R10005838

DOCUMENT INFORMATION

Please provide the following information when submitting a document to PDC.

Correspondence (CCN) No: 051760	**Rev: N/A**
Document No:	**Rev:**

Project Information (Check Applicable Box)

☐ Balance of Facilities
☒ Pretreatment
☐ HLW Vitrification
☐ LAW Vitrification
☐ Analytical
☐ External Interfaces
☐ Across all areas

Document is applicable to ALARA? ☐ Yes ☒ No

Applicability to ALARA means that the item has the potential to affect doses, contamination levels, or releases to the environment. (See 24590-WTP-GPP-SRAD-002, *Application of ALARA in the Design Process*, sections 4.1 and 4.2 for more information.)

Additional Information for Correspondence

Subject Code(s) 4152

Action Item Information. (This section does not apply to Meeting Minutes.)

☒ No Action Item within the correspondence
☐ Action(s) (Give a brief description of actions in the following space [optional])

Due Date ______ (If no due date is indicated, a 2-week period will be assigned.)

Action Owed to ______

Actionee(s)

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WDOH ☐ Internal ☐ ORP ☐
OTHER ______

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3-26-07

Concurrence Sheet

CCN: 051760

Required Reviewers

Title	Name	Concurrence required (Check appropriately)	Initials	Date
Project Director	R. F. Naventi	☐		
Project Manager	J. P. Betts	☒	[signed]	3/6/03
Operations Manager	W. G. Poulson	☐		
Engineering Manager	R. J. Tosetti	☐		
Construction Manager	T. L. Horst	☐		
Business Manager	C. E. Rogers	☐		
Environmental & Nuclear Safety	F. Beranek	☒	[signed]	3/6/03
Contracts Manager	A. R. Veirup	☒	[signed]	3/6/03
Project QA Manager	G. T. Shell	☐		
HLW Area Project Manager	P. W. Schuetz	☐		
LAW Area Project Manager	W. Clements	☐		
Pretreatment Area Project Manager	R. E. Lawrence	☒	[signed]	3/6/03
BOF Area Project Manager	J. Q. Hicks	☐		
Lab Area Project Manager	P. J. Keuhler	☐		
Process Technology	K. J. Rueter	☐		
Research and Technology	G. T. Wright	☐		
Commissioning	M. N. Brosee	☐		
Interface Management Manager	T. M. Brown	☐		
BNI Legal	D. M. Curtis	☐		

Additional Reviewers

Title	Name	Initials	Date

Name	Signature	Date
W. R. Spezialetti	[signed]	3/6/03
Print/Type Applicable Line Manager's Name	*Signature*	*Date*
T. G. Hersum	[signed]	3/6/03
Print/Type Originator's Name	*Signature*	*Date*

U.S. Department of Energy
Office of River Protection
Mr. R. J. Schepens
Manager
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

CCN: 051760

MAR 0 7 2003

Dear Mr. Schepens:

CONTRACT NO. DE-AC27-01RV14136 – CLOSEOUT COMMENT/RESPONSE ON PRETREATMENT CONSTRUCTION AUTHORIZATION REQUEST

Reference: CCN 049785, Letter, R. J. Schepens, ORP, to R. F. Naventi, BNI, "Pretreatment Construction Authorization Request Review Question," 03-OSR-00001, dated January 7, 2003.

The U.S. Department of Energy, Safety Regulation Division (OSR) provided a Pretreatment (PT) Construction Authorization Request review comment (PT-PSAR-342) to Bechtel National, Inc. in the referenced letter. Attached is the response to this comment, which has been reviewed with OSR staff members.

Please contact Mr. Bill Spezialetti at 371-3074 if you have any additional comments.

Very truly yours,

R. F. Naventi
Project Director

TH/slr

Attachments:
1) Comment Response Form with Contractor Response (PT-PSAR-342)
2) CCN 052558
3) Signature Pages of Structural Calcs

cc:

