of Horizontal Reinforcement Exceedance for Reactor Building Wall at Grid Line 3

Average of Shell Elements 4951/4431/4421: Design Check					
Horizontal Reinforcement (Local X)					
Membrane Tension A_{s1} (in^2)	In-Plane Shear A_{s2} (in^2)	OOP Moment A_{s3} (in^2)	Total A_s (in^2)	A_s Provided (in^2)	Horizontal Reinf. D/C Ratio
11.416	7.563	1.938	20.917	28.080	0.745
			Horiz. Membrane Comp. Stress f_{xx} (ksi)	Membrane Compression Strength (ksi)	Membrane Compression Stress D/C Ratio
			1.39	3.34	0.416
Vertical Reinforcement (Local Y)					
Membrane Tension A_{s1} (in^2)	In-Plane Shear A_{s2} (in^2)	OOP Moment A_{s3} (in^2)	Total A_s (in^2)	A_s Provided (in^2)	Vertical Reinf. D/C Ratio
9.867	7.563	0.821	18.251	28.080	0.650
			Vertical Membrane Comp. Stress f_{yy} (ksi)	Membrane Compression Strength (ksi)	Membrane Compression Stress D/C Ratio
			1.15	3.34	0.345
Shear Friction			**IP Shear**	**OOP Shear**	
XZ-Plane Shear-Friction A_{vfx} (in^2)	$\phi_v V_{nx} = \phi_v A_{vfx} f_y \mu$ (lb)	Sxy < $\phi_v V_{nx}$?	Sxy < $\phi_v V_{in\text{-}plane}$?	XZ-Plane Shear Capacity (kip)	XZ-Plane D/C Ratio
16.664	36,000.0	OK	~~FAIL~~Performing averaging†	129.8	0.374
YZ-Plane Shear-Friction A_{vfy} (in^2)	$\phi_v V_{ny} = \phi_v A_{vfy} f_y \mu$ (lb)	Sxy < $\phi_v V_{ny}$?		YZ-Plane Shear Capacity (kip)	YZ-Plane D/C Ratio
18.213	36,000.0	OK		129.8	0.162

Note:
† See Section 3B.2.2.2 and Table 3B-51.

RAI 03.08.04-26S1

Table 3B-5: Element Averaging of Horizontal Membrane Compression Stress for Reactor Building Wall at Grid Line 3

Average of Shell Elements 4942/4422: Design Check					
Horizontal Reinforcement (Local X)					
Membrane Tension A_{s1} (in^2)	In-Plane Shear A_{s2} (in^2)	OOP Moment A_{s3} (in^2)	Total A_s (in^2)	A_s Provided (in^2)	Horizontal Reinf. D/C Ratio
4.031	11.149	1.790	16.971	28.080	0.604
			Horiz. Membrane Comp. Stress f_{xx} (ksi)	Membrane Compression Strength (ksi)	Membrane Compression Stress D/C Ratio
			2.03	3.34	0.609
Vertical Reinforcement (Local Y)					
Membrane Tension A_{s1} (in^2)	In-Plane Shear A_{s2} (in^2)	OOP Moment A_{s3} (in^2)	Total A_s (in^2)	A_s Provided (in^2)	Vertical Reinf. D/C Ratio
1.574	11.149	0.836	13.559	28.080	0.483
			Vertical Membrane Comp. Stress f_{yy} (ksi)	Membrane Compression Strength (ksi)	Membrane Compression Stress D/C Ratio
			0.97	3.34	0.291
Shear Friction			**IP Shear**	**OOP Shear**	
XZ-Plane Shear-Friction A_{vfx} (in^2)	$\phi_v V_{nx} = \phi_v A_{vfx} f_y \mu$ (lb)	$Sxy < \phi_v V_{nx}$?	$Sxy < \phi_v V_{in\text{-}plane}$?	XZ-Plane Shear Capacity (kip)	XZ-Plane D/C Ratio
24.049	36,000.0	~~FAIL~~Performing averaging†	~~FAIL~~Performing averaging††	151.9	0.371
YZ-Plane Shear-Friction A_{vfy} (in^2)	$\phi_v V_{ny} = \phi_v A_{vfy} f_y \mu$ (lb)	$Sxy < \phi_v V_{ny}$?		YZ-Plane Shear Capacity (kip)	YZ-Plane D/C Ratio
26.506	36,000.0	~~FAIL~~Performing averaging†		172.4	0.141

Notes:

† See Section 3B.2.2.2 and Table 3B-52.

†† See Section 3B.2.2.2 and Table 3B-51.

RAI 03.08.04-26S1

Table 3B-6: Element Averaging of Vertical Reinforcement Exceedance for Reactor Building Wall at Grid Line 3

