STP Nuclear Operating Company

South Texas Project Electric Generating Station P.O. Box 289 Wadsworth, Texas 77483

July 21, 2010
U7-C-STP-NRC-100147
10 CFR 50.12
10 CFR 50.10

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

South Texas Project
Units 3 & 4
Docket Nos. 52-012 and 52-013
Revised Request for Exemption to Authorize
Installation of Crane Foundation Retaining Walls

References: 1. Letter, Mark A. McBurnett to Document Control Desk, "Request for Exemption to Authorize Installation of Crane Foundation Retaining Walls," U7-C-STP-NRC-100066, dated March 23, 2010 (ML100880055)

2. Letter, Scott Head to Document Control Desk, "Response to Request for Additional Information," U7-C-STP-NRC-100132, dated July 21, 2010

STP Nuclear Operating Company (STPNOC) has submitted an application for combined licenses (COLs) for South Texas Project (STP) Units 3 & 4 (STP 3 & 4), and the NRC has docketed that application. Plans for construction and installation activities rely on the use of construction cranes that are founded at the site grade elevation. Crane foundation retaining walls (CFRW) are needed to allow the crane foundations to be located at grade adjacent to the excavation areas for STP 3 & 4. The purpose of this letter is to revise the previous STPNOC request for an exemption to authorize installation of the CFRW prior to issuance of COLs for STP 3 & 4 (Reference 1), to incorporate STPNOC's response to the Request for Additional Information regarding the CFRW (Reference 2), and to incorporate into a single document the information required to support the exemption request. Changes in this revision to text and tables in the attachment are indicated by revision bars in the right hand margin. Changes to figures are as described.

The attachment to this letter provides STPNOC's revised formal request for an exemption from 10 CFR 50.10(a)(1), to the extent necessary to authorize installation of the CFRW for STP 3 & 4,

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and provides the information identified by § 50.12, including the relevant factors identified in § 50.12(a), and the four factors to be balanced in accordance with § 50.12(b).

Preparation for installation of the CFRW is ongoing, with final installation activities planned to begin no later than November 1, 2010. Since CFRW installation is a critical path activity for the construction of STP 3 & 4, STPNOC seeks prompt approval to avoid unnecessary delay and expense, and requests that the NRC make a determination on this request as soon as practicable.

There are no commitments in this letter.

If there are any questions regarding this request, please contact me at (361) 972-7136, or Bill Mookhoek at (361) 972-7274.

I declare under penalty of perjury that the foregoing information is true and correct.

Executed on 7/21/10

Scott Head
Manager, Regulatory Affairs
South Texas Project Units 3 & 4

ccc

Attachment: Request for Exemption for Crane Foundation Retaining Wall Installation cc: w/o attachment except*

(paper copy)

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Attachment

Request for Exemption for Crane Foundation Retaining Wall Installation

A. Introduction and Purpose

Introduction

STP Nuclear Operating Company (STPNOC) has submitted an application for combined licenses (COLs) for South Texas Project (STP) Units 3 and 4, and the NRC has docketed that application. Plans for construction include installation of construction cranes that are founded at the site grade elevation. Crane foundation retaining walls (CFRW) are needed to allow the crane foundations to be located at grade adjacent to the excavation areas for Units 3 and 4. Installation of the CFRW must precede the excavation. Excavation as defined in 10 CFR 50.10(a)(2)(v) is not a construction activity.

Under 10 CFR 50.10 COL applicants may perform certain activities defined in § 50.10(a)(2) without prior approval by the U.S. Nuclear Regulatory Commission (NRC). However, COL applicants are prohibited from performing construction activities, as defined in § 50.10(a)(1), without prior NRC approval. Under § 50.12, an applicant may request an exemption permitting the conduct of activities that are otherwise prohibited by § 50.10 prior to the issuance of a COL.

Purpose

Pursuant to 10 CFR 50.12(b), STPNOC requests an exemption from certain of the prohibitions specified under 10 CFR 50.10 to authorize the installation of the CFRW for STP Units 3 & 4, i.e., one CFRW per unit for a total of two CFRW.

B. Requested Exemption

STPNOC requests a limited exemption from the definition of construction in 10 CFR 50.10(a)(1), which states: "Activities constituting construction are the driving of piles, subsurface preparation, placement of backfill, concrete, or permanent retaining walls within an excavation, installation of foundations, or in-place assembly, erection, fabrication, or testing, which are for…." The requested exemption is limited to CFRW installation as summarized below and described in more detail on the following pages.

The exemption request is for CFRW located to the east of the excavation for each unit and generally extending approximately 890 feet in the north-south direction, from south of the Reactor Building to north of the Turbine Building. The location and length of the CFRW is established to support the installation of the construction crane pads. The exposed height of the CFRW is expected to vary up to a maximum of approximately 90 feet. The maximum depth of the CFRW is approximately minus 80 feet elevation. The CFRW are permanent since the tiebacks will be cut/de-tensioned and they will be abandoned in place.

C. CRFW Role, Location, and Description

NOTE: Distances, where provided below, are approximated.

1. Role of CFRW in Site Preparation and Excavation Activities.

Planning for the STP Units 3 and 4 preconstruction sequence includes the *in situ* installation of CFRW prior to excavations for plant construction, i.e., the CFRW will be installed prior to the commencement of any nearby excavation activities. As described in Final Safety Analysis Report (FSAR) Section 2.5S.4.5.2.4[1], CFRW is required to accommodate the reach of a heavy lift crane needed to place the reactor vessels. In addition, the crane will be used for other major lifts in support of the modular construction of the facility. The sole purpose of the CFRW is to facilitate excavation activities by retaining soil next to the excavations of the Reactor Building (R/B), Control Building (C/B), and Turbine Building (T/B) foundations, allowing the crane areas to be at grade and near the buildings. The CFRW are used only during plant construction activities. The CFRW are permanent structures, since they will be abandoned in-place, having no permanent facility function.

The CFRW are located to the east side of each unit and generally extend, in a North-South line, from south of the R/B to north of the T/B. Figure 1a, which is an annotated version of FSAR Figure 2.5S.4-48, illustrates the Units 3 and 4 overall excavation plan and notes the location of the walls, relative to each unit. The CFRW for each unit are labeled in Figure 1 as the crane wall. The location of the CFRW is established to support the installation of the crane pads. As discussed in more detail below, the CFRW have no adverse interactions with any of the structures, systems or components (SSC) identified in 10 CFR 50.10(a)(1).

2. Location of CFRW Relative to Construction Activities.

As noted above, an annotated version of FSAR Figure 2.5S.4-48 is provided in this attachment as Figure 1a. Figure 1b shows a cutaway view showing the relative location of the CFRW to the R/B. The referenced figures are general illustrations of the arrangement of plant structures and do not precisely represent separation distances. However, the approximate separation distances between the CFRW and the structures described below will be met during plant construction. The CFRW location generally provides a separation distance of approximately 15 feet from structure walls of SSCs identified in 10 CFR 50.10(a)(1). Exceptions to this uniform distance are discussed in Appendix A.

3. Physical Description and Installation of the CFRW.

As discussed in FSAR Section 2.5S.4.5.2.4, the CFRW are non-safety related, reinforced concrete walls. One CFRW is installed on the east side of each unit. The installation method utilizes an *in situ* “slurry trench” method. As described in FSAR Section 2.5S.4.5.4.4, this method consists of excavating a "one bucket wide" trench that is continuously filled with

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[1] FSAR references pertain to Revision 3 (Reference 1).

"slurry." The slurry exerts positive hydrostatic pressure against the trench wall, thereby maintaining vertical excavation sidewalls, even below the groundwater table, which enables the placement of reinforcing and concrete.

The anticipated sequence for construction of the CFRW is as follows:

- A full depth and width slurry excavation is made with the excavation being maintained by the slurry
- Reinforcing is placed in the slurry filled trench
- Concrete is placed by tremie in the excavation from the bottom up
- As the site construction excavation proceeds on the west side of the wall, tiebacks and whalers are installed.

During subsequent excavation, the exposed height of the CFRW is expected to vary up to a maximum of 90 feet. Lateral support for the CFRW is provided by a tieback and whaler system, as described in FSAR Section 2.5S.4.5.2.4. The CFRW are construction aids provided for the purpose of supporting cranes used during construction. The area on the west side of the CFRW will be backfilled as construction progresses. Following crane use, the tiebacks will be cut/de-tensioned and the CFRW will be abandoned in place.

D. Application of 10 CFR 50.12(a)

Section 50.12(a) states that the NRC may grant exemptions which are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security. In addition, the NRC will not consider granting an exemption unless special circumstances are present.

1. The exemption is authorized by law.

   Issuance of the exemption is authorized by law since this is the type of exemption contemplated by § 50.12(b), and would not conflict with any provision of the Atomic Energy Act, the National Environmental Policy Act (NEPA), or any other law.

2. The exemption does not present an undue risk to the public health and safety.

   As described above, the exemption will authorize installation of CFRW for STP Units 3 & 4 before issuance of COLs. The exemption will affect only the timing of installation of the CFRW, and will not affect any NRC safety requirements that apply to the design, construction and operation of STP Units 3 & 4. Similarly, the exemption also will not affect any NRC requirements that apply to the operation of STP Units 1 & 2. Consequently, the exemption will not present an undue risk to the public health and safety.

3. The exemption is consistent with the common defense and security.

   Because the exemption will only affect the timing of installation of the CFRW, and will not authorize the possession of licensed material or affect any NRC security requirements that apply to STP Units 1, 2, 3 & 4, the exemption is consistent with the common defense and security.

4. Special circumstances are present.

   10 CFR 50.12(a)(2) states that special circumstances are present whenever any of six listed circumstances exist. The following listed circumstances apply here:

   a. Section 50.12(a)(2)(ii) applies because application of the regulation to CFRW installation will not serve the purposes of Section 50.10(c).

      The purpose of § 50.10(c) is to prohibit the initiation of onsite construction activities that have a reasonable nexus to safety before issuance of NRC approval. Application of § 50.10 to delay the installation of the CFRW will not serve that purpose because the CFRW do not have a reasonable nexus to safety.

      Although the CFRW are permanent retaining walls, they do not affect the safety of STP Units 3 & 4 or have a reasonable nexus to safety. As described above, the CFRW are non-safety related support facilities for construction. The location of the CFRW is designed to accommodate the crane function and to facilitate modular construction techniques. The CFRW are considered "permanent" because the tiebacks will be cut/de-tensioned and they will be abandoned in-place after construction. The CFRW have no function during operation of STP Units 3 & 4, and will not affect the safety of any plant structures. This conclusion is supported by an evaluation of the influence of the CFRW on interactions with the structures, systems or components identified in 10 CFR 50.10(a)(1), including influence on the stability (static and dynamic) analyses. This evaluation is included with this attachment as Appendix A which shows that the CFRW has no adverse influence on the stability (static and dynamic) of any SSCs identified in 10 CFR 50.10(a)(1).

      The results reported in Appendix A reflect the effect of the CFRW on the safety-related structures as described in the COL application. Fundamentally, the relatively small CFRW is inconsequential to the massive Reactor and Control Buildings and has no significant effect on those structures. Additional details concerning the analytical models and results are provided in Appendix B.

      Consequently, the special circumstance described in 10 CFR 50.12(a)(2)(ii) applies to this exemption request.

b. Section 50.12(a)(2)(iii) applies because compliance with § 50.10(c) would result in undue hardship or other costs that are significantly in excess of those contemplated when NRC adopted the most recent modifications to § 50.10.

If installation of the CFRW is not initiated until after receipt of the COLs the construction schedule for STP Unit 3 would be extended and commercial operation of Unit 3 would be delayed by approximately eight months. STPNOC understands that the procedural requirements for issuance of an LWA to allow the installation of the CFRW prior to COL issuance would have an adverse impact on the schedule for completion of NRC's review of the COL application, and would delay COL issuance. Although the amount of such delay is uncertain, any such delay would also delay commercial operation of Unit 3. The cost of any delay of the commercial operation of Unit 3 would depend upon a number of uncertain factors, but is expected to be substantial.

STPNOC has identified two potentially viable alternative construction approaches to reduce or avoid such delay; however, either approach would involve significant increased cost and technical uncertainties. The first alternative is to redesign the CFRW to make it practical to remove them prior to fuel load. If such a redesign could be accomplished, the CFRW would be temporary structures, and installation would clearly be an activity that does not meet the definition of construction. There are, however, technical considerations that would need to be resolved before this approach could be considered viable, and it is estimated that use of temporary CFRW would increase the combined cost of construction of Units 3 & 4 by approximately $22 million. The second alternative is to increase the size of the excavation and locate the construction cranes in the excavation. This alternative would result in the need to dismantle, relocate, and reassemble the cranes from time to time during construction to facilitate backfill operations. This would significantly complicate the construction sequence, is estimated to increase combined cost of construction of Units 3 & 4 by more than $260 million and would extend the construction schedule by in excess of 5 months.

The need for CFRW arises from the unique characteristics of the STP site, which is a deep soil site without any rock foundations. Without the CFRW, it will not be possible to locate the construction cranes sufficiently close to the permanent plant buildings and at plant grade. Since installation of the CFRW must be accomplished before the excavation for the permanent plant structures, compliance with § 50.10(c) will result in the costs described above. Such costs were not considered by the Commission, and would not occur at sites that have rock foundations.

E. Application of 10 CFR 50.12(b)

The balance of the factors in § 50.12(b) supports issuance of the requested exemption.

1. Installation of the CFRW will not give rise to a significant adverse impact on the environment.

   The impacts of CFRW installation are within the scope of the anticipated preconstruction activities described in Sections 3.9S and 3.10S and Chapter 4 of the Environmental Report for STP Units 3 & 4 (ER). The principal CFRW installation steps consist of:

   - Full depth and width slurry excavation for each CFRW, with the excavation being maintained by the slurry
   - Reinforcing placed in the slurry filled trench
   - Concrete placed by tremie in the excavations from bottom up
   - Installation of tiebacks and whalers as the site construction excavation proceeds to provide lateral support for the CFRW

   Installation of each CFRW will disturb an area approximately 890 feet long by 13 feet wide, which is 23,140 square feet or or approximately 0.54 acres for both CFRW. This acreage is 0.1 percent of the 540 acres that are estimated to be impacted by site preparation and construction of STP Units 3 & 4 (ER Table 4.1-1).