Allen, B. T. w/a	WTP	MS4-B1
Barr, R. C. w/a	OSR	H6-60
Barrett, M. K. w/o	ORP	H6-60
Beranek, F. w/o	WTP	MS4-A1
Betts, J. P. w/o	WTP	MS14-3C
DOE Correspondence Control w/a	ORP	H6-60
Ensign, K. R. w/o	ORP	H6-60
Erickson, L. w/o	ORP	H6-60
Hamel, W. F. w/o	ORP	H6-60
Hanson, A. J. w/o	ORP	H6-60
Hersum, T. G. w/a	WTP	MS4-B1
Hinckley, J. P. w/a	WTP	MS9-A
Klein, D. A. w/o	WTP	MS4-A1
Naventi, R. F. w/o	WTP	MS14-3C
PDC w/a	WTP	MS11-B
Spezialetti, W. R. w/o	WTP	MS4-B1
Taylor, W. J. w/a	ORP	H6-60
Tosetti, R. J. w/o	WTP	MS4-A2
Veirup, A. R. w/o	WTP	MS14-3B

Comment Response Form with Contractor Response

(PT-PSAR-342)

Office of Safety Regulation	OSR Review Team Questions for BNI
Question # PT-PSAR-342	**Date Opened:** 01/07/2003
Place "X" if answering "yes": Limited Rights Information? ___ Team Accepted? ___	**Date to Contractor:** **Date of Response:** **Date Closed:** **Reviewer:**

Cited Reference:

SRD Safety Criterion 4.1-3 states in part, "SSCs designated as Important to Safety (i.e., Safety Design Class and Safety Design Significant) shall be designed to withstand the effects of NPH events such as earthquakes, wind, and floods without loss of capability to perform specified safety functions as the result of the NPH events."
ASCE 4-98, Seismic Analysis of Safety Related Nuclear Structures and Commentary" Section 3.3.1(a) an implementing standard for this criterion requires, "Soil-structure interaction (SSI) effects shall be considered for all structures not supported by rock or rock-like soil foundation material"
02-OSR-0517, Contract No. DE-AC27-01RV14136 – U.S. Department of Energy (DOE) Notice to Proceed with Construction Activities, "Construction Authorization Agreement, Revision 0, between the U.S. Department of Energy, Office of River Protection and Bechtel National, Inc." Appendix A, p A-14 states in part "Perform a revised seismic SSI analysis based on the revised building layout in which lateral dynamic soil pressure will be calculated directly for a few critical below grade walls using soil pressure elements in the SASSI model. If soil pressure is not obtained directly form the revised SSI analysis, the SASSI generated moment results will be use to develop the lateral dynamic soil pressures."

Cited Submittal Text:

BNI Calculation 24590-PTF-S0C-S15T-00002, Pretreatment Facility (PTF) – Structural Model for SSI Analysis," Revision 1A (draft)

BNI Calculation 24590-PTF-S0C-S15T-00003, Pretreatment Building Seismic Analysis: SSI Analysis," Revision 1A (draft)

BNI Calculation 24590-PTF-S0C-S15T-00004, Pretreatment Building Seismic Analysis: Seismic Loads," Revision 1A (draft)

BNI Calculation 24590-PTF-S0C-S15T-00005, Seismic Analysis of Pretreatment Building – In-Structure Response Spectra," Revision 1 (draft)

OSR Question:

a) What calculation provides the resulting design loads and calculated D/C ratios considering the revised SSI input for the basemat and below grade structures? If the SSI loads exceed the design loads, how are the higher SSI loads accounted for in representing the demand?

b) Where are the soil pressures for the fire-water pit developed or what comparisons have been performed for the fire-water pit? (See section 7.3.2 of 24590-PTF-SOC-S15T-00003, including figures)

c) What calculation addresses the effect of the change in element size between the basemat and walls and the resulting disconnected nodes at the basemat/wall interface? (See Page D-5 of 24590-PTF-SOC-S15T-00002)

d) What is the effect of using two springs for each mass when developing floor vertical accelerations? Does using two springs create an artificial increase in the stiffness of the floors by connecting two nodes with plate elements and spring elements? What affect does double counting floor mass have on the overall behavior of the structure? (see Section 7.3.2 of 24590-PTF-SOC-S15T-00005)

e) What calculation demonstrates that the soil pressures resulting from accidental torsion are included/enveloped in the design analyses as required by ASCE 4-98, Section 3.1.1(e)?

f) When will calculations 24590-PTF-S0C-S15T-00002, 24590-PTF-S0C-S15T-00003, 24590-PTF-S0C-S15T-00004, and 24590-PTF-S0C-S15T-00005 be issued?