Average of Shell Elements 4951/4950/4949: Design Check					
Horizontal Reinforcement (Local X)					
Membrane Tension A_{s1} (in^2)	In-Plane Shear A_{s2} (in^2)	OOP Moment A_{s3} (in^2)	Total A_s (in^2)	A_s Provided (in^2)	Horizontal Reinf. D/C Ratio
15.978	7.614	1.497	25.089	28.080	0.893
			Horiz. Membrane Comp. Stress f_{xx} (ksi)	Membrane Compression Strength (ksi)	Membrane Compression Stress D/C Ratio
			1.91	3.34	0.572
Vertical Reinforcement (Local Y)					
Membrane Tension A_{s1} (in^2)	In-Plane Shear A_{s2} (in^2)	OOP Moment A_{s3} (in^2)	Total A_s (in^2)	A_s Provided (in^2)	Vertical Reinf. D/C Ratio
11.479	7.614	0.604	19.698	28.080	0.701
			Vertical Membrane Comp. Stress f_{yy} (ksi)	Membrane Compression Strength (ksi)	Membrane Compression Stress D/C Ratio
			1.25	3.34	0.374
Shear Friction			**IP Shear**	**OOP Shear**	
XZ-Plane Shear-Friction A_{vfx} (in^2)	$\phi_v V_{nx} = \phi_v A_{vfx} f_y \mu$ (lb)	$Sxy < \phi_v V_{nx}$?	$Sxy < \phi_v V_{in\text{-}plane}$?	XZ-Plane Shear Capacity (kip)	XZ-Plane D/C Ratio
12.102	36,000.0	OK	~~FAIL~~Performing averaging†	129.8	0.473
YZ-Plane Shear-Friction A_{vfy} (in^2)	$\phi_v V_{ny} = \phi_v A_{vfy} f_y \mu$ (lb)	$Sxy < \phi_v V_{ny}$?		YZ-Plane Shear Capacity (kip)	YZ-Plane D/C Ratio
16.601	36,000.0	OK		129.8	0.117

Note:
† See Section 3B.2.2.2 and Table 3B-51.

RAI 03.08.04-26S1

Table 3B-9: Element Averaging of Reinforcement Exceedance for Reactor Building Wall at Grid Line 4

Average of Shell Elements 16180/16479/16778: Design Check					
Horizontal Reinforcement (Local X)					
Membrane Tension A_{s1} (in^2)	In-Plane Shear A_{s2} (in^2)	OOP Moment A_{s3} (in^2)	Total A_s (in^2)	A_s Provided (in^2)	Horizontal Reinf. D/C Ratio
4.504	5.537	0.367	10.408	18.720	0.556
			Horiz. Membrane Comp. Stress f_{xx} (ksi)	Membrane Compression Strength (ksi)	Membrane Compression Stress D/C Ratio
			0.96	3.15	0.304
Vertical Reinforcement (Local Y)					
Membrane Tension A_{s1} (in^2)	In-Plane Shear A_{s2} (in^2)	OOP Moment A_{s3} (in^2)	Total A_s (in^2)	A_s Provided (in^2)	Vertical Reinf. D/C Ratio
2.174	5.537	0.089	7.800	18.720	0.417
			Vertical Membrane Comp. Stress f_{yy} (ksi)	Membrane Compression Strength (ksi)	Membrane Compression Stress D/C Ratio
			0.38	3.15	0.120
Shear Friction			**IP Shear**	**OOP Shear**	
XZ-Plane Shear-Friction A_{vfx} (in^2)	$\phi_v V_{nx} = \phi_v A_{vfx} f_y \mu$ (lb)	$Sxy < \phi_v V_{nx}$?	$Sxy < \phi_v V_{in\text{-}plane}$?	XZ-Plane Shear Capacity (kip)	XZ-Plane D/C Ratio
14.216	28,800.0	OK	~~FAIL~~Performing Averaging†	130.6	0.061
YZ-Plane Shear-Friction A_{vfy} (in^2)	$\phi_v V_{ny} = \phi_v A_{vfy} f_y \mu$ (lb)	$Sxy < \phi_v V_{ny}$?		YZ-Plane Shear Capacity (kip)	YZ-Plane D/C Ratio
16.546	28,800.0	OK		151.4	0.030

Note:

† See Section 3B.2.2.2 and Table 3B-51.

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Table 3B-12: Element Averaging of Horizontal Reinforcement Exceedance for RXB Wall at Grid Line 6

Average of Shell Elements 16296/16595: Design Check					
Horizontal Reinforcement (Local X)					
Membrane Tension A_{s1} (in^2)	In-Plane Shear A_{s2} (in^2)	OOP Moment A_{s3} (in^2)	Total A_s (in^2)	A_s Provided (in^2)	Horizontal Reinf. D/C Ratio
10.227	5.549	1.198	16.975	18.720	0.907
			Horiz. Membrane Comp. Stress f_{xx} (ksi)	Membrane Compression Strength (ksi)	Membrane Compression Stress D/C Ratio
			1.19	3.15	0.376
Vertical Reinforcement (Local Y)					
Membrane Tension A_{s1} (in^2)	In-Plane Shear A_{s2} (in^2)	OOP Moment A_{s3} (in^2)	Total A_s (in^2)	A_s Provided (in^2)	Vertical Reinf. D/C Ratio
3.630	5.549	0.309	9.488	18.720	0.507
			Vertical Membrane Comp. Stress f_{yy} (ksi)	Membrane Compression Strength (ksi)	Membrane Compression Stress D/C Ratio
			0.49	3.15	0.156
Shear Friction			**IP Shear**	**OOP Shear**	
XZ-Plane Shear-Friction A_{vfx} (in^2)	$\phi_v V_{nx} = \phi_v A_{vfx} f_y \mu$ (lb)	$Sxy < \phi_v V_{nx}$?	$Sxy < \phi_v V_{in\text{-}plane}$?	XZ-Plane Shear Capacity (kip)	XZ-Plane D/C Ratio
8.493	28,800.0	OK	~~FAIL~~Performing Averaging†	123.2	0.139
YZ-Plane Shear-Friction A_{vfy} (in^2)	$\phi_v V_{ny} = \phi_v A_{vfy} f_y \mu$ (lb)	$Sxy < \phi_v V_{ny}$?		YZ-Plane Shear Capacity (kip)	YZ-Plane D/C Ratio
15.090	28,800.0	OK		138.4	0.036

Note:
† See Section 3B.2.2.2 and Table 3B-52.