   As described in ER Section 4.1, the affected area was previously disturbed during the construction of STP Units 1 & 2, and is not environmentally sensitive.

   As described in ER Section 4.6, CFRW installation will employ best management practices (BMP) in accordance with regulatory and permit requirements, and will implement the environmental controls required in the Storm Water Pollution Prevention Plan (SWPPP). These measures will mitigate the impacts of ground disturbance due to CFRW installation and assure that there will not be a significant environmental impact.

   Approximately 75 workers are expected to be needed to complete CFRW installation. This is a small fraction of the estimated 1300 to 2400 workers projected to be employed during preconstruction activities, as described in ER Section 3.10S. In fact, 75 workers is within the normal variation in the number of workers and visitors at the STP site (ER Figure 3.10S-3). Given the small number of workers involved with installation of the CFRW, the CFRW installation will not result in significant adverse socio-economic impacts to local communities.

   The completed CFRW will be below-grade reinforced concrete walls approximately three feet wide, extending 890 feet in the north-south direction and to a maximum depth of minus 80 feet elevation. The CFRW will not be a significant barrier to movement of groundwater because of their limited depth (ER Section 4.2.1).

The completed CFRW will not have an adverse aesthetic impact, since they are below grade and not visible from off-site (ER Section 4.4.2.2.5).

Consequently, installation of the CFRW will not give rise to a significant adverse impact on the environment.

2. Redress of any adverse environmental impact from CFRW installation can reasonably be effected should such redress be necessary.

   As discussed above, installation of the CFRW will not result in a significant adverse environmental impact. The presence of the CFRW will not prevent any anticipated future uses of the STP site, or of the site-area in the vicinity of Units 3 & 4, and if it ever becomes desirable to remove the CFRW, this could be done using conventional construction methods. Therefore, redress of any adverse environmental impact due to CFRW installation can be reasonably effected, and no anticipated future use of the site will be prevented.

3. CFRW installation will not foreclose subsequent adoption of alternatives.

   None of the alternatives considered in the ER Chapter 9 would require any different use of the subsurface in the vicinity of the CFRW location, and the cost of CFRW installation would be a small fraction of the cost of preconstruction activities. Consequently, installation of the CFRW will not foreclose adoption of any alternatives.

4. Delay of CFRW installation would impose a significant cost that would be contrary to the public interest.

   As described above, delay of CFRW installation until COL issuance would delay commercial operation of Unit 3 by approximately eight months, and alternative construction approaches would significantly increase the cost of construction.

   Thus, delay in CFRW installation would result in significant cost to the owners of STP Units 3 & 4 and the public. Issuance of an exemption authorizing CFRW installation would avoid these unnecessary costs, and is clearly in the public interest.

5. Issuance of such an exemption shall not be deemed to constitute a commitment to issue a construction permit. During the period of any exemption granted pursuant to paragraph (b), any activities conducted shall be carried out in such a manner as will minimize or reduce their environmental impact.

   STPNOC acknowledges that issuance of the requested exemption would not constitute a commitment to issue COLs for STP Units 3 & 4. As described above, the activities authorized by the exemption will be carried out in accordance with Best Management Practices and will not have a significant environmental impact.

F. Conclusion

CFRW installation is of critical importance to the STP Units 3 & 4 construction schedule. Issuance of an exemption to authorize CFRW installation prior to issuance of COLs is consistent with the provisions of 10 CFR 50.12, and the four factors identified in § 50.12(b) all favor the granting of this exemption request.

G. References

1. Letter, Mark A. McBurnett to Document Control Desk, "Submittal of Combined License Application Revision 3," dated September 16, 2009, U7-C-STP-NRC-090130 (ML092930393)

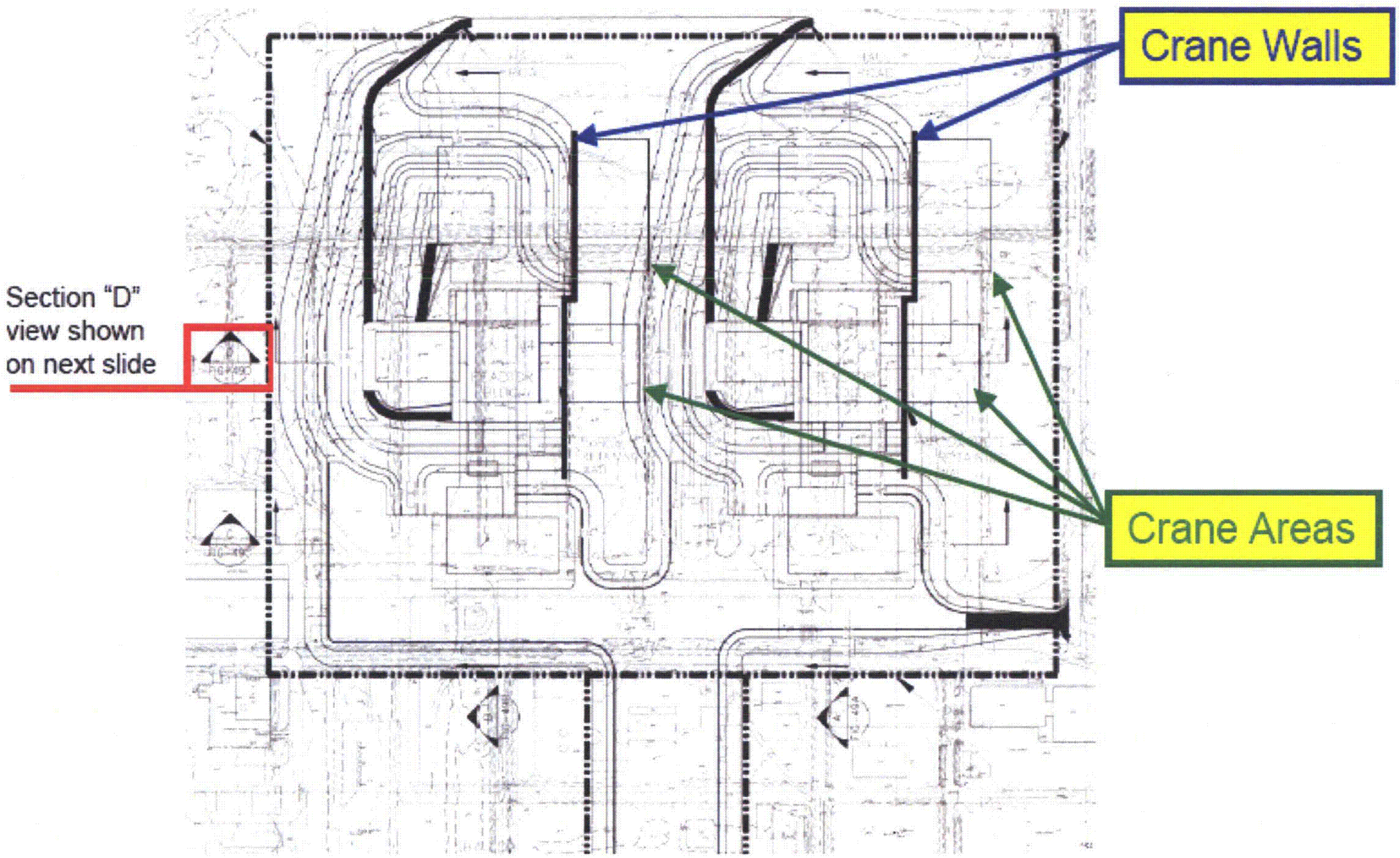


Figure 1a. Overall Excavation Plan (From FSAR Figure 2.5S.4-48)

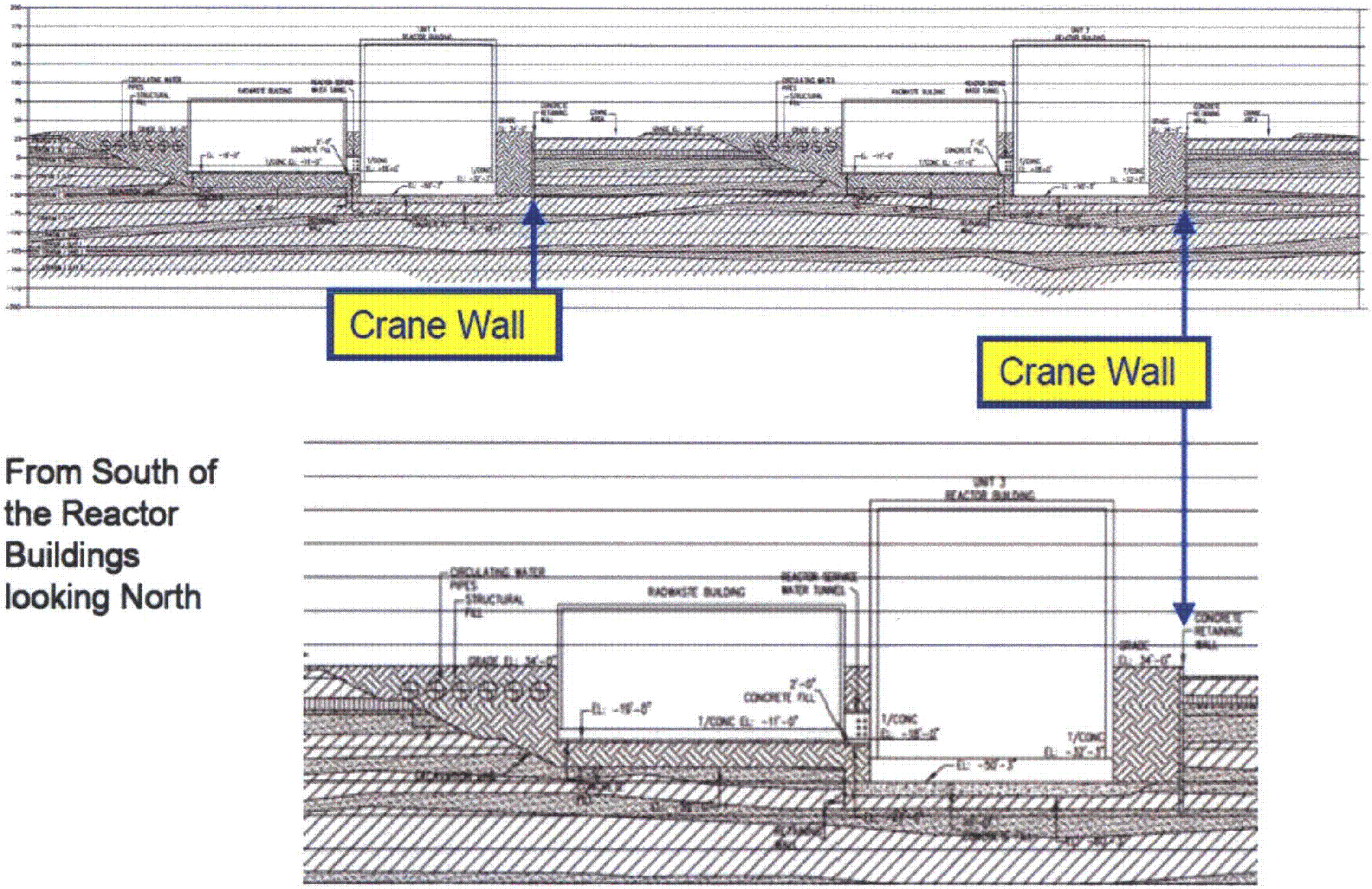


Figure 1b. Cutaway View (From FSAR Figure 2.5S.4-49D Section "D")

Appendix A

Crane Foundation Retaining Wall Evaluation Summary

Crane Foundation Retaining Wall Evaluation Summary

A. Purpose and Scope

1. Purpose

The purpose of this evaluation is to demonstrate that the construction Crane Foundation Retaining Wall (CFRW) installation has no adverse interactions with SSCs as identified by 10 CFR 50.10(a)(1)(i) through (vii), including influence on the stability (static and dynamic) analyses.

2. Scope of Evaluation

To assess the potential for adverse interactions with SSCs as identified by 10 CFR 50.10 (a)(1)(i) through (vii), the scope of this evaluation includes:

a. Soil-structure interaction analysis
b. Static and dynamic bearing capacity and settlement

The appropriate elements of the STPNOC Quality Assurance Program Document (QAPD) for design and construction would be applied to the evaluation described below.

3. Structures Evaluated

SSCs as identified by 10 CFR 50.10(a)(1)(i) through (vii) with potential influence from the CFRW installation, i.e., the structures included in the evaluation, are:

a. Reactor Building
b. Control Building
c. Ultimate Heat Sink and Reactor Service Water Pump House
d. Turbine Building
e. Service Building
f. Diesel Generator Fuel Oil Storage Vault and Tunnel
g. Reactor Service Water Piping Tunnel
h. Fire Protection Pump House

B. Evaluation and Results

NOTE: Distances, where provided below, are approximated.

1. Soil-structure interaction (SSI) analysis

The CFRW occupies a very small volume relative to the overall soil mass and represents a small increase in overall weight as compared to the replaced soil (150 pcf concrete density versus soil densities of 125 to 130 pcf). As expected, it has a negligible effect on other nearby structures.