Explanation/Discussion (Optional)

a) The referenced calculations do not provide the D/C ratios requested. D/C ratios are required to quantify that positive margins are available for the revised analysis, which is needed to demonstrate the current level of conservatism.

b) The soil pressures provided in Calculation 24590-PTF-S0C-S15T-00003 cover only the main pits and tunnels. If soil pressures are not available for the fire water pit, a comparison of the forces and moments from the most recent analysis with those from the previous SSI (Preliminary Design) or those used in design should be provided (Similar to Tables A-E of CCN: 044586). The fire water pit walls are considered critical (SDC and SC-I) and therefore must be addressed as required in 02-OSR-0517.

c) The SSI model has disconnected nodes at the edge of the basemat in the center of each wall element with no justification provided. This can result in underestimating vertical stiffness of the wall and underestimating horizontal out-of-plane stiffness of the wall.

d) Using two nodes connected to an oscillator is an unconventional method for the development of in structure response spectra (ISRS) and therefore the potential effects on the results, if any, must be explained. Also, it appears that the mass of the floors has been double counted inappropriately by adding a mass for each floor in the oscillator used for developing floor vertical accelerations. Because the mass for the oscillator is not co-linear with the structure nodes (it is placed near the model origin), it appears that an artificial moment may be created.

e) The statement in Section 7.3.2 of 24590-PTF-S0C-S15T-00004, page 105, "Any accidental torsional forces at and below grade are mostly resisted by soil resistance" is qualitative and not supported. It must be demonstrated that the effects of accidental torsion on soil pressures is included or enveloped as required by ASCE 4-98, Section 3.1.1(e), which states in part, "When calculating forces in various structural elements, the torsional moments due to accidental eccentricity with respect to the center of rigidity and the effects of nonvertically incident or incoherent waves shall be accounted for. An acceptable means of accounting for these torsional moments is to include an additional torsional moment is the design or evaluation of structural members." Without a quantitative evaluation of the loads in the subgrade structure, the requirements of ASCE 4-98 cannot be demonstrated to be met.

f) Only draft (undated and unsigned) calculations have been provided to ORP.

Contractor Response

(a) The slab and walls below grade calculations, 24590-PTF-DGC-S13T-00002, Revision 2, using the 1.5 times peak of spectra static results were issued on 10/01/02. These calculations contain the D/C ratios demonstrating adequacy. The soil pressures on the fire water pits from the revised SSI analysis are compared to the GTSTRUDL design loads to demonstrate the adequacy and conservatism of the design configuration currently in place. The results of this comparison are provided in CCN 052558.

To demonstrate the adequacy of the dowels in the basemat, a comparison of the loading demand on the walls above grade from the 1.5 x peak static analysis to the demand from the static model using the latest SSI accelerations was completed. The analysis results for the concrete walls above grade at the west end of the PT facility will be released on 02/28/03. These results show D/C ratios in the 0.5 to 0.8 range with the majority of the higher values resulting from thermal loads on the uncracked sections.

(b) The firewater pit walls were designed with the1.5 times peak of spectra static loads used in the GTSTRUDL analysis. These design loads will be compared with the loads from the SASSI analysis and documented in CCN 052558. Currently, the resulting loads are less than the design loads issued in the basemat and below grade wall calculations. The SASSI analysis loads evaluated include the surface skin friction that concerned the OSR reviewers. The comparison also includes the design capacity of the below grade walls to demonstrate compliance.

(c) All wall elements above elevation 0 ft are modeled with plate elements that have horizontal dimensions of 18-ft in both East-West and North-South directions. The 8-ft thick basemat at elevation 0 ft are also modeled with plate elements. However, all of the plate elements of this basemat have horizontal dimensions of 9 feet by 9 feet. Therefore, along the intersecting line between each of the walls and the basemat, every other node at the basemat is common to the wall nodes. Forces and stiffness can transfer between these walls and basemat only through these common nodes.

Structurally, grid size spacing of 18-ft is adequate for modeling both walls and basemat elements in this finite element model. The smaller 9-ft spacing at the basemat is used to match the size requirement of the softer soil elements.

This model is used primarily to develop the accelerations throughout the structure, which are used to determine the static loading for the detailed GTSTRUDL static model. The loading on the basemat and above grade structural elements is adequately represented in the static model. The member forces/stresses in the below grade walls are more accurately calculated in the SASSI model for the seismic response. The response in the below grade walls is used as a check to assure conservatism in the design that uses representative loads from the static model.