RAI 03.08.04-15, RAI 03.08.04-16, RAI 03.08.04-17, RAI 03.08.04-26S1

Table 3B-22: ~~Summary of D/C Ratios for West Wing Wall at Grid Line 4~~ Not Used

		~~Demand/Capacity Ratios~~						
~~Section~~		~~Horizontal Reinf.~~	~~Horiz. Comp. Stress~~	~~Vertical Reinf.~~	~~Vert. Comp. Stress~~	~~XZ-Plane Shear~~	~~YZ-Plane Shear~~	~~# Elems Checked~~
~~RXB;4;D-C;24-50~~	~~D/C Ratio~~	~~0.40~~	~~0.19~~	~~0.68~~	~~0.76~~	~~0.24~~	~~0.83~~	~~16~~
	~~Element~~	~~4638~~	~~4638~~	~~3071~~	~~3071~~	~~4638~~	~~3071~~	
~~RXB;4;C-B;24-50~~	~~D/C Ratio~~	~~0.38~~	~~0.17~~	~~0.67~~	~~0.74~~	~~0.25~~	~~0.82~~	~~16~~
	~~Element~~	~~4645~~	~~4645~~	~~3072~~	~~3072~~	~~4645~~	~~3072~~	
~~RXB;4;D-C;50-75~~	~~D/C Ratio~~	~~0.38~~	~~0.22~~	~~0.62~~	~~0.42~~	~~0.46~~	~~0.39~~	~~20~~
	~~Element~~	~~8070~~	~~8070~~	~~8073~~	~~5781~~	~~7300~~	~~7300~~	
~~RXB;4;C-B;50-75~~	~~D/C Ratio~~	~~0.40~~	~~0.22~~	~~0.62~~	~~0.42~~	~~0.50~~	~~0.42~~	~~20~~
	~~Element~~	~~8077~~	~~8077~~	~~8074~~	~~5782~~	~~7307~~	~~7307~~	
~~RXB;4;D-C;75-100~~	~~D/C Ratio~~	~~0.32~~	~~0.18~~	~~0.61~~	~~0.40~~	~~0.39~~	~~0.41~~	~~16~~
	~~Element~~	~~11582~~	~~9082~~	~~9678~~	~~9678~~	~~11582~~	~~11585~~	
~~RXB;4;C-B;75-100~~	~~D/C Ratio~~	~~0.33~~	~~0.18~~	~~0.61~~	~~0.41~~	~~0.41~~	~~0.44~~	~~16~~
	~~Element~~	~~11589~~	~~9089~~	~~9679~~	~~9679~~	~~11589~~	~~11586~~	
~~RXB;4;D-C;100-126~~	~~D/C Ratio~~	~~0.95~~	~~0.35~~	~~0.48~~	~~0.29~~	~~0.38~~	~~0.28~~	~~16~~
	~~Element~~	~~13686~~	~~13686~~	~~13686~~	~~12459~~	~~12456~~	~~12459~~	
~~RXB;4;C-B;100-126~~	~~D/C Ratio~~	~~0.96~~	~~0.36~~	~~0.48~~	~~0.30~~	~~0.40~~	~~0.30~~	~~16~~
	~~Element~~	~~13693~~	~~13693~~	~~13693~~	~~12460~~	~~12463~~	~~12460~~	

RAI 03.08.04-11, RAI 03.08.04-26S1

Table 3B-22a: Not Used

RAI 03.08.04-11, RAI 03.08.04-26S1

Table 3B-22b: Not Used

RAI 03.08.04-26S1

Table 3B-45: Element Averaging of XZ Plane Shear Exceedance - Control Building Slab at EL. 100'-0"

Average of Shell Elements 2565/2564: Design Check					
East-West Reinforcement (Local X)					
Membrane Tension A_{s1} (in^2)	In-Plane Shear A_{s2} (in^2)	OOP Moment A_{s3} (in^2)	Total A_s (in^2)	A_s Provided (in^2)	East-West Reinf. D/C Ratio
2.392	0.058	0.300	2.750	3.120	0.881
			E-W Membrane Comp. Stress f_{xx} (ksi)	Membrane Compression Strength (ksi)	Membrane Compression Stress D/C Ratio
			0.35	2.42	0.145
North-South Reinforcement (Local Y)					
Membrane Tension A_{s1} (in^2)	In-Plane Shear A_{s2} (in^2)	OOP Moment A_{s3} (in^2)	Total A_s (in^2)	A_s Provided (in^2)	North-South Reinf. D/C Ratio
0.446	0.058	0.227	0.731	3.120	0.234
			N-S Membrane Comp. Stress f_{yy} (ksi)	Membrane Compression Strength (ksi)	Membrane Compression Stress D/C Ratio
			0.07	2.42	0.030
Shear Friction			**Code Check**	**OOP Shear**	
XZ-Plane Shear-Friction A_{vfx} (in^2)	$\phi_v V_{nx} = \phi_v A_{vfx} f_y \mu$ (lb)	$Sxy < \phi_v V_{nx}$?	$Sxy < \phi_v V_{in\text{-}plane}$?	XZ-Plane Shear Capacity (kip)	XZ-Plane D/C Ratio
0.728	2,730.2	~~FAIL~~Performing Averaging†	OK	17.0	0.727
YZ-Plane Shear-Friction A_{vfy} (in^2)	$\phi_v V_{ny} = \phi_v A_{vfy} f_y \mu$ (lb)	$Sxy < \phi_v V_{ny}$?		YZ-Plane Shear Capacity (kip)	YZ-Plane D/C Ratio
2.674	10,028.2	OK		37.5	0.248

Note:
† See text in Section 3B.3.3.2 and Table 3B-48.