In order to confirm this expectation, an SSI analysis of the Reactor and Control Buildings was performed for the site-specific conditions, including site-specific Safe Shutdown Earthquake (SSE) and soil properties. This analysis was performed using two-dimensional (2D) models. For these 2D analyses, 2D models of the Reactor and Control Buildings were developed, and SSI analyses were performed using computer program SASSI2000, described in Final Safety Analysis Report (FSAR) Appendix 3C.8. These analyses used the same methodology, soil properties, and input motions as described in detail in FSAR Appendix 3A, Sections 3A.12 through 3A.21, except that a 2D model was used instead of a 3D model. The use of a 2D model was necessary since both the buildings and the CFRW could not be modeled in a 3D model which would be of a manageable size. The CFRW was modeled with the Reactor Building and Control Building in separate analyses, and the SSI analyses were repeated to evaluate the influence of the CFRW on the seismic response of the Reactor and Control Buildings.

a. Reactor Building

The CFRW is installed 15 feet from the exterior wall of the Reactor Building (R/B). The comparison of the SSI analysis results, with and without the CFRW, are presented in Figures 2.1 through 2.4 for the R/B in-structure response spectra at four locations: bottom of basemat, reactor pressure vessel/main steam (RPV/MS) nozzle, top of the reinforced concrete containment vessel (RCCV), and top of the R/B. Table 2.1 compares maximum forces and moments, at key locations, with and without the CFRW. It can be seen from these figures and table that the CFRW does not have a significant effect on the responses of the R/B.

Figure 2.5 shows a comparison of the lateral soil pressure obtained from the SSI analysis on the R/B walls, with and without the CFRW. As expected, the lateral soil pressures are increased due to the presence of the CFRW. However, the R/B exterior walls are designed for the larger of the: (1) pressures provided in the Advanced Boiling Water Reactor Design Control Document (DCD) Tier 2 Figure 3H.1-11 and (2) pressures obtained from the alternate modified Ostadan method described in FSAR Reference 2.5S.4-62 (see FSAR Section 2.5S.4.10.5.2). Both of these methods yield lateral pressures substantially higher than those obtained from the SSI analysis, as shown in Figure 2.5. Therefore, the increase in pressure due to the CFRW in the SSI analysis is of no consequence to the design of the exterior walls.

b. Control Building

The CFRW is installed 80 feet from the exterior wall of the Control Building (C/B). The SSI analysis described above for the R/B and CFRW was also performed for the C/B and the CFRW. The distance separating the C/B from the CFRW used in the analysis was conservatively based on 67 feet. Comparison of the in-structure response spectra for the C/B at the top of the basemat and the top of the C/B is shown in Figures 2.6 and 2.7, and the comparison of maximum seismic forces and moments is shown in Table 2.2. It can be seen from these figures and table that the CFRW does not have a significant effect on the responses of the C/B.

The evaluation and conclusion for lateral soil pressure for the C/B is the same as described for the R/B in paragraph B.1.a above.

c. Ultimate Heat Sink and Reactor Service Water Pump House

The Ultimate Heat Sink (UHS) and Reactor Service Water Pump House (RSWPH) is a large structure. Its smallest separation distance from the CFRW is 60 feet. The dynamic response of a relatively large structure (UHS and RSWPH) at a significant distance from a relatively small structure (CFRW) would not be influenced by the presence of the small structure. Based upon the results of the R/B and C/B SSI analyses, it can be concluded that the CFRW does not have a significant effect on the response of the UHS and RSWPH.

d. Turbine Building

The CFRW is installed 15 feet from the exterior wall of the Turbine Building (T/B). The T/B is a large structure. The influence of the CFRW, a much smaller structure, on the T/B is expected to be insignificant. Based upon the results of the R/B SSI analyses, it can be concluded that the CFRW does not have a significant effect on the response of the T/B.

e. Service Building

The Service Building (S/B) is a non-Seismic Category I structure (refer to FSAR Section 3.2, Table 3.2-1) designed for the SSE, meeting Seismic Category II/I requirements. The SSE input for this II/I evaluation is determined based on the influence of a heavy structure (i.e., C/B) on the lighter nearby structure (S/B). The influence of the C/B on the SSE input and design of the S/B far exceeds any influence from the much lighter CFRW. Therefore, the presence of the CFRW has no influence on the S/B design.

f. Diesel Generator Fuel Oil Storage Vault and Tunnel

The Diesel Generator Fuel Oil Storage Vault and Tunnel are designed for the SSE input considering the influence of a heavy structure (i.e., R/B) on the lighter nearby structure (Diesel Generator Fuel Oil Storage Vault and Tunnel). The influence of the R/B on the SSE input and design of the Diesel Generator Fuel Oil Storage Vault and Tunnel far exceeds any influence from the much lighter CFRW. Therefore, the presence of the CFRW has no influence on the design of the Diesel Generator Fuel Oil Storage Vault and Tunnel.

g. Reactor Service Water (RSW) Piping Tunnel

The RSW Piping Tunnel is located more than 250 feet away from the CFRW. At this location, the CFRW has no effect on the RSW Piping Tunnel.

h. Fire Protection Pump House

The Fire Protection Pump House is located more than 300 feet away from the CFRW. At this location, the CFRW has no effect on the Fire Protection Pump House.

2. Static and Dynamic Bearing Capacity and Settlement

A qualitative engineering assessment was performed to determine if the preconstruction activity of installing the CFRW results in adverse interactions with the static and dynamic stability (bearing capacity and settlement) of the structures listed in Section A.3 above. The 3-foot wide concrete CFRW is needed to provide support for cranes that will be used during construction of Units 3 & 4. The CFRW is generally located on the east side of each unit. The closest separation from the CFRW and the near edge of a structure wall foundation (specifically a Diesel Generator Fuel Oil Storage Vault) is 15 feet to the structure wall and 11 feet to the edge of the foundation. The Diesel Generator Fuel Oil Storage Vaults foundations are at elevation minus 9 feet. The Diesel Generator Fuel Oil Storage Vault Tunnel is located between the R/B wall and the CFRW, approaching within approximately 2 feet of the CFRW. This tunnel structure is 7.5 feet wide and 11 feet high with the bottom bearing at elevation 23 feet, 11 feet below planned post-construction site grade of 34 feet. The tunnel structure will be supported on structural fill placed as backfill for Units 3 & 4 excavation. The structural loads resulting from the tunnel structure are similar to those of the backfill loads and the CFRW will have negligible impact to the Diesel Generator Fuel Oil Storage Vault Tunnel. The S/B will be located across the CFRW, supported on undisturbed soil and/or backfill west of the CFRW and on undisturbed soil on the east side of the CFRW. The S/B will be separated by 3 feet of soil from the top of the CFRW and 15 feet horizontally from the CFRW. Thus, the CFRW does not support the S/B foundation.

The qualitative analysis of the R/B was performed as the worst case scenario due to its proximity to the CFRW and because the bulk of the structural fill within the nuclear island would not be in place at the time of its construction. The bottom of the CFRW at elevation minus 80 feet is 30 feet below the foundation level elevation (minus 50 feet) of the R/B. The R/B foundation is underlain by 10 feet of concrete fill (stress influence extending at a roughly 45 degree angle outward to elevation approximately minus 60 feet) whose edge is then 5 feet from the CFRW.

a. Bearing Capacity

From qualitative considerations, the results of existing analyses (refer to FSAR Section 2.5S.4.10.3) indicate that the conclusion that the ultimate static bearing capacity will exceed the applied soil bearing pressure by an adequate factor of safety of three remains valid.

The dynamic bearing capacity is of interest after construction is complete and fuel is loaded. The CFRW does not impact the dynamic bearing capacity after construction since the space between the safety-related and non-safety related structures and the CFRW has been backfilled and the soil behind the CFRW will be in a natural state. Therefore, there is no adverse impact to safety-related and non-safety related structures.

b. Settlement

The qualitative assessment for the settlement considered: (1) the change in settlement caused by the change in area (configuration) of the structural fill zones surrounding the R/B; (2) the impact to settlement due to adhesion created between the structural fill and the CFRW; and (3) the impact of adhesion on soil rebound. From qualitative considerations, the CFRW will affect the settlement of the R/B foundation in the following ways:

- The bottom elevation of the CFRW, at 15 feet horizontally from and 30 feet deeper than the R/B foundation, encroaches on the 1:1 (horizontal: vertical) line usually used to assign relative depth between adjacent foundations to avoid stress overlap. This encroachment will interfere with (reduce) the dissipation of stress laterally away from the foundation, which will slightly increase settlement of the R/B foundation along the side nearest to the CFRW.

- Settlement of soil relative to the CFRW will be partially reduced by adhesion of the soil to the wall, and will slightly reduce the settlement of the R/B foundation.

- The weight of the retained soil mass will cause the stresses remaining in the soil beneath the R/B foundation at the completion of the excavation to be greater than if the entire area was excavated as was assumed in the existing settlement calculations (results presented in FSAR Section 2.5S.4.10.4). This will reduce the soil rebound of the reactor foundation subgrade in the vicinity. A reduction of soil rebound is generally considered a positive impact to the foundation.

The net effect of the qualitative assessment is that the total settlement of the R/B increases slightly at the east side of the structure due to the change in the configuration of the structural backfill zones as a result of the presence of the CFRW. However, this slight increase is offset due to the reduction in settlement caused by the adhesion between the soil and the CFRW. The results of the qualitative considerations indicate that there is generally little difference to the overall previously calculated total settlement (see FSAR Section 2.5S.4.10.4).

The qualitative assessment also indicates that the slight increase in settlement at the east side due to the presence of the CFRW has a beneficial effect on the angular distortion across the R/B. The amount of maximum angular distortion decreases across the structure from the previously calculated value of 1/600 (refer to FSAR Section 2.5S.4.10.4) to approximately 1/625 in the current qualitative analysis.

The CFRW is located between the loaded crane pad and the nuclear safety-related structures. The CFRW will act as a barrier between the crane pad and the structures so that there is little increase in effective stress and influence on the structures from crane operations.

The majority of the structures will be constructed farther away from the CFRW than the distance of the CFRW from the R/B. In addition, installation of the CFRW and a majority of the backfill should be completed prior to the construction of these other structures; therefore, the above-described qualitative assessment shows that the presence of the CFRW does not adversely influence the static and dynamic stability of the structures.

C. Conclusion

The evaluations discussed above demonstrate that the CFRW has no adverse interaction with SSCs as identified in 10 CFR 50.10(a)(1), including influence on the stability (static and dynamic) analyses.

Table 2.1
Reactor Building Force Comparison

Effect Of Crane Wall on Maximum Forces, Mean Soil				
Beam Element	Location	Response Type	Model in SASSI Analysis: 2-D Reactor Building (alone)	Model in SASSI Analysis: 2-D Reactor Building + Crane Wall
28	Shroud Support	Shear	101	98
		Moment	1,993	1,948
69	RPV Skirt	Shear	373	373
		Moment	6,500	6,420
78	RSW Base	Shear	299	313
		Moment	4,464	4,689
86	Pedestal Base	Shear	1,939	1,943
		Moment	118,771	119,905
89	RCCV at Grade	Shear	5,847	5,985
		Moment	319,708	329,289
99	R/B at Grade	Shear	12,941	13,117
		Moment	874,650	898,702

Units: Shear in kip; Moment in kip-ft

Table 2.2
Control Building Force Comparison

Effect of Crane Wall on Maximum Forces, Mean Soil				
Beam Element	Location	Response Type	Model in SASSI Analysis: 2-D Control Building (alone)	Model in SASSI Analysis: 2-D Control Building + Crane Wall
6	C/B at Grade	Shear	3,068	3,124
		Moment	111,181	110,472