The common nodes of the walls above grade and of the basemat are spaced at 18 ft. This is adequate because:

- As stated above, the transfer of seismic load, from the superstructure to the foundation and then to the soil below, is accurately captured by the model, and the 18 ft grid size is adequate for modeling the walls. These loads are transferred at every wall node (18 ft apart) to the basemat and equilibrium of the forces between the walls and the basemat are maintained at all times. It should be noted that loads are not being transferred from the basemat to the superstructure.

- Grid size of the common nodes between walls above grade and the basemat is 18 ft. The basemat is 8-ft thick. Although the basemat has an extra node between each pair of adjacent common nodes, stiffness of the basemat between a pair of adjacent common nodes remains essentially rigid. Additional stiffness will have no effect on the relative stiffness between adjacent common nodes, and therefore, will have no effect on the calculated responses.

- The maximum response accelerations at selected locations of the basemat were examined and verified to be essentially uniform. Maximum horizontal accelerations at nodes 4782 through 4790 (basemat intersecting with south end of wall at column line 30) are calculated for the Upper Bound soil case. Within this set of nodes, all even number nodes are common to both the 5 ft thick wall at column line 30 and the 8 ft thick basemat at elevation 0 ft, while all of the odd number nodes are located on the basemat only. In the X-direction, the calculated maximum accelerations are 0.23 g at all nodes. In the Y-direction, maximum acceleration are 0.19 g at nodes 4782 through 4787 and 0.20 g at nodes 4788 through 4790. This uniform maximum acceleration confirmed the expectation that these intersections are essentially rigid and requires no modification. SASSI output file for these 2 analyses are shown in the attached tables.

(d) Vertical oscillators are used to represent vertical floor flexibility. Each of these vertical oscillators (with zero horizontal mass) has the vertical effective mass of the floor slab and is supported by 2 vertical springs (with zero horizontal stiffness) at 2 support points. The effective mass includes the portion of vertical mass of the slab and equipment that are participating in the vertical mode. The vertical mass of the oscillator and its vertical support stiffness are chosen so that the oscillator has the same frequency as that of the fundamental frequency of the slab and equipment. In calculating the slab vertical frequency, the mass and stiffness of floor beams are also considered. Since the placement of the equipment on the floor is not accurately represented, an additional 10% factor is included in the vertical ISRS to account for these uncertainties.

The exact amount of the vertical mass modeled as the oscillator mass is subtracted from the slab and its support nodes so that the total vertical mass of the model remains unchanged. Since horizontal mass was never altered, the total horizontal mass also remains unchanged.

It is recognized that the reinforced concrete slabs are modeled in the dynamic model of the building using plate elements (which have vertical stiffness) while the springs for each of the vertical oscillators also contribute relative vertical stiffness between the oscillator support nodes. However, the 2 springs that support each oscillator are 'in series' and the equivalent vertical stiffness between the 2 supporting wall nodes from the 2 oscillator springs is only 25% of the actual stiffness in parallel.

Therefore, for the oscillators that are supported by reinforced concrete walls, the relatively small additional vertical stiffness from the oscillator springs would not affect the global vertical responses at these vertically rigid supporting walls. There are multiple spring/mass combinations at these locations to characterize the full frequency range of response for the in-structure response spectra.

Oscillators are supported by steel columns, which are very stiff in the vertical direction but not as rigid as the reinforced concrete walls. As shown above, the oscillator springs in series adds only 25% of the actual stiffness between the columns, while the majority of the vertical stiffness of these reinforced concrete slabs are from the supporting steel floor beams that are not modeled in the finite element model. Therefore, any added vertical stiffness to these steel columns would be small and will not affect the vertical responses at the steel columns.

(e) Two load factors were applied in the design of the PT facility. One factor was applied to the horizontal accelerations to account for accidental torsion not included in the SASSI analysis and the second factor was applied to account for members subjected to accelerations greater than the floor average. There is an additional 20% increase in the seismic accelerations, as defined in calculation 24590-PTF-SOC-S15T-00004, Revision 1A, pages 4 and 6, to account for use of a weighted average in determining the floor accelerations. Using this method, the overall acceleration and the overall seismic load would be correct, however, locally, there may be some members that have higher accelerations. Therefore, this 20% increased factor was applied to the accelerations in the seismic loads.

In addition, the accidental torsion was incorporated in the floor acceleration values using the increased load factors according to the tables on page 106 of calculation 24590-PTF-SOC-S15T-00004, Revision 1A. The SASSI floor accelerations from this calculation are used in the static GTSTRUDL model to simulate the dynamic loading.