RAI 03.08.04-26S1, RAI 03.08.05-6, RAI 14.03.02-1

Table 3B-55: RXB Critical Sections

Structure Type	Location	Figure Reference	Critical Dimension*
Walls			
	Wall at grid line 1 - West outer perimeter wall at foundation level	3B-8, 3B-9	5'-0"
	Wall at grid line 3 - Interior weir wall	3B-11, 3B-12	5'-0"
	Wall at grid line 3 - Interior upper stiffener	3B-11, 3B-13	4'-0"
	Wall at grid line 4 - Interior wall of RXB	3B-15, 3B-16	5'-0"
	Wall at grid line 4 - Interior wall of RXB	3B-15, 3B-17	4'-0"
	Wall at grid line 6 - Upper stiffener wall	3B-19, 3B-20	4'-0"
	Wall at grid line 6 - Pool wall	3B-19, 3B-21	5'-0"
	Wall at grid line 6 - Pool wall	3B-19, 3B-21	7'-6"
	Wall at grid line E - South exterior wall extending upward from foundation level	3B-23, 3B-24	5'-0"
Slabs			
	Basemat Foundation	3B-88, 3B-89	10'-0"
	Slab at EL. 100'-0" - Slab at grade	3B-29, 3B-27	3'-0"
	Slab at EL. 181'-0" - Slab at roof	3B-29, 3B-30	4'-0"
Pilasters			
	Pilasters at grid line A	3B-32, 3B-33, 3B-34, 3B-35, 3B-36	5'-0"
Beams			
	Beam at EL. 75'-0"	3B-38, 3B-39	2'-0"
Buttresses			
	Buttress at EL. 126'-0"	3B-41	5'-0"
NPM Bay			
	West wing wall	~~3B-43, 3B-44~~ 3B-15, 3B-16	5'-0"
	Pool wall	3B-46, 3B-47	5'-0"

*Dimensions shall be acceptable if found within the tolerances specified in ACI 117-06

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Table 3B-66: Design Summary - Wall at Grid Line 1, EL 24'-75'

Description	**Parameters**	**Value**
Reinforcement Schedule	-	2-#11 @ 6" oc, EWEF, #11 @ 6" oc, EW on both sides of wall centerline, with #9 headed bars @12" oc, EW.
Section thickness	h (in)	60
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	13.0
Nominal moment capacity	M_N (kip-ft/ft)	2,186
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	Φ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**1,967**
In-plane shear capacity	**$\phi V_{In-plane}$ (kip/ft)**	**305**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**214**

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Table 3B-67: Design Summary - Wall at Grid Line 1, EL 75'-100'

Description	**Parameters**	**Value**
Reinforcement schedule	-	4-#11 @ 6" oc, EWEF, with #9 headed bars @12" oc, EW.
Section thickness	h (in)	60
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	17.0
Nominal moment capacity	M_N (kip-ft/ft)	2,618
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**2,356**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**305**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**210**

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Table 3B-68: Design Summary - Wall at Grid Line 1, EL 100'-145'-6"

Description	Parameters	Value
Reinforcement	-	4-#11 @ 6" oc, EWEF. See Ref. 1.4.1, S33, W/S57, with #9 headed bars @12" oc, EW.
Section thickness	h (in)	60
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	7,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	15.6
Nominal moment capacity	M_N (kip-ft/ft)	2,800
Strength reduction factor for flexure (Reference 1.4.9, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**2,520**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**361**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**217**

RAI 03.08.04-26S1

Table 3B-69: Design Summary - Wall at Grid Line 1, EL 145'-6"-181'

Description	Parameters	Value
Reinforcement schedule	-	2-#11 @ 6" oc, EWEF, #11 @ 6" oc, EW on both sides of wall centerline, with #9 headed bars @12" oc, EW.
Section thickness	h (in)	60
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	7,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	11.5
Nominal moment capacity	M_N (kip-ft/ft)	2,255
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	Φ_M	0.90
Out-of-plane moment capacity $\Phi M_N = \Phi_M M_N$	**ΦM_N (kip-ft/ft)**	**2030**
In-plane shear capacity	**$\Phi V_{In\text{-}plane}$ (kip/ft)**	**361**
Out-of-plane shear capacity	**ΦV_{OOP} (kip/ft)**	**225**

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Table 3B-70: Design Summary - Interior Weir Wall at Grid Line 3

Description	Parameters	Value
Reinforcement schedule	-	3 curtains of #11 bars, spaced at 6”-3.25”-6”-3.25” oc EWEF, one similar curtain at the centerline of the wall, with #9 headed bars @ 9¼ “ horizontally and 18½” vertically oc.
Section thickness	h (in)	60
Concrete cover dimension	c_c (in)	6
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	17.0
Nominal moment capacity	M_N (kip-ft/ft)	2,717
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	Φ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**2,445**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**305**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**196**

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Table 3B-71: Design Summary - 4'-Thick Interior Upper Stiffener Wall at Grid Line 3

Description	Parameters	Value
Reinforcement schedule	-	2- #11 bars, spaced at 6" oc EWEF, with #9 headed bars @12" oc, EW.
Section thickness	h (in)	48
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	8.3
Nominal moment capacity	M_N (kip-ft/ft)	1,167
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**1,051**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**244**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**186**