Units: Shear in kip; Moment in kip-ft

Figure 2.1: Comparison of Response Spectra, Reactor Building, Bottom of Basemat

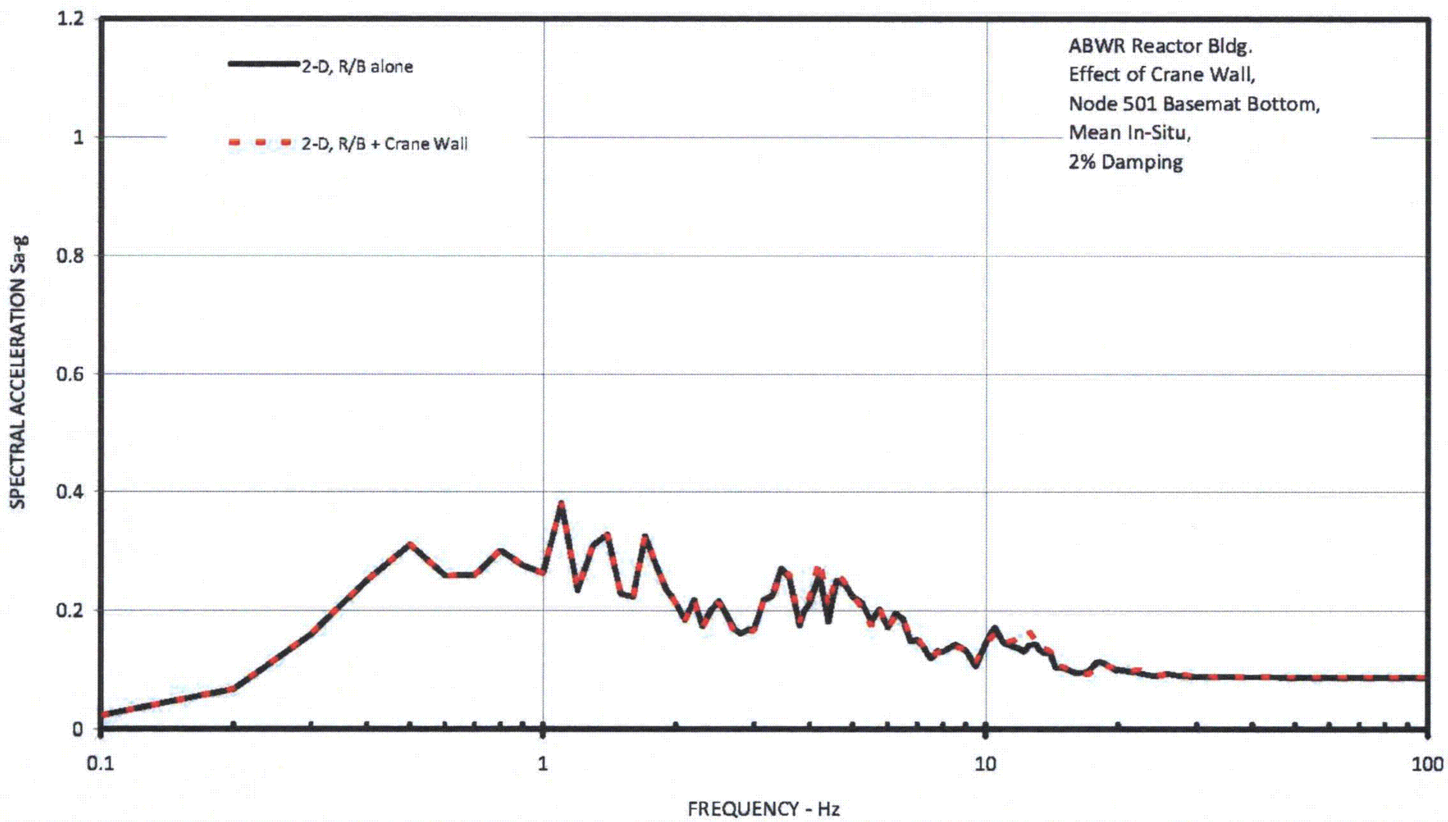


Figure 2.2: Comparison of Response Spectra, Reactor Building, RPV/MS Nozzle

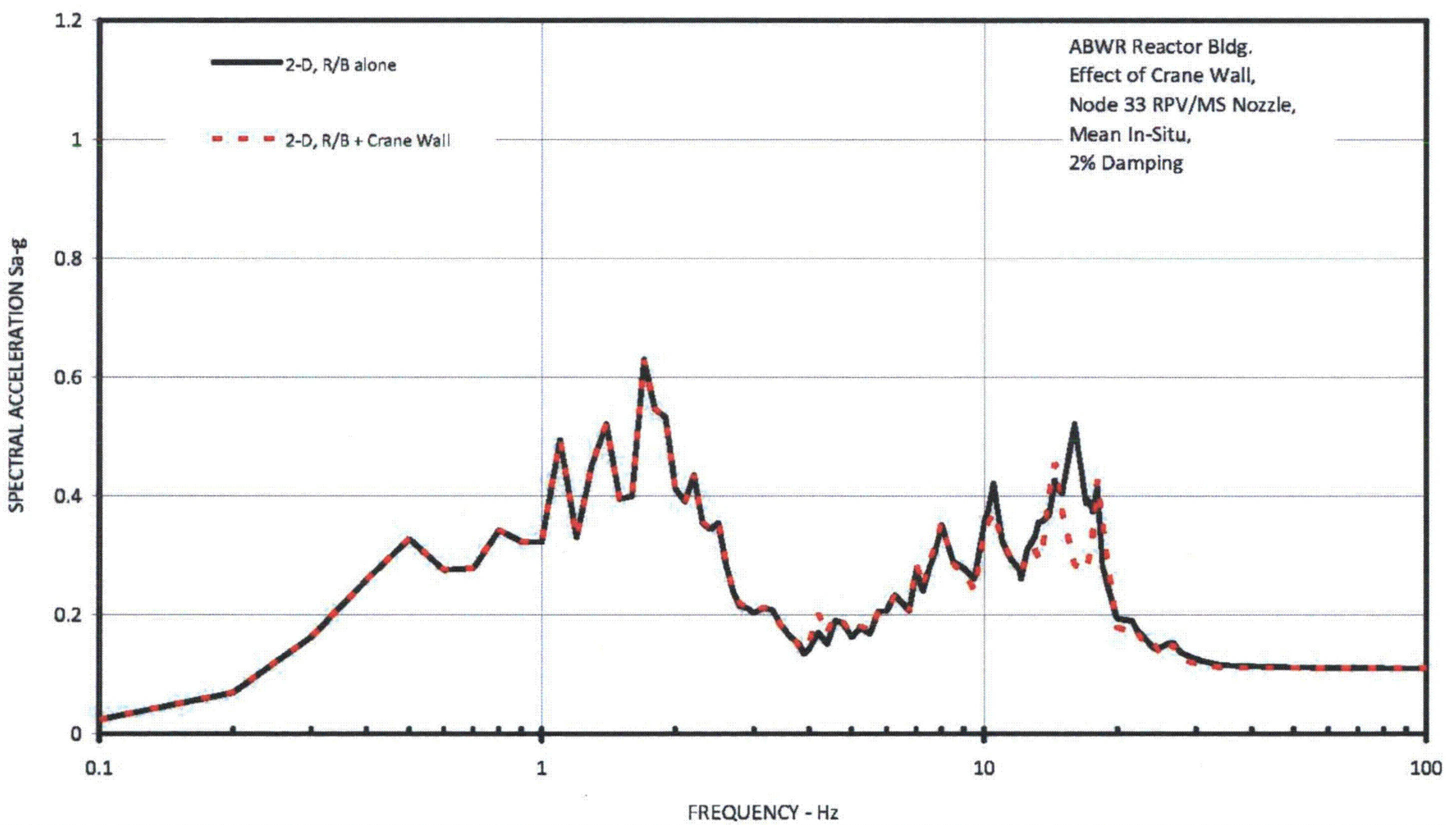


Figure 2.3: Comparison of Response Spectra, Reactor Building,Top of RCCV

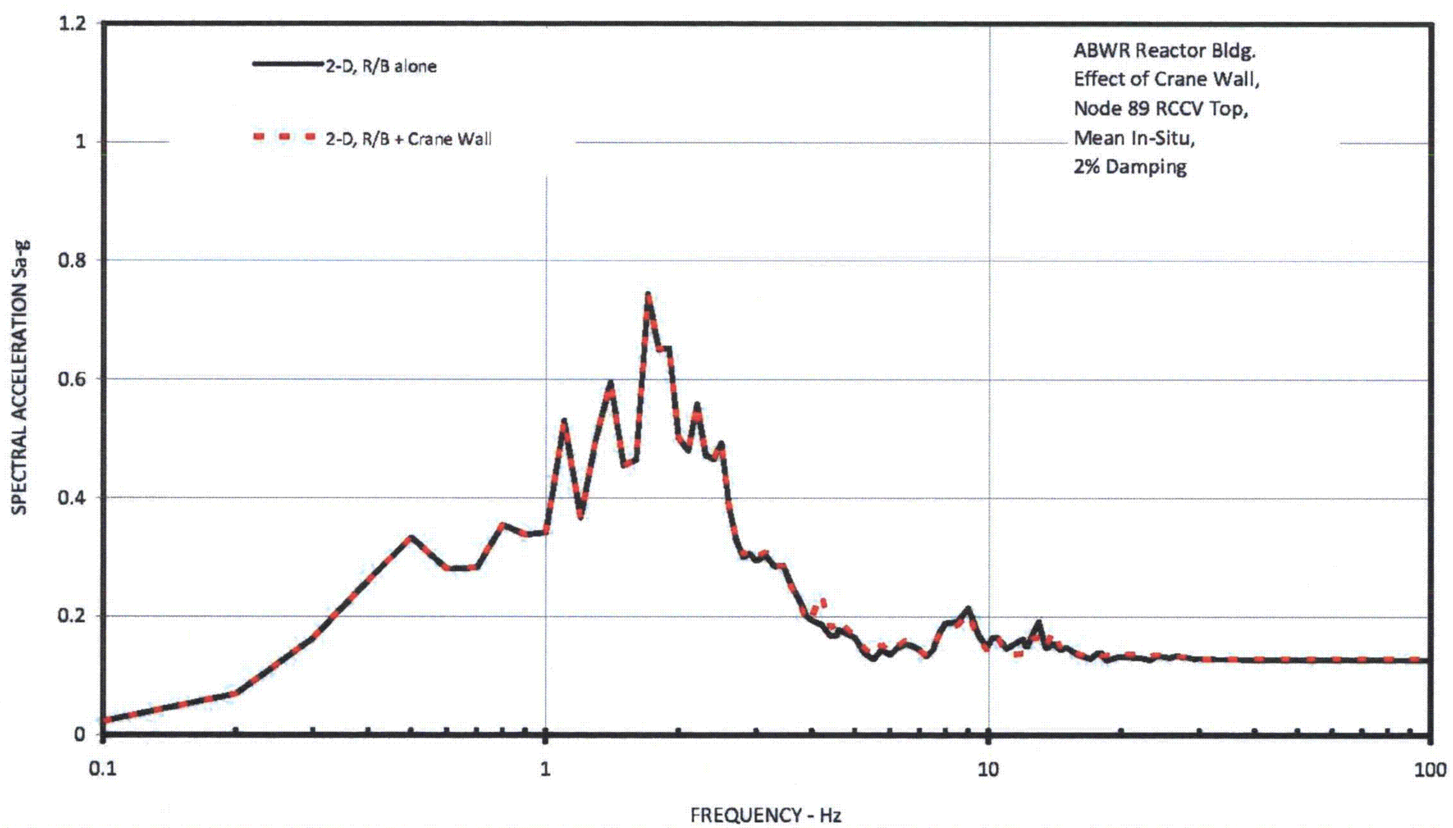


Figure 2.4: Comparison of Response Spectra, Top of Reactor Building

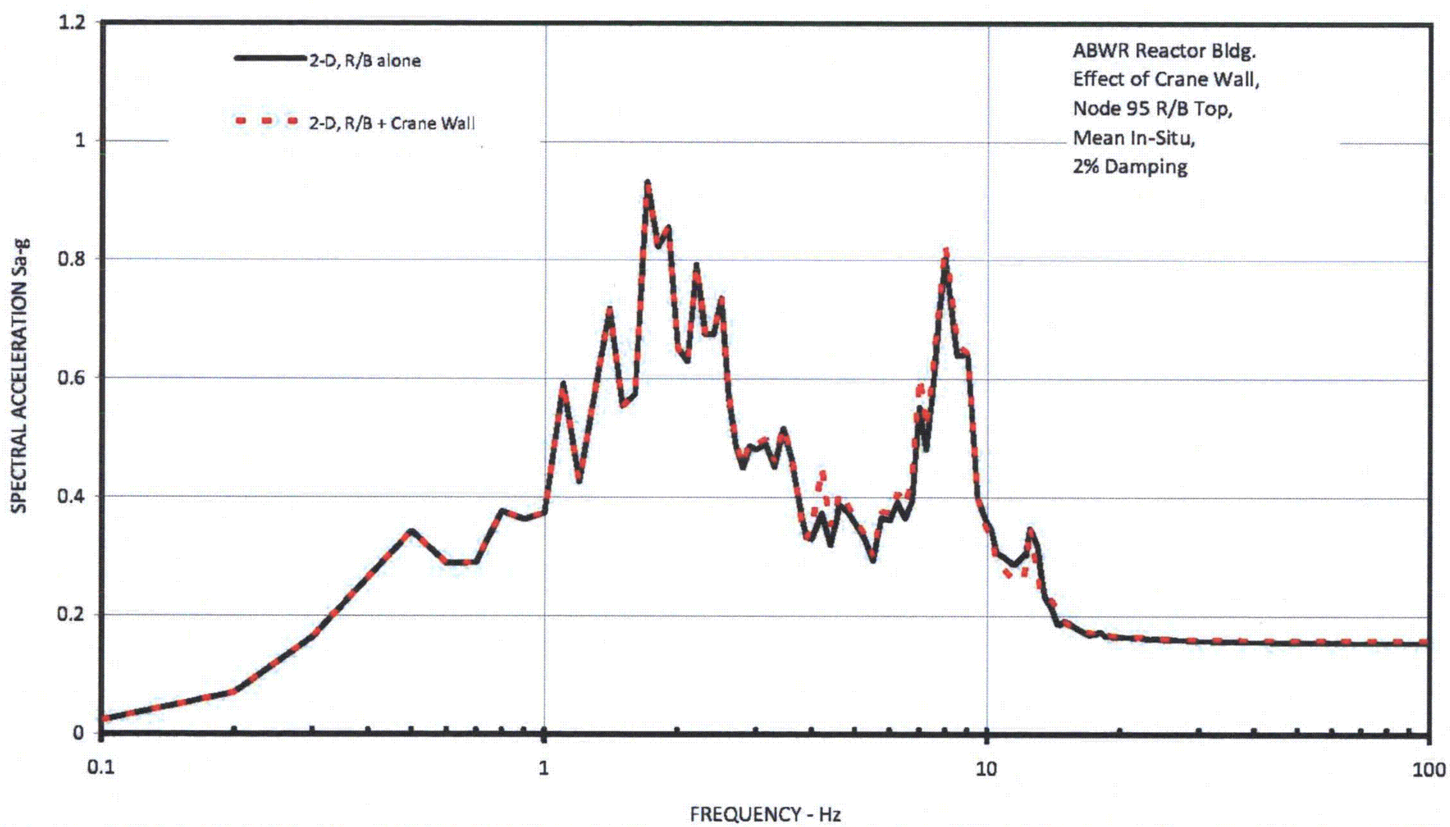


**Figure 2.5:
Reactor Building Site Specific
At-Rest Seismic Lateral Earth Pressure (psf)
Multiple Methods Displayed**

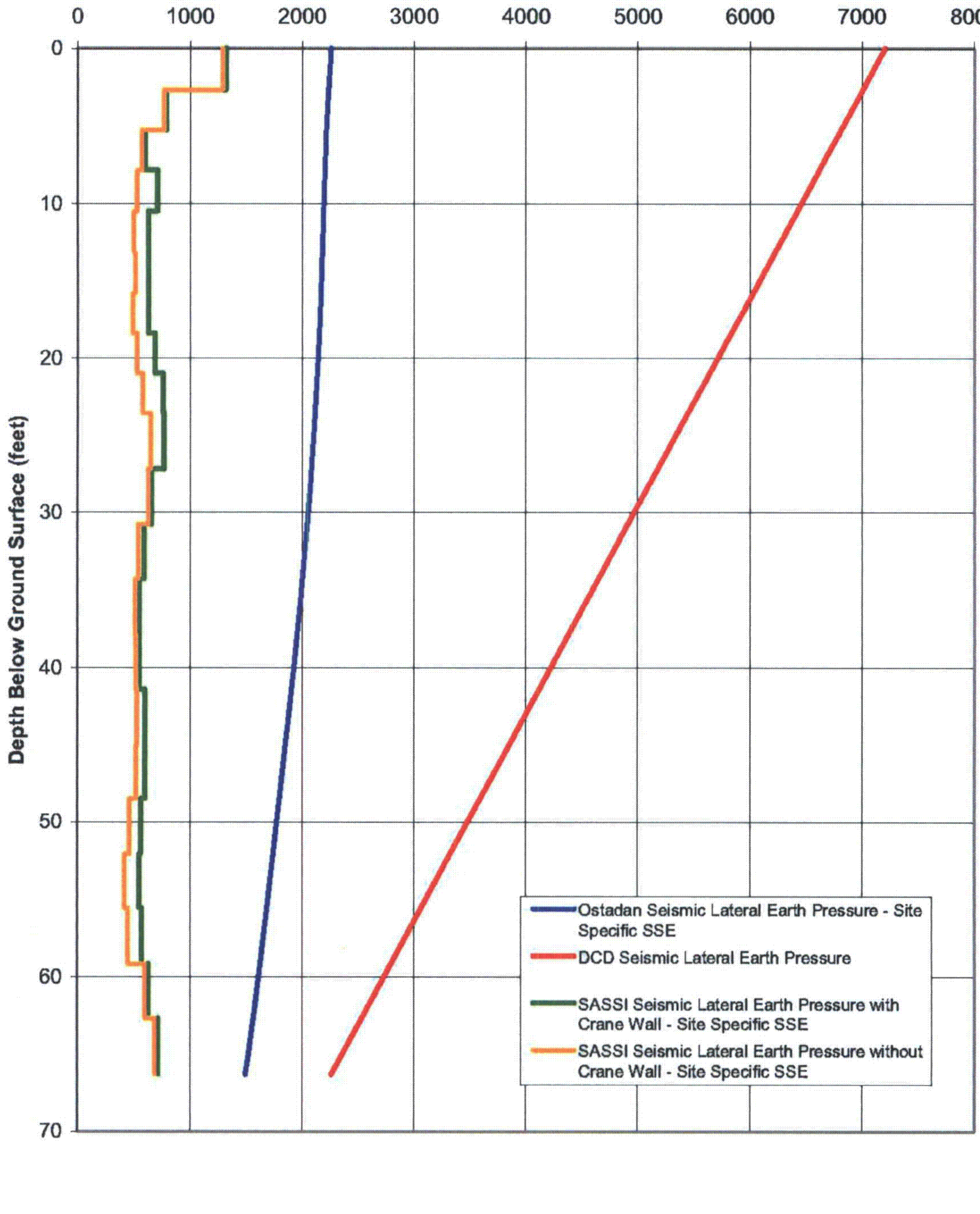


Figure 2.6: Comparison of Response Spectra, Control Building, Top of Basemat

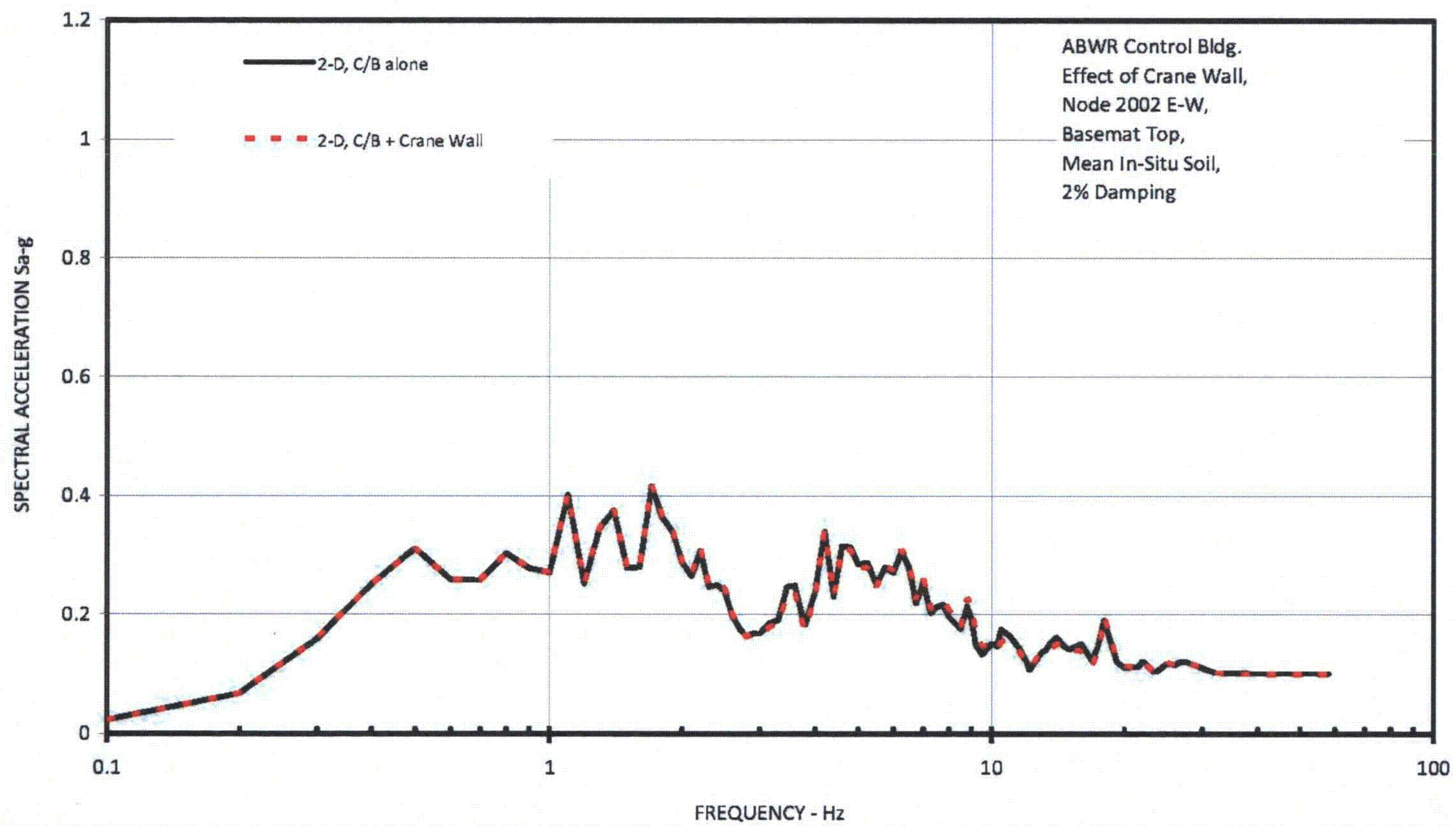


Figure 2.7: Comparison of Response Spectra, Top of Control Building

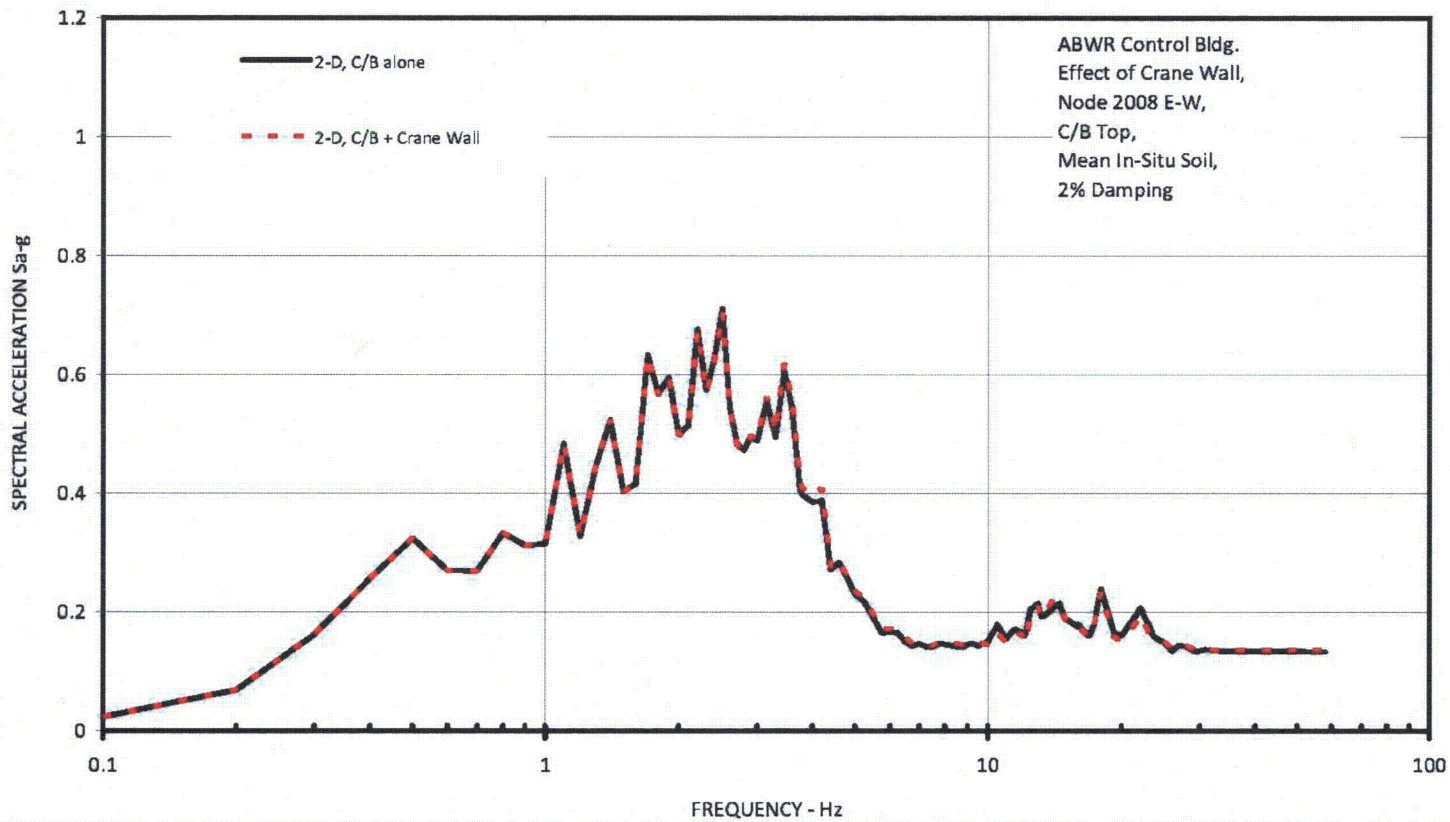
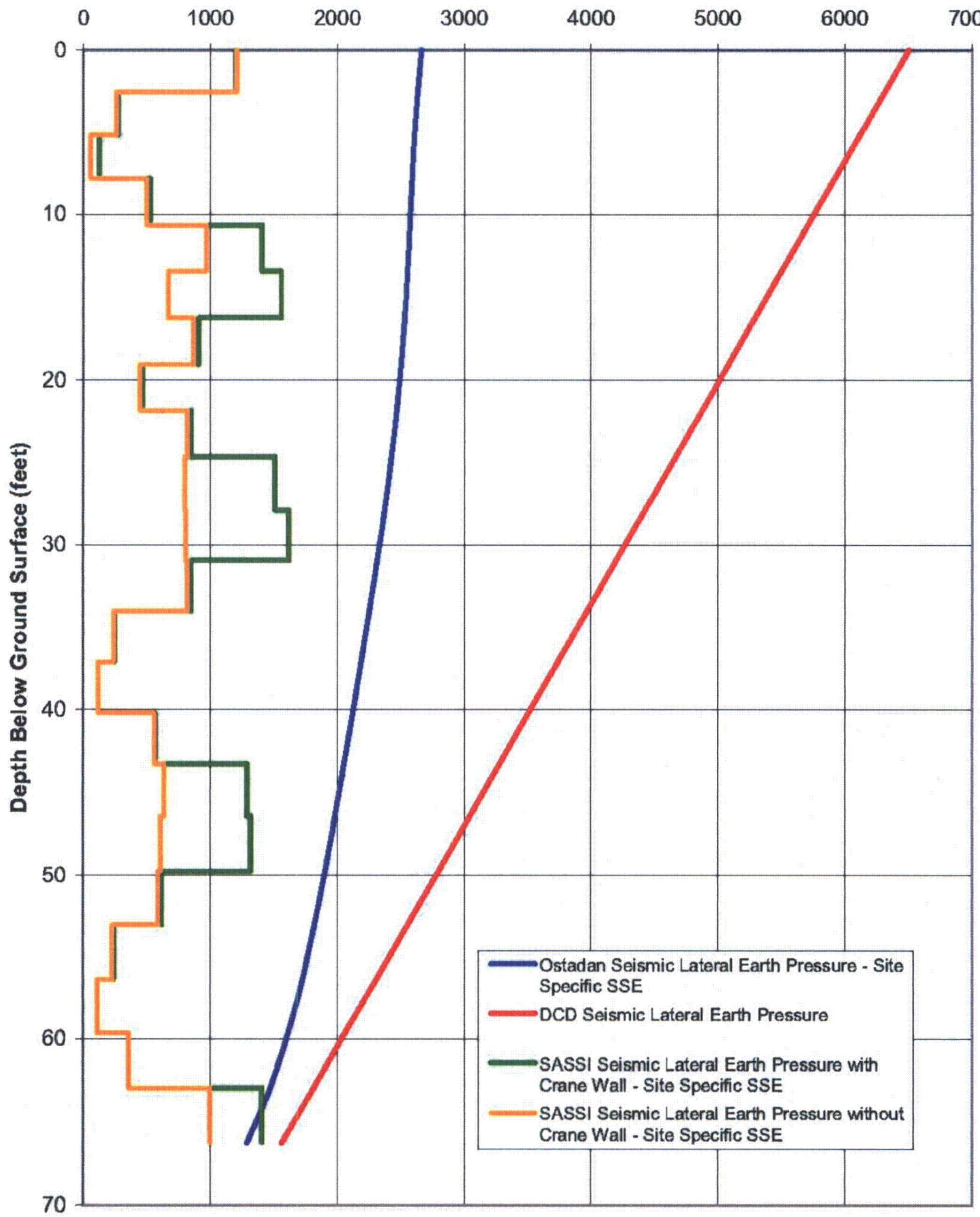


Figure 2.8:
Control Building Site Specific
At-Rest Seismic Lateral Earth Pressure (psf)
Multiple Methods Displayed



Appendix B

Description of 2-D Analytical Models and Revisions to Tables and Figures in Appendix A

Introduction and Purpose

Details of the analytical models and analysis results used in preparation of the response to RAI question 1 (RAI 1) in "Request for Additional Information Regarding South Texas Project Nuclear Operating Company Request for Exemption to Authorize Installation of Crane Foundation Retaining Walls" (ML101400240), dated May 24, 2010, are provided in this appendix as follows:

- A description of the 2D analytical model of the Reactor Building (R/B), the Control Building (C/B), and the Crane Foundation Retaining Wall (CFRW) including figures identifying the locations of the nodes and elements reported in the tables and figures provided in Appendix A to this Attachment.