The structure above grade has the accidental torsion accounted for in the loading that is applied to the static model. The loads and data extracted directly from the SASSI analysis, and used for evaluation of the loads on the walls below grade, do not include these increased load factors.

The portions of the fire water pit structure below grade will be reviewed using the SASSI results on the elements below grade with an additional 1.2 factor applied to address accidental torsion. These loads and will be compared to the GTSTRUDL static analysis resulting loads coupled with the normal pressures from the ASCE-4 methodologies to assure that the SSI results are properly bounded in the design. The comparison results are presented in CCN 052558.

(f) The SSI calculations are issued. (Response by Mark Scott)

Disposition:
Hyperlink Connection #1:
\\WTPS0018\ES&HInfo\PT-PSAR-342_Hyperlink_1.doc
Hyperlink Connection #2:
Hyperlink Connection #3:

051760

Attachment to PT-PSAR-342:

SASSI 'Motion' output of maximum acceleration with X-input motion, Upper Bound Soil.

The Current Time is : 11:34:06 02/07/2003

OKMOTION - N FILE FOR ALL DIR ZPA, RPP-WTP PT BLDG
M A X I M U M A B S O L U T E A C C E L .

N.P.	XACC	AT TIME	YACC	AT TIME	ZACC	AT TIME
4782	0.23	6.22	0.01	5.57	0.00	0.00
4783	0.23	6.22	0.01	5.57	0.00	0.00
4784	0.23	6.23	0.01	12.79	0.00	0.00
4785	0.23	6.22	0.01	12.80	0.00	0.00
4786	0.23	6.23	0.01	15.34	0.00	0.00
4787	0.23	6.22	0.01	12.80	0.00	0.00
4788	0.23	6.23	0.01	12.80	0.00	0.00
4789	0.23	6.23	0.01	12.80	0.00	0.00
4790	0.23	6.23	0.01	12.80	0.00	0.00

BLANKS IN THE ABOVE TABLES ARE DOFS WHERE OUTPUT HAS NOT BEEN REQUESTED

SASSI 'Motion' output of maximum acceleration with Y-input motion, Upper Bound Soil.

The Current Time is : 11:34:07 02/07/2003

OKMOTION - N FILE FOR ALL DIR ZPA, RPP-WTP PT BLDG
M A X I M U M A B S O L U T E A C C E L .

N.P.	X-ACC	AT TIME	Y-ACC	AT TIME	Z-ACC	AT TIME
4782	0.01	12.02	0.19	3.50	0.00	0.00
4783	0.01	12.02	0.19	3.50	0.00	0.00
4784	0.01	11.99	0.19	3.50	0.00	0.00
4785	0.01	11.99	0.19	3.50	0.00	0.00
4786	0.01	11.99	0.19	3.50	0.00	0.00
4787	0.01	6.18	0.19	3.50	0.00	0.00
4788	0.01	3.52	0.20	3.50	0.00	0.00
4789	0.01	3.52	0.20	3.50	0.00	0.00
4790	0.01	3.52	0.20	3.50	0.00	0.00

BLANKS IN THE ABOVE TABLES ARE DOFS WHERE OUTPUT HAS NOT BEEN REQUESTED

CCN 052558

052558

Memorandum

To:	Bill Spezialetti, ES&H	Date:	03/05/03
From:	Mark A. Scott, CS&A (PT)	CCN:	052558
Ext:	371-8513		
Fax:	371-8689		

Subject: Response to PT-PSAR-342

References:

1) 24590-PTF-S0C-S15T-00003, Revision 1A, Pretreatment Building Seismic Analysis: SSI Analysis, dated November 29, 2002.
2) 24590-PTF-DGC-S13T-00002, Revision 2, Design of Pit and Below Grade Walls for PT Building, dated October 1, 2002.
3) 24590-PTF-S0C-S15T-00012, Revision 1, Structural Analysis for the Pretreatment Facility, dated 9-30-02.
4) 24590-PTF-S0C-S15T-00004, Revision 1A, Pretreatment Building Seismic Analysis: Seismic Loads, dated November 29, 2002.
5) 02-OSR-0517, *Contract No. DE-AC27-01RV14136 – U.S. Department of Energy (DOE) Notice to Proceed with Construction Activities,* "Construction Authorization Agreement, Revision 0, between the U.S. Department of Energy, Office of River Protection and Bechtel National, Inc." Appendix A.
6) CCN: 044586, Memorandum I. J. Ghosh to D. Houghton, Subject: Response to additional information, requested by OSR, in relation to the structural evaluation of the Pretreatment Below-Grade Pits and Tunnels.