RAI 03.08.04-26S1

Table 3B-72: Design Summary - 5'-Thick Interior Wall at Grid Line 4

Description	Parameters	Value
Reinforcement schedule	-	3 curtains of #11 bars, spaced at 6”-3.25”-6”-3.25” oc, EWEF, one similar curtain at the center line of the wall, with 2 #9 headed bars @ 18½” oc, EW.
Section thickness	h (in)	60
Concrete cover dimension	c_c (in)	6
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	17.5
Nominal moment capacity	M_N (kip-ft/ft)	2,826
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**2,543**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**305**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**196**

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Table 3B-73: Design Summary - Reactor Building 4'-Thick Interior Wall at Grid Line 4

Description	Parameters	Value
Reinforcement schedule	-	3- #11 bars, spaced at 6" oc, EWEF, with #9 headed bars @12" oc, EW.
Section thickness	h (in)	48
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	11.5
Nominal moment capacity	M_N (kip-ft/ft)	1,600
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**1,440**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**244**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**190**

RAI 03.08.04-26S1

Table 3B-74: Design Summary - 4'-Thick Pool Wall at Grid Line 6

Description	Parameters	Value
Reinforcement schedule	-	3- #11 bars, spaced at 6" oc, EWEF, with #9 headed bars @12" oc, EW.
Section thickness	h (in)	48
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	11.5
Nominal moment capacity	M_N (kip-ft/ft)	1,600
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**1,440**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**244**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**190**

RAI 03.08.04-26S1

Table 3B-75: Design Summary - Pool Wall at Grid Line 6 above EL 123'

Description	**Parameters**	**Value**
Reinforcement schedule	-	3-#11 bars, spaced at 6" oc, EWEF, 1-#11 @ 6" on both sides of the centerline of the wall, with #8 headed bars @ 12" vertically and @ 12½" -6"-12½"-6" horizontally oc.
Section thickness	h (in)	60
Concrete cover dimension (inner)	c_c (in)	6
Concrete cover dimension (outer)	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	15.8
Nominal moment capacity	M_N (kip-ft/ft)	2,583
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	Φ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**2,324**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**275**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**217**

RAI 03.08.04-26S1

Table 3B-76: Design Summary - Pool Wall at Grid Line 6 below EL 123'

Description	Parameters	Value
Reinforcement schedule	-	3 curtains of #11 bars, spaced at 6”-3.25”-6”-3.25” oc, EWEF, with #8 headed bars @ 12” vertically and @ 12½” -6”-12½”-6” horizontally oc.
Section thickness	h (in)	60
Concrete cover dimension (inner)	c_c (in)	6
Concrete cover dimension (outer)	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	12.7
Nominal moment capacity	M_N (kip-ft/ft)	2,548
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**2,293**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**275**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**236**

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Table 3B-77: Design Summary - Pool Wall at Grid Line 6 - 7'-6" Thick Section below EL 123'

Description	Parameters	Value
Reinforcement schedule	-	3 curtains of #11 bars, spaced at 6”-3.25”-6”-3.25” oc EWEF, with #9 headed bars @ 12” vertically and @ 12½” -6”-12½”-6” horizontally oc.
Section thickness	h (in)	90
Concrete cover dimension (inner)	c_c (in)	6
Concrete cover dimension (outer)	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	12.7
Nominal moment capacity	M_N (kip-ft/ft)	4,370
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**3.933**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**428**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**327**

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Table 3B-78: Design Summary - Exterior Wall at Grid Line E below EL 50'

Description	**Parameters**	**Value**
Reinforcement schedule	-	2-#11 bars, spaced at 6" oc, EWEF, 1-#11 @ 6" at the centerline of the wall, with #9 headed bars @12" oc, EW.
Section thickness	h (in)	60
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	10.4
Nominal moment capacity	M_N (kip-ft/ft)	1,884
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	Φ_M	0.90
Out-of-plane moment capacity $\Phi M_N = \Phi_M M_N$	**ΦM_N (kip-ft/ft)**	**1,696**
In-plane shear capacity	**$\Phi V_{In\text{-}plane}$ (kip/ft)**	**305**
Out-of-plane shear capacity	**ΦV_{OOP} (kip/ft)**	**233**

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Table 3B-79: Design Summary - Exterior Wall at Grid Line E between EL 50' and EL 100'

Description	Parameters	Value
Reinforcement schedule	-	2-#11 bars, spaced at 6" oc, EWEF, with #9 headed bars @12" oc, EW.
Section thickness	h (in)	60
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	8.3
Nominal moment capacity	M_N (kip-ft/ft)	1,542
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_{NNew} (kip-ft/ft)**	**1,388**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**305**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**238**

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Table 3B-80: Design Summary - Exterior Wall at Grid Line above EL 100'

Description	**Parameters**	**Value**
Reinforcement schedule	-	2-#11 bars, spaced at 6" oc, EWEF, with #9 headed bars @12" oc, EW.
Section thickness	h (in)	60
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	7,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	7.7
Nominal moment capacity	M_N (kip-ft/ft)	1,582
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	Φ_M	0.90
Out-of-plane moment capacity $\Phi M_N = \Phi_M M_N$	**ΦM_N (kip-ft/ft)**	**1,424**
In-plane shear capacity	**$\Phi V_{In\text{-}plane}$ (kip/ft)**	**361**
Out-of-plane shear capacity	**ΦV_{OOP} (kip/ft)**	**240**