- A comparison of the lateral soil pressure on the wall of the C/B obtained from the Soil-Structure Interaction (SSI) analysis of the C/B similar to that previously shown for the R/B, demonstrating that the C/B wall pressures due to interaction of the CFRW are acceptable.

- A discussion of revisions to tables and figures provided in Appendix A to this attachment, based on the response to RAI 1.

Description of 2D Analytical Model of Reactor Building (R/B) and Crane Foundation Retaining Wall (CFRW) and Analysis Results

The SSI analysis of the 2D analytical models of the R/B without CFRW and with CFRW was performed using computer program SASSI2000. The details of the East-West direction 2D structural part of the SSI models of the R/B without CFRW and with CFRW are shown in Figures 1.1 through 1.6. Figures 1.1 and 1.2 show the R/B without CFRW and with CFRW, respectively, with the center-line R/B stick representing the Building Walls, Reinforced Concrete Containment Vessel (RCCV), Reactor Shield Wall (RSW)/Pedestal and Reactor Pressure Vessel (RPV). Figures 1.3 and 1.4 show the node locations in various sticks of the R/B. Figures 1.5 and 1.6 show the beam element locations in various sticks of the R/B. Note that elevation 39.37' in Figures 1.1 and 1.2 corresponds to finished grade elevation of 12.00 m TMSL noted in DCD, which corresponds to STP finished grade elevation of 34' MSL.

The structural model properties (stiffness and mass) for the 2D analysis correspond to per unit depth (1 foot dimension in the out-of-plane direction) of the R/B. The approximately 3-foot-thick concrete CFRW is modeled by beam elements. In Figure 1.2, the CFRW extends from the finished grade elevation of 39.37' TMSL down to elevation -74.63' TMSL. The properties of the beams correspond to per unit depth (1 foot dimension in the out-of-plane direction) of the CFRW. The basemat and the mudmat are modeled by 4-node plane strain elements. To properly transfer the rotation of the stick model to the basemat (and vice versa), a set of rigid beams are placed at the top of the basemat connecting each stick to its respective footprint. To calculate the SSI-induced soil pressures on the R/B walls and the CFRW, 4-node plane strain soil elements are added in regions adjacent to the R/B side walls, CFRW, and between the R/B wall and the CFRW. The distance separating the R/B from the CFRW used in the analysis is 13 feet.

The comparison of the SSI analysis results, with and without the CFRW, is presented in Figures 2.1 through 2.4 for the R/B in-structure response spectra at four locations: bottom of basemat, reactor pressure vessel/main steam (RPV/MS) nozzle, top of the reinforced concrete containment vessel (RCCV), and top of the R/B. The nodes reported in Figures 2.1 through 2.4 are circled in Figures 1.1 through 1.4. Table 2.1 compares maximum forces and moments, at key locations, with and without the CFRW. The beam elements reported in Table 2.1 are circled in Figures 1.5 and 1.6. The moment and shear reported in Table 2.1 are total moment and shear. These are obtained by multiplying the corresponding responses from the 2D model by the out-of- plane depth of the R/B. It can be seen from these figures and table that the CFRW does not have a significant effect on the responses of the R/B.

Figure 2.5 shows a comparison of the lateral soil pressure obtained from the SSI analysis on the R/B walls, with and without the CFRW. As expected, the lateral soil pressures are increased due to the presence of the CFRW. However, the R/B exterior walls are designed for the larger of the: (1) pressure provided in the Advanced Boiling Water Reactor (ABWR) Design Control Document (DCD) Tier 2 Figure 3H.1-11 and (2) pressure obtained from the alternate modified Ostadan method described in the Reference (Reference 2.5S.4-62, FSAR Section 2.5S.4.10.5.2). Both of these methods yield lateral pressures substantially higher than those obtained from the SSI analysis, as shown in Figure 2.5. Therefore, the increase in pressure due to the CFRW in the SSI analysis is of no consequence to the design of the R/B exterior walls.

Description of 2D Analytical Model of Control Building (C/B) and CFRW and Analysis Results

The SSI analysis of the 2D analytical models of the C/B without CFRW and with CFRW was performed using computer program SASSI2000. The details of the East-West direction 2D structural part of the SSI models of the C/B without CFRW and with CFRW are shown in Figures 1.7 and 1.8, respectively. The C/B is modeled by vertical beam elements with lumped masses located at each floor elevation. The side walls are modeled with beam elements, and they provide shear rigidity in the direction of motion. Note that elevation 39.37' in Figures 1.7 and 1.8 corresponds to finished grade elevation of 12.00 m TMSL noted in DCD, which corresponds to STP finished grade elevation of 34' MSL.

The structural model properties (stiffness and mass) for the 2D analysis correspond to per unit depth (1 foot dimension in the out-of-plane direction) of the C/B. The approximately 3-foot-thick concrete CFRW is modeled by beam elements. In Figure 1.8, the CFRW extends from the finished grade elevation of 39.37' TMSL down to elevation of -35.63' TMSL. The properties of the beams and nodal masses correspond to per unit depth (1 foot dimension in the out-of-plane direction) of the CFRW. The basemat and the mudmat are modeled by 4-node plane strain elements. To properly transfer the rotation of the stick model to the basemat (and vice versa), a pair of rigid beams are placed at the bottom of the basemat connecting the stick to the basemat elements on each side of the stick, as shown in Figure 1.7. The effect of the outer cross walls is modeled by a pair of beams at the top of the basemat connecting the stick to the east and west exterior walls. To calculate the SSI-induced soil pressures on the C/B walls and the CFRW, 4-node plane strain soil elements are added in regions adjacent to the C/B side walls, CFRW, and between the C/B wall and the CFRW. The distance separating the C/B from the CFRW used in the analysis is 67 feet.

Comparison of the in-structure response spectra for the C/B at the top of the basemat and the top of the C/B is shown in Figures 2.6 and 2.7, and the comparison of maximum seismic forces and moments is shown in Table 2.2. The nodes reported in Figures 2.6 and 2.7 are circled in Figures 1.7 and 1.8. The beam element reported in Table 2.2 is circled in Figures 1.7 and 1.8. The moment and shear reported in Table 2.2 are total moment and shear. These are obtained by multiplying the corresponding responses from the 2D model by the out-of-plane depth of the C/B. It can be seen from these figures and table that the CFRW does not have a significant effect on the responses of the C/B.

Figure 2.8 shows a comparison of the lateral soil pressure obtained from the SSI analysis on the C/B walls, with and without CFRW. As expected, the lateral soil pressures are increased due to the presence of the CFRW. However, the C/B exterior walls are designed for the larger of the: (1) pressure provided in the ABWR DCD Tier 2 Figure 3H.2-14 and (2) pressure obtained from the alternate modified Ostadan method described in the Reference (Reference 2.5S.4-62, FSAR Section 2.5S.4.10.5.2). Both of these methods yield lateral pressures substantially higher than those obtained from the SSI analysis, as shown in Figure 2.8. Therefore, the increase in pressure due to the CFRW in the SSI analysis is of no consequence to the design of the C/B exterior walls.

Revisions to Tables and Figures in Appendix A

Tables and figures provided in Appendix A to this Attachment were revised based on the response to RAI 1 as described below. The RAI response resolved some differences in the results between the analyses with regard to computed shears, moments, and soil pressure on walls as provided in STPNOC letter U7-C-STP-NRC-100066, "Request for Exemption to Authorize Installation of Crane Foundation Retaining Walls" (ML100880055), dated March 23, 2010, and the STPNOC response to RAI 03.07.01-24 related to COLA Part 2, Tier 2, Section 3.7, letter U7-C-STP-NRC-100083, "Supplemental Response to Request for Additional Information" (ML101090143), dated April 14, 2010.

The response to RAI 03.07.01-24 and the CFRW exemption request (U7-C-STP-NRC-100066) both described the results of analyses based on analytical models of the R/B and C/B structures, with and without the CFRW. The differences between the shear and moment (CFRW exemption letter U7-CSTP-NRC-100066, dated March 23, 2010, Tables 2.1 and 2.2, and RAI Tables 03.07.01-24a and 03.07.01-24b) and lateral soil pressures (CFRW exemption letter Figure 2.5 and RAI Figure 03.07.01-24e) resulted from differences in the analytical models of the R/B and the C/B. As the exemption request explained in section D.4.a (page 7 of 25), the analyses it described used analytical models that included some proposed design changes that were being handled in accordance with Interim Staff Guidance, DC/COL-ISG-011 Finalizing Licensingbasis Information. The analyses described in the response to RAI 03.07.01-24, which were completed after the exemption request was submitted, used analytical models that did not include these proposed design changes.

Summary of differences in the analytical models:

- Mass and stiffness differences between the R/B and C/B models used for the analyses described in the exemption request and those used in the analyses described in the response to RAI 03.07.01-24.

- The 4-node plane strain basemat elements, mudmat elements, soil elements in regions adjacent to the building side walls, CFRW, and between the building walls and the CFRW used in the analyses described in the response to RAI 03.07.01-24 were more refined than in the model used in the exemption request.

Although the results were somewhat different for the reasons provided above, the conclusions of both analyses, the one presented in the exemption request and the other in the response to RAI 03.07.01-24, are the same, i.e., the CFRW has no significant effect on the adjacent R/B and C/B structures.

The information in the exemption request (Attachment to this letter) was revised to include the descriptions of the analytical models and the analysis results for R/B and C/B provided above.

In addition, the supplemental response to RAI 03.07.01-24 was revised and submitted in STPNOC letter U7-C-STP-NRC-100161. This submittal was concurrent with the response to RAI 1 (CFRW) submitted in STPNOC letter U7-C-STP-NRC-100132, dated July 21, 2010.

Reference:

"Seismic Soil Pressure for Building Walls-An Updated Approach," The 11th International Conference on Soil Dynamics and Earthquake Engineering (11th ICSDEE) and the 3rd International Conference on Earthquake Geotechnical Engineering (3rd ICEGE), Ostadan, F., 2004.

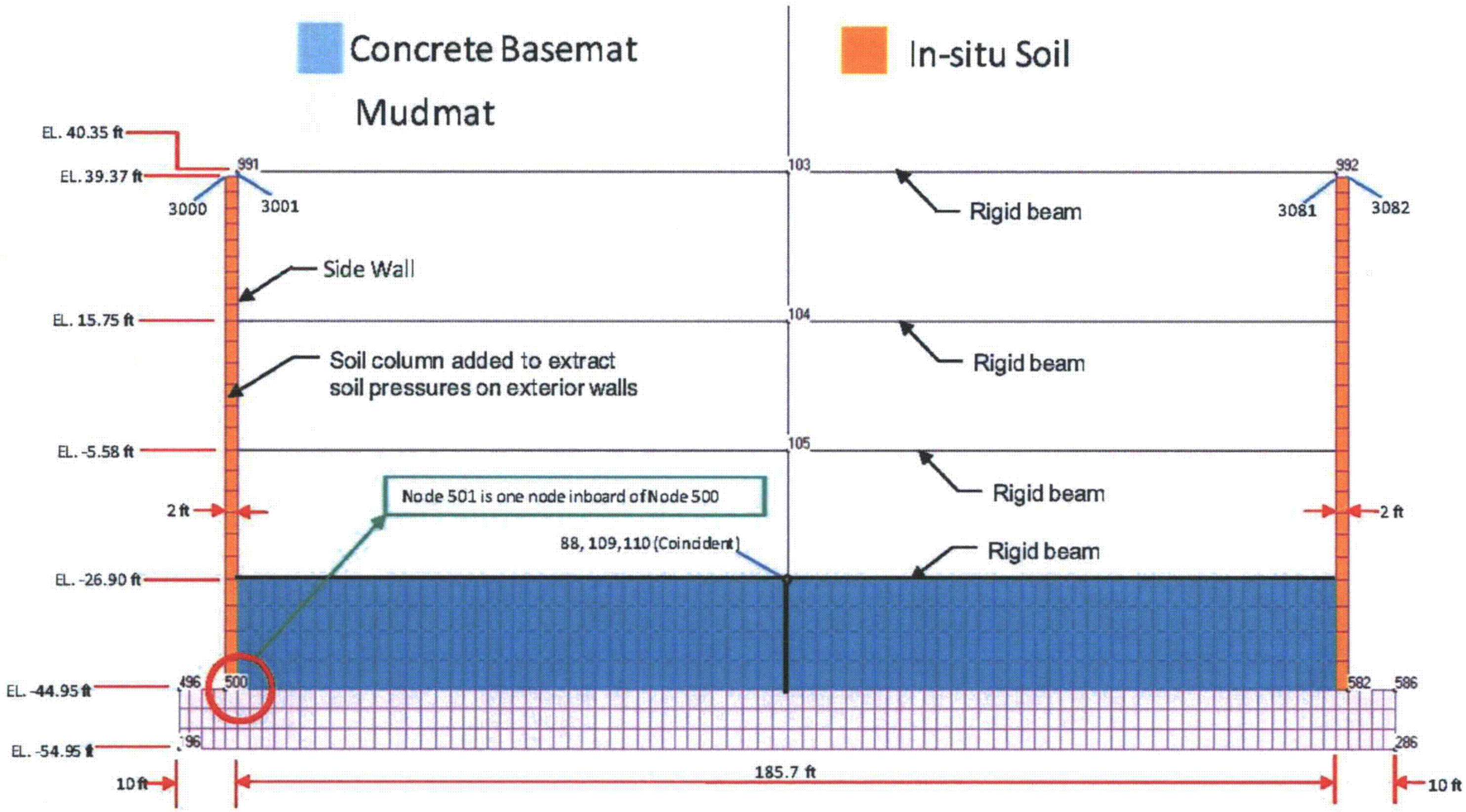


Figure 1.1 – Model of Reactor Building without Crane Wall

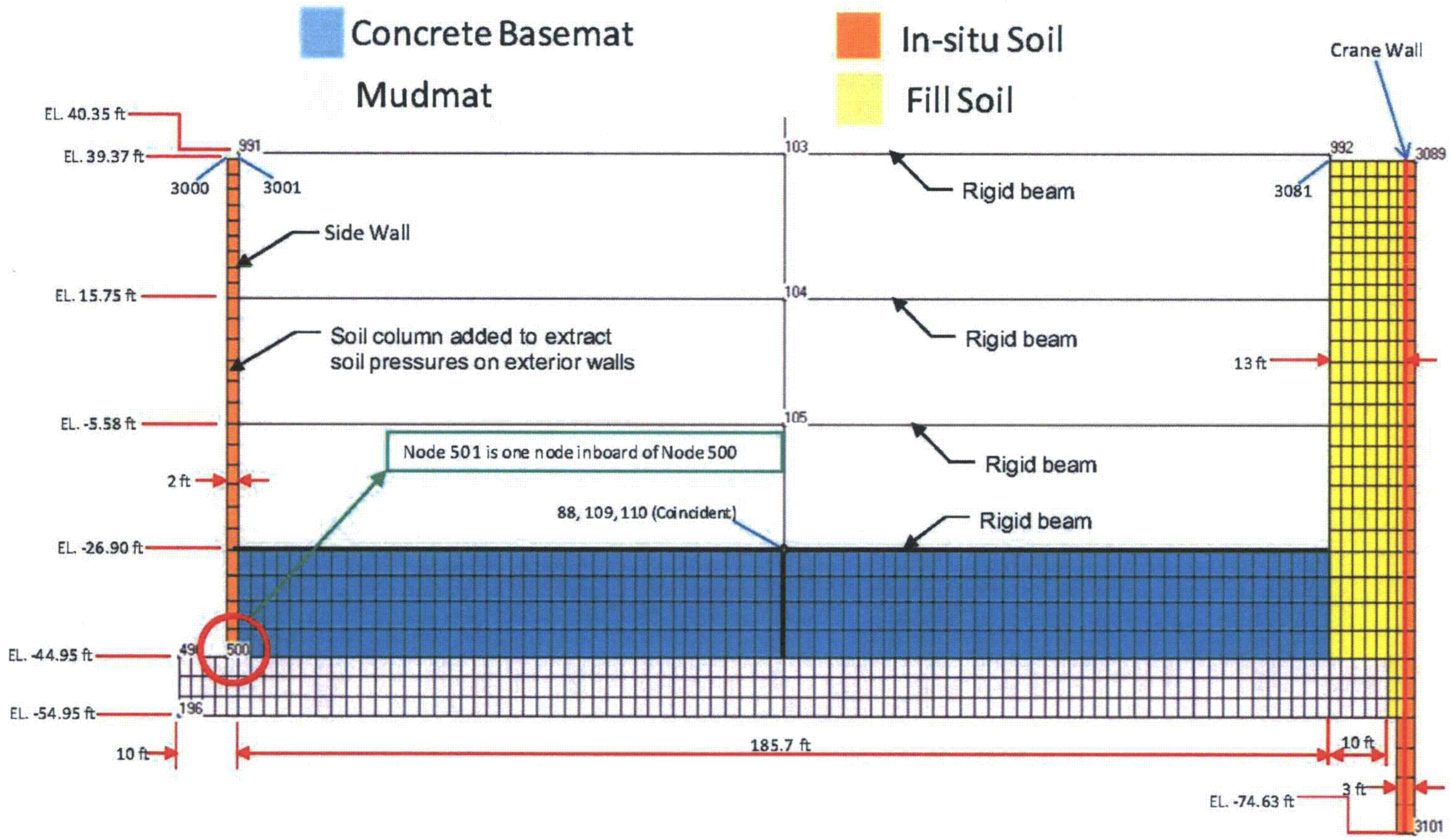


Figure 1.2 – Model of Reactor Building with Crane Wall

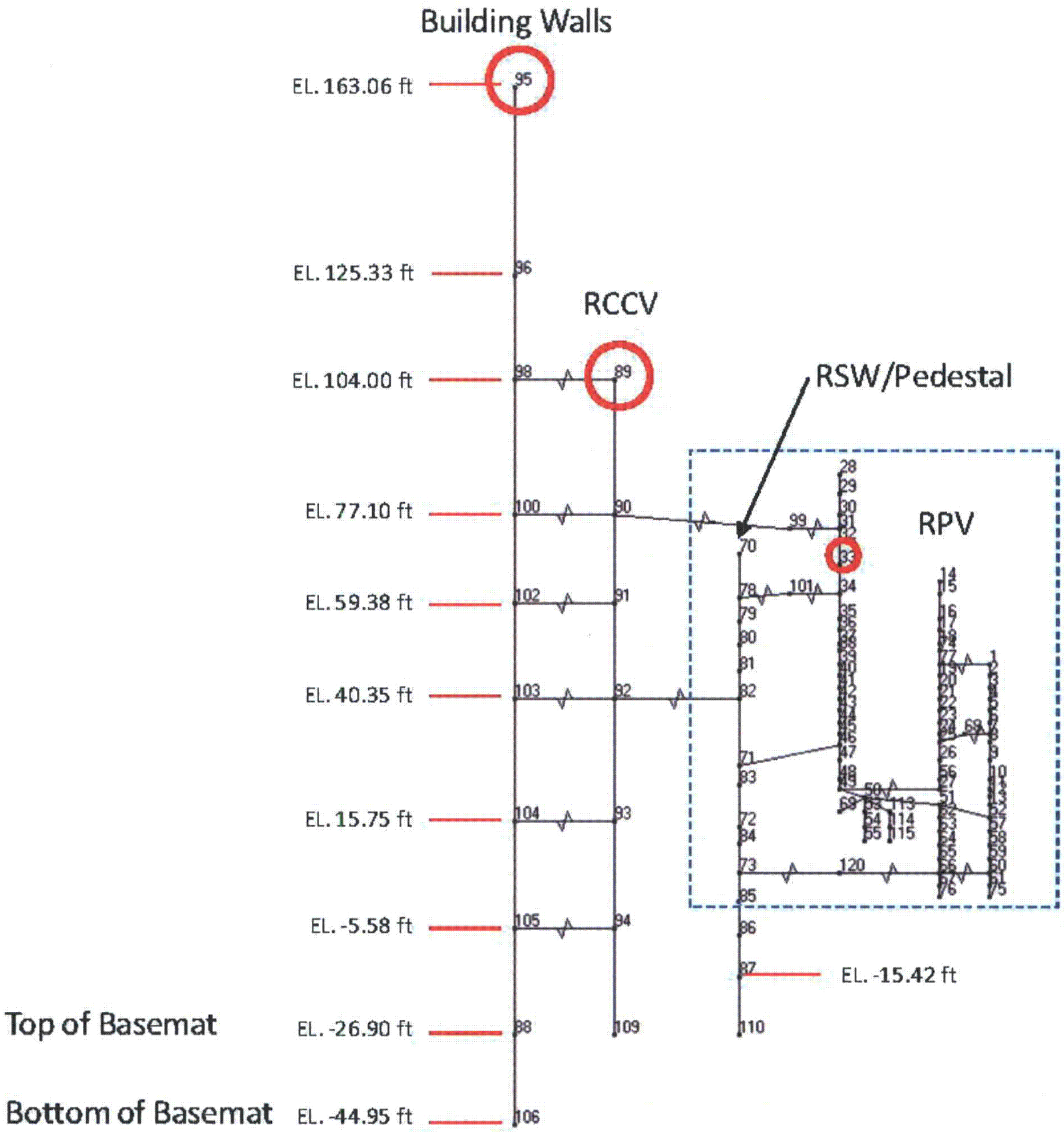


Figure 1.3 – Reactor Building Stick Model: Nodal Points.
Nodal points in the dashed box are shown in Figure 1-4.

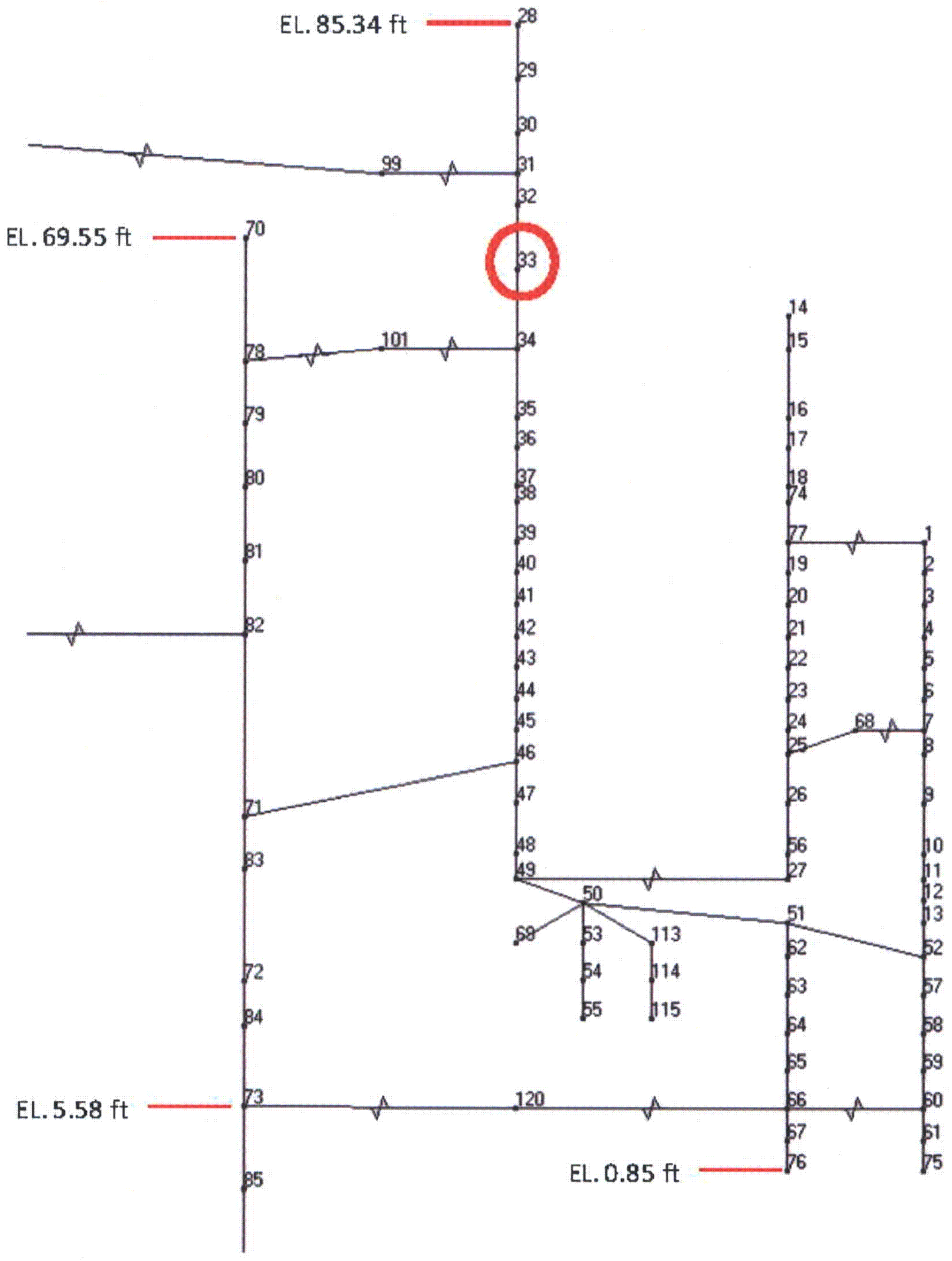


Figure 1.4 – Reactor Building Stick Model: Nodal Points (cont'd)