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Table 3B-81: Design Summary - Reactor Building Basemat Perimeter

Description	Parameters	Value
Reinforcement schedule	-	3-#11 bars, spaced at 6" oc, top and bottom, with #9 headed bars @ 12 oc, EW.
Section thickness	h (in)	120
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	11.5
Nominal moment capacity	M_N (kip-ft/ft)	4,970
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	Φ_M	**0.90**
Out-of-plane moment capacity $\Phi M_N = \Phi_M M_N$	ΦM_N (kip-ft/ft)	**4,473**
In-plane shear capacity	$\Phi V_{In\text{-}plane}$ (kip/ft)	**611**
Out-of-plane shear capacity	ΦV_{OOP} (kip/ft)	**500**

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Table 3B-82: Design Summary - Reactor Building Basemat Interior

Description	**Parameters**	**Value**
Reinforcement schedule	-	2-#11 bars, spaced at 6" oc, top and bottom, with #6 headed bars @ 12 oc, EW.
Section thickness	h (in)	120
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	8.3
Nominal moment capacity	M_N (kip-ft/ft)	3,414
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	**0.90**
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	ϕM_N **(kip-ft/ft)**	**3,073**
In-plane shear capacity	$\phi V_{In\text{-}plane}$ **(kip/ft)**	**611**
Out-of-plane shear capacity	ϕV_{OOP} **(kip/ft)**	**328**

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Table 3B-83: Design Summary - Reactor Building Slab at EL 100'

Description	Parameters	Value
Reinforcement schedule	-	Outer layer of #11 bars @ 6" oc, EW, top and bottom, inner layer of #11 bars @ 12" oc EW, top and bottom, with 2 #6 shear ties @ 12 oc, EW.
Section thickness	h (in)	36
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	6.96
Nominal moment capacity	M_N (kip-ft/ft)	639
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	Φ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**575**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**183**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**129**

RAI 03.08.04-26S1

Table 3B-84: Design Summary - Reactor Building Roof Slab at EL 181'

Description	Parameters	Value
Reinforcement schedule	-	Two curtains of #11 bars spaced at 6"-3"-3"-6" EW, T&B, with #9 headed bars @ 12" oc, EW.
Section thickness	h (in)	48
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	9.8
Nominal moment capacity	M_N (kip-ft/ft)	1,684
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**1,516**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**244**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**204**

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Table 3B-85: Design Summary - West Wing Wall

Description	Parameters	Value
Reinforcement schedule	-	3 curtains of #11 bars, spaced at 6”-3.25”-6”-3.25” oc EWEF, one similar curtain at the center line of the wall, with 2 #9 headed bars @ 18½” oc, EW.
Section thickness	h (in)	60
Concrete cover dimension	c_c (in)	6
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	17.5
Nominal moment capacity	M_N (kip-ft/ft)	2,826
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	Φ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**2,543**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**305**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**196**

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Table 3B-86: Design Summary - Pool Wall at Grid Line B

Description	Parameters	Value
Reinforcement schedule	-	2-#11 bars, spaced at 6" oc, EWEF, with #9 headed bars @ 12" oc, EW.
Section thickness	h (in)	60
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	8.3
Nominal moment capacity	M_N (kip-ft/ft)	1,542
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**1,388**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**275**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**239**

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Table 3B-87: Design Summary - Control Building Interior Wall at Grid Line 3

Description	Parameters	Value
Reinforcement schedule	-	2-#9 bars, spaced at 12" oc, EWEF.
Section thickness	h (in)	24
Concrete cover dimension	c_c (in)	0.75
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	3.8
Nominal moment capacity	M_N (kip-ft/ft)	202
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_{NNew} (kip-ft/ft)**	**182**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**122**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**26**

RAI 03.08.04-26S1

Table 3B-88: Design Summary - Control Building Exterior Wall at Grid Line 4

Description	**Parameters**	**Value**
Reinforcement schedule	-	2-#11 bars, spaced at 12" oc, EWEF, #6 stirrups @ 12" oc (below EL 100').
Section thickness	h (in)	36
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	6.25
Nominal moment capacity	M_N (kip-ft/ft)	451
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**406**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**183**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**84**

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Table 3B-89: Design Summary - Control Building Exterior Wall at Grid Line A

Description	**Parameters**	**Value**
Reinforcement schedule	-	2-#11 bars, spaced at 12" oc, EWEF, with #6stirrup@12"oc,EW (below EL 100').
Section thickness	h (in)	36
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	6.25
Nominal moment capacity	M_N (kip-ft/ft)	451
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	Φ_M	0.90
Out-of-plane moment capacity $\Phi M_N = \Phi_M M_N$	**ΦM_N (kip-ft/ft)**	**406**
In-plane shear capacity	**$\Phi V_{In\text{-}plane}$ (kip/ft)**	**183**
Out-of-plane shear capacity	**ΦV_{OOP} (kip/ft)**	**84**

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Table 3B-90: Design Summary - Control Building Basemat Perimeter

Description	Parameters	Value
Reinforcement schedule	-	4-#11 bars, spaced at 12" oc, top and bottom, with 2 #6 ties @ 12" oc, EW.
Section thickness	h (in)	60
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	10.9
Nominal moment capacity	M_N (kip-ft/ft)	1,499
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**1,349**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**305**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**129**

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Table 3B-91: Design Summary - Control Building Basemat Interior

Description	Parameters	Value
Reinforcement schedule	-	3-#11 bars, spaced at 12” oc, top and bottom, with 2 #6 ties @ 12” oc, EW.
Section thickness	h (in)	60
Concrete cover dimension	c_c (in)	3
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	8.6
Nominal moment capacity	M_N (kip-ft/ft)	1,181
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**1,063**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**305**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**134**

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Table 3B-92: Design Summary - Control Building 2'-Thick Slab at EL 100'

Description	Parameters	Value
Reinforcement schedule	-	#11 bars, spaced at 12" oc, top and bottom.
Section thickness	h (in)	24
Concrete cover dimension	c_c (in)	0.75
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	2.8
Nominal moment capacity	M_N (kip-ft/ft)	157
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**141**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**122**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**27**

RAI 03.08.04-26S1

Table 3B-93: Design Summary - Control Building 3'-Thick Slab at EL 100'

Description	Parameters	Value
Reinforcement schedule	-	#11 bars, spaced at 12” oc, top and bottom.
Section thickness	h (in)	36
Concrete cover dimension	c_c (in)	0.75
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	2.8
Nominal moment capacity	M_N (kip-ft/ft)	251
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**226**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**183**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**43**

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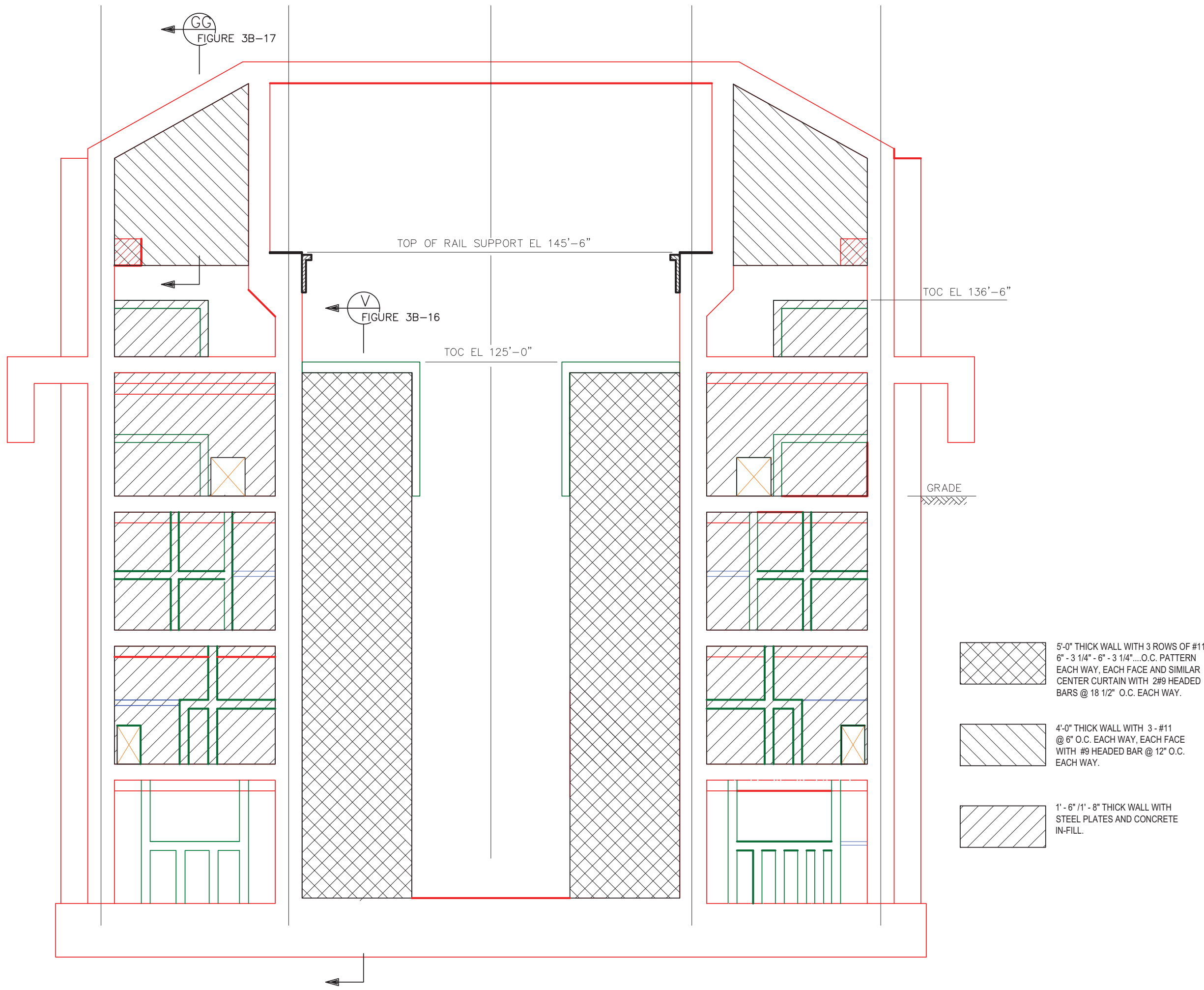
Table 3B-94: Design Summary - Control Building Tunnel Slab