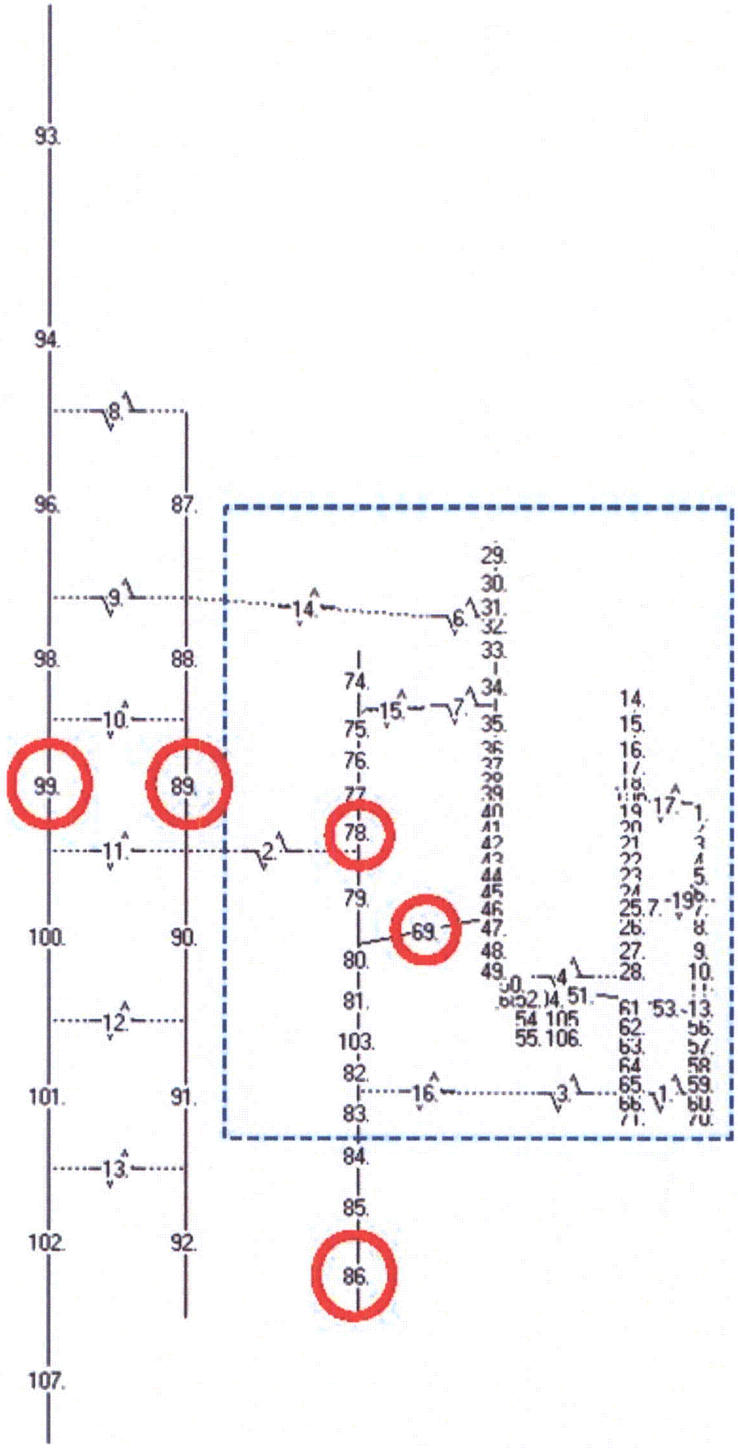


Figure 1.5 – Reactor Building Stick Model: Element Numbers. Element numbers in the dashed box are shown in Figure 1-6.

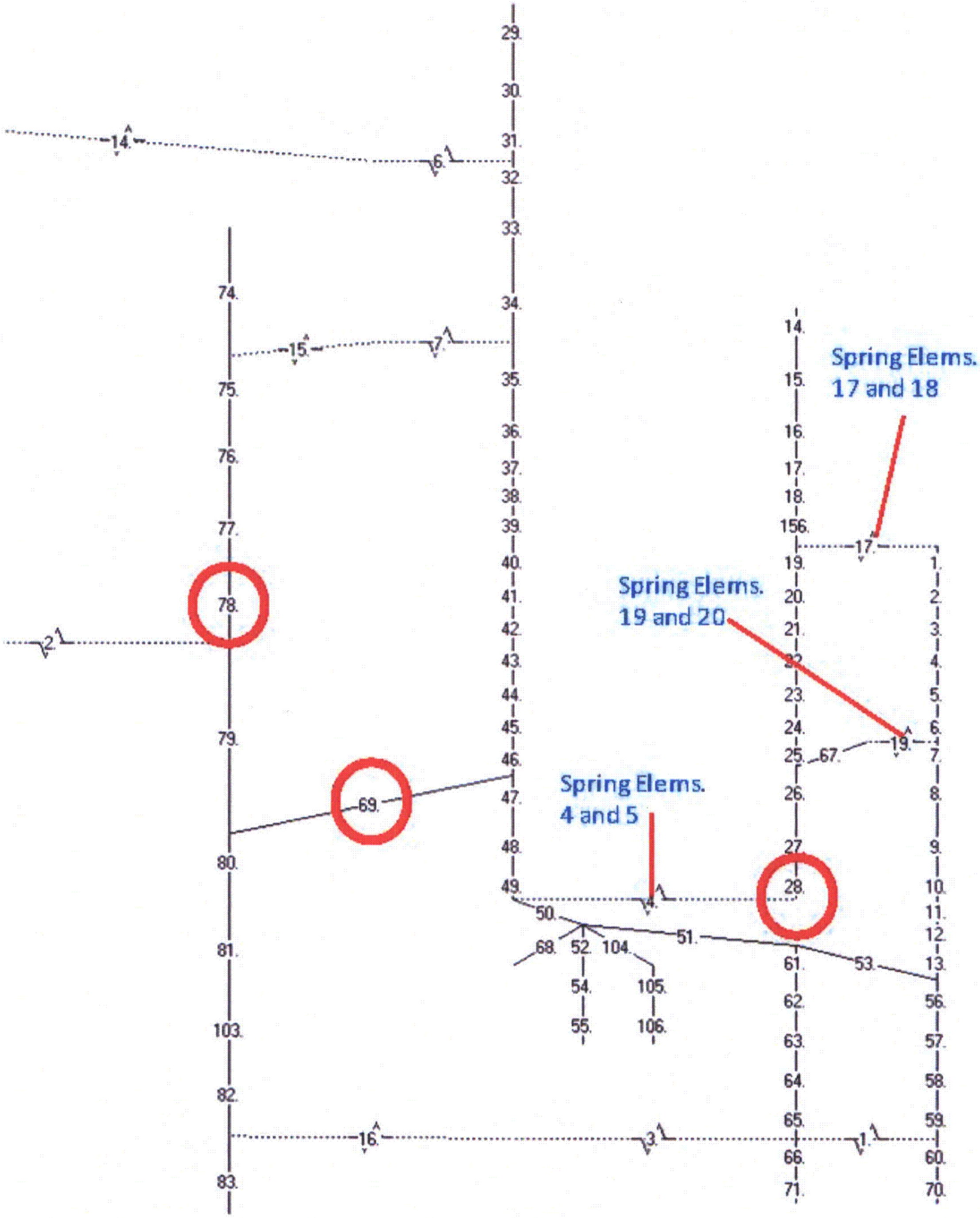


Figure 1.6 – Reactor Building Stick Model: Element Numbers (cont'd)

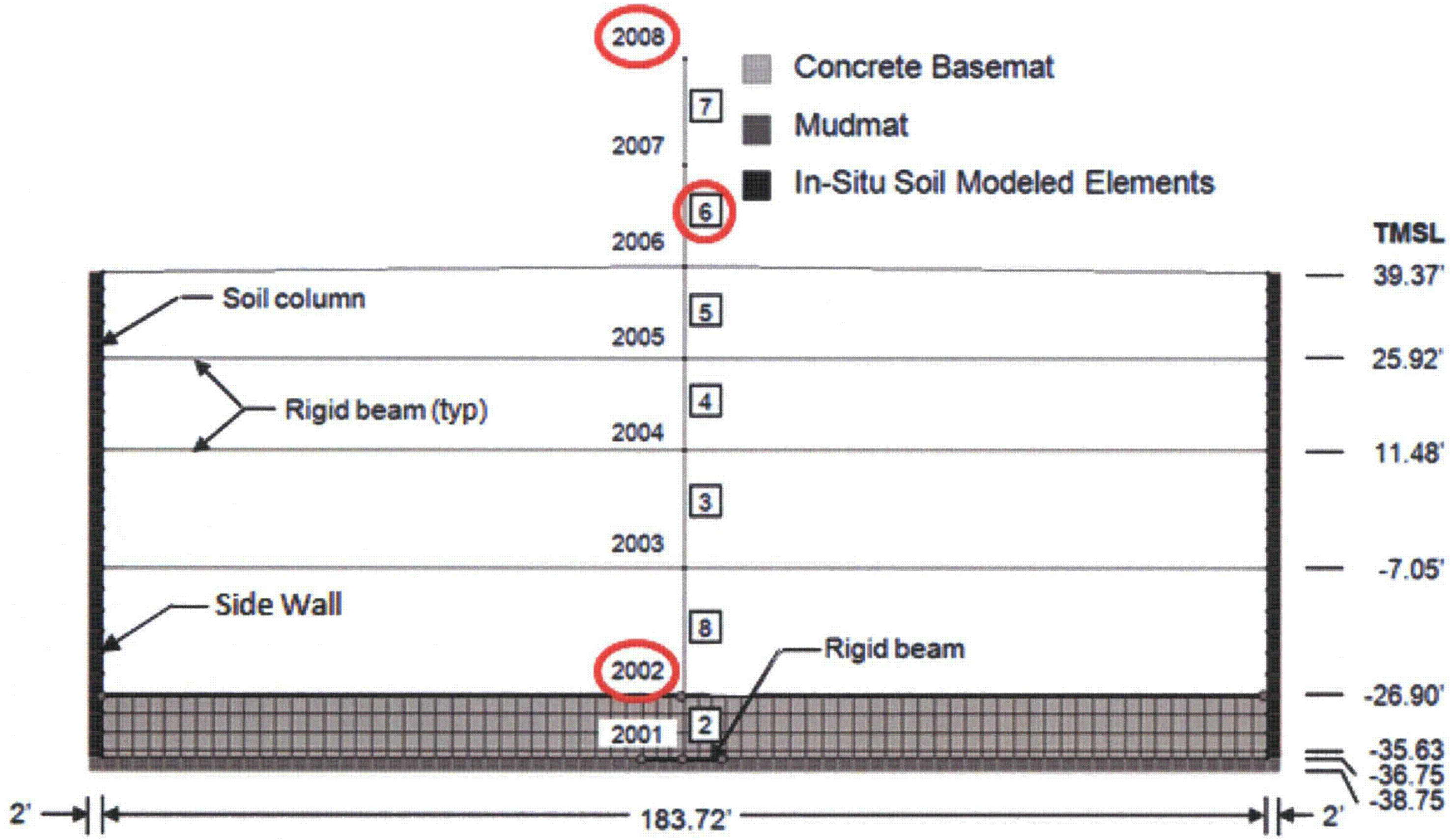


Figure 1.7 – Model of Control Building without Crane Wall

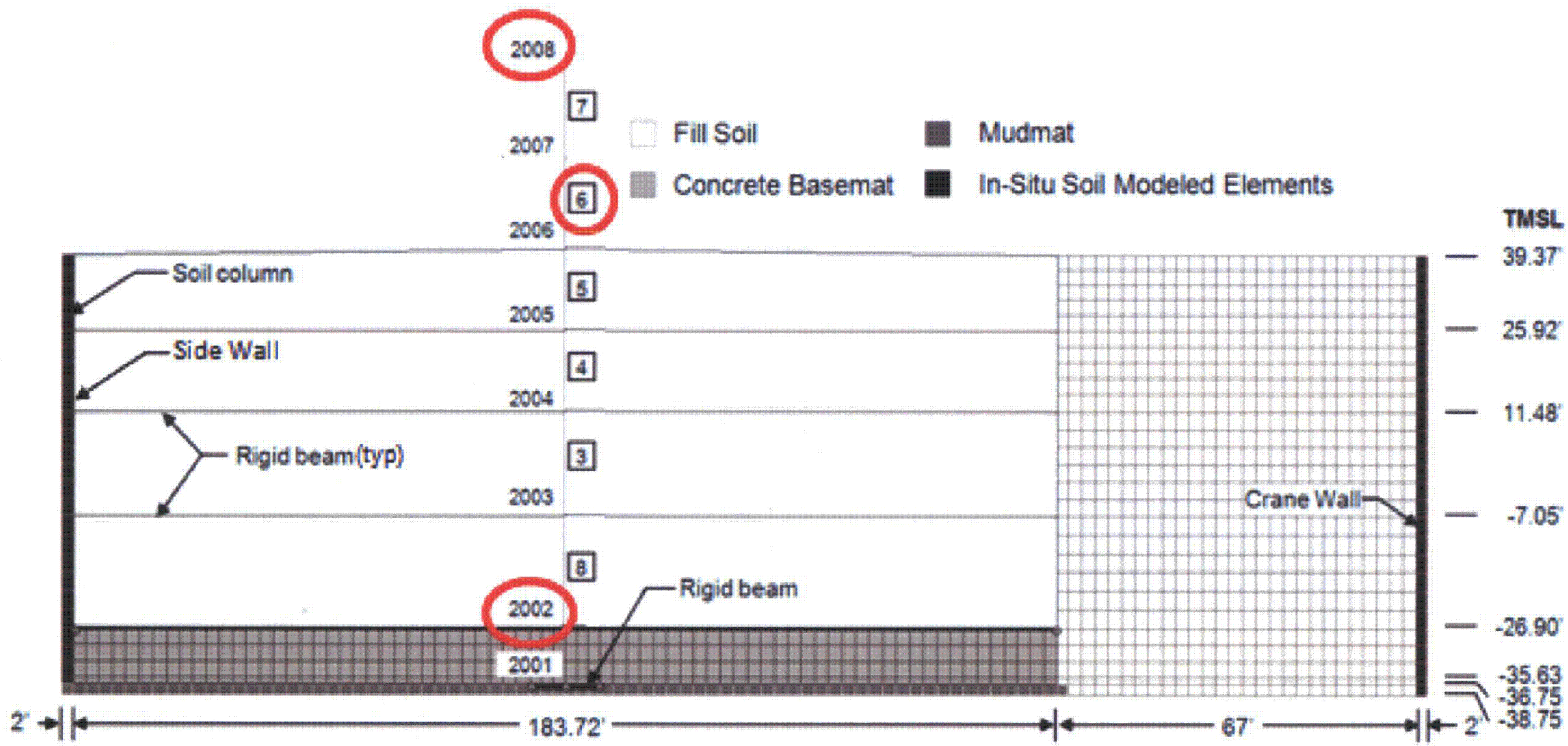


Figure 1.8 – Model of Control Building with Crane Wall