Description	Parameters	Value
Reinforcement schedule	-	2-#11 bars, spaced at 12" oc, top and bottom, with #6 stirrups @ 12" oc, EW.
Section thickness	h (in)	36
Concrete cover dimension	c_c (in)	2
Concrete compressive strength	f_c' (psi)	5,000
Rebar yield strength	f_y (psi)	60,000
Distance from neutral axis to compression face	c (in)	5.8
Nominal moment capacity	M_N (kip-ft/ft)	460
Strength reduction factor for flexure (ACI 349-06, Section 9.3.2.1)	ϕ_M	0.90
Out-of-plane moment capacity $\phi M_N = \phi_M M_N$	**ϕM_N (kip-ft/ft)**	**414**
In-plane shear capacity	**$\phi V_{In\text{-}plane}$ (kip/ft)**	**183**
Out-of-plane shear capacity	**ϕV_{OOP} (kip/ft)**	**87**

RAI 03.08.04-15, RAI 03.08.04-16, RAI 03.08.04-17, RAI 03.08.04-26S1

Figure 3B-15: RXB Reinforcement Elevation at Grid Line 4 Wall



RAI 03.08.04-15, RAI 03.08.04-16, RAI 03.08.04-17, RAI 03.08.04-26S1

Figure 3B-16: RXB Reinforcement Section View of 5 ft Thick Wall on Grid Line 4

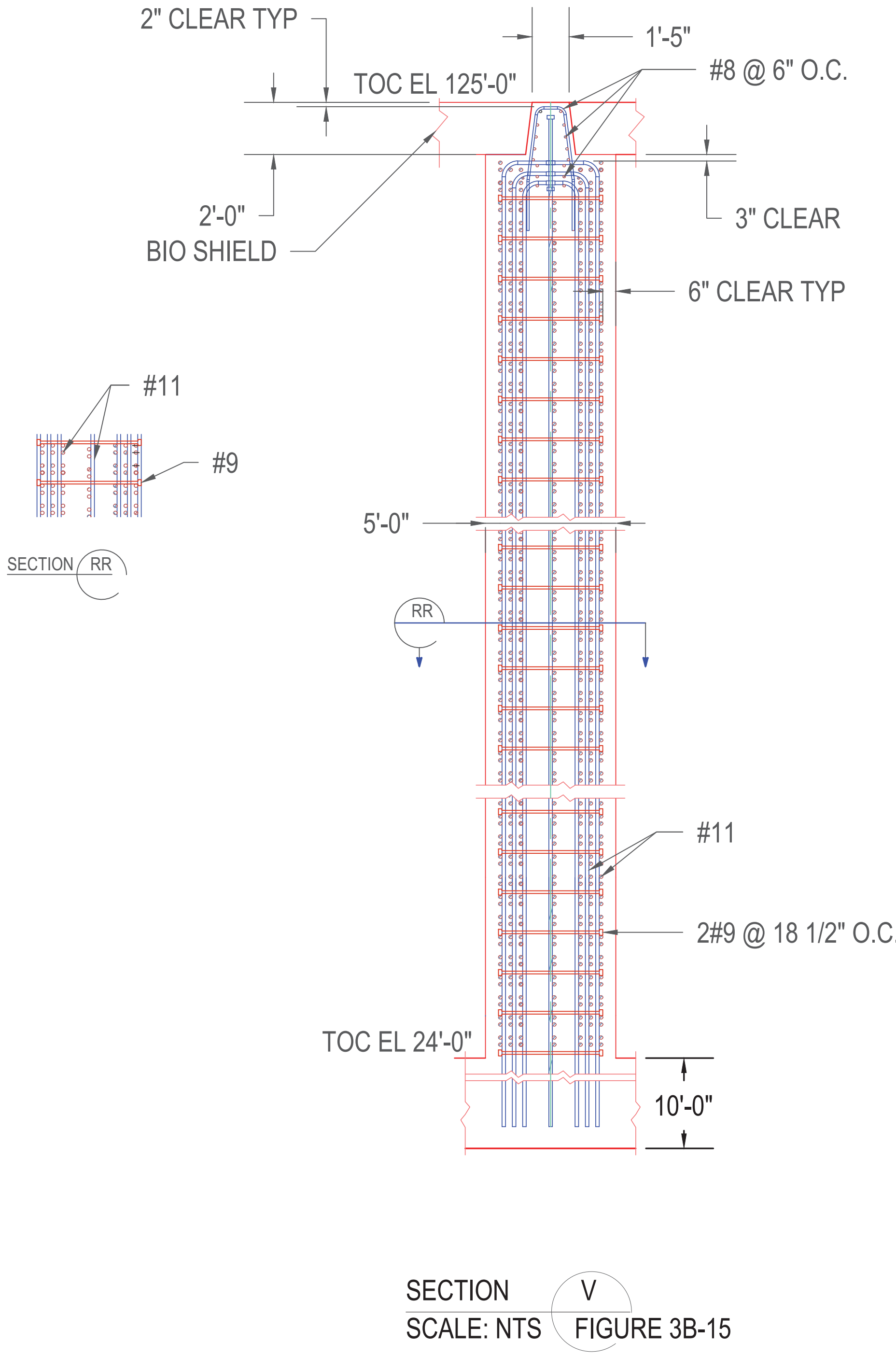


Figure 3B-42: ~~SAP2000 Elevation View and Shell Element Numbers for West Wing Wall at Grid Line 4~~Not Used

RAI 03.08.04-15, RAI 03.08.04-16, RAI 03.08.04-17, RAI 03.08.04-26S1

Figure 3B-43: ~~RXB Reinforcement Elevation at RXB Grid Line 4 Wall~~Not Used

RAI 03.08.04-15, RAI 03.08.04-16, RAI 03.08.04-17, RAI 03.08.04-26S1

Figure 3B-44: ~~RXB Reinforcement Section View of 5 Foot Thick Wall on RXB Grid Line 4~~Not Used