In response to the reference 5 request to rerun the Soil Structure Interaction (SSI) analysis, the resulting calculations were submitted to OSR for review. The questions which resulted, PT-PSAR-342, require the assessment of the soil pressures on the below grade walls. The actual request stated:

> "Perform a revised seismic SSI analysis based on the revised building layout in which lateral dynamic soil pressures will be calculated directly for a few critical below-grade walls using soil pressure elements in the SASSI model before full PT facility construction authorization. If soil pressure is not obtained directly from the SSI analysis, the SASSI generated moment results will be used to estimate the lateral dynamic soil pressure."

The purpose of this memorandum is to provide the information to resolve the questions of PT-PSAR-342 related to reference 5. This memorandum will provide excerpts of data extracted from the new SSI results (reference 1) that will be used to assess the adequacy of the existing design calculations for the walls below grade (reference 2).

Several questions were raised related to the design adequacy of the existing design of the walls below grade. The questions from PT-PSAR-342 are paraphrased along with the supplemental information requested in the follow on meetings with OSR representatives.

1. Item (b) asked for the soil pressures on the Firewater Pit and how they were considered for design. Additionally, how is the soil/concrete interface friction resistance on the face of the walls included in the design loads.
2. Item (e) asked how accidental torsion was considered for the basemat and walls below grade.
3. The second part of Item (a) asks: "If the SSI loads exceed the design loads, how are the higher SSI loads accounted for in representing the demand?"

Item 1.

The soil pressures on the firewater pit were not explicitly determined from the SSI analysis using the pressure surfaces as they were for the main pits and tunnels. The soil/concrete interface shear force was not explicitly considered in the results of the SSI analysis either. To assure that the existing design bounded these loads, a comparison was completed between the explicit loads on the firewater pit from the SSI analysis (reference 1) and the loads taken from the static STRUDL model (reference 3) that were used in the wall design (reference 2).

The static model that was used for the design of the PT structure did not explicitly model the soil boundary conditions surrounding the walls below grade. Soil pressure loading was applied on the below grade walls to simulate the sustained soil pressure on all walls. The plus/minus dynamic soil pressure applied to the wall faces in the same direction as the above grade lateral forces. The static model used springs at the bottom of the pits and the bottom of the mat on grade to provide the resistance to the lateral seismic loads. Thus the shear used for the design of the walls was the reactionary shear from the static model responding to the applied .77g static load plus the dynamic soil pressure applied in separate load cases on opposing walls. The resulting loads on the firewater pits should reflect the normal surface pressures plus a global load on the pit which will result in a net interface-shear load.

The loads on the firewater pit walls below grade from the SSI analysis model were not given explicitly in reference 4. The resulting stresses on the firewater pit walls below grade and the main pit walls below grade were provided by BNI/SF from the SSI results. The SSI model would properly characterize the interface soil surface pressures and shears.

The only logical method to demonstrate that the design methods of reference 2 used adequate design loads is to compare the shears and bending moments used in the design to the shears and bending moments directly from the SSI model. This is the methodology used previously in reference 6. Additionally, to account for the accidental torsion concern from Item (e), the comparison will utilize 1.2 load factor on the new SSI loads.

The two portions of the firewater pit that were examined to assure that the loads were properly bounded. First, the horizontal interface joint between the vertical pit walls and the bottom face of the foundation mat is evaluated. This is to make sure that the total design shear load/stress at the interface is greater than the resulting shear load/stress at the interface from the SSI analysis. The results are presented in the attached tables. The shear loads at the horizontal interface of the Firewater Pit to the basemat were evaluated for both the north-south and east-west directional loading. The shear load at this interface is parallel to the wall. The shear loads have two components, the directional loading parallel to the wall (major component), and the directional loading normal to the wall (minor direction). The directional load parallel with the wall is combined with 40% directional load normal to the wall. The results are presented in Tables 1 and 2. When the GTSTRUDL/SSI Ratio is greater than 1, it is indicative that the design load used for the analysis is conservative.

Second, the GTSTRUDL design out of plane moments in the walls below grade are compared to the resulting out of plane moments from the SSI analysis. These are the same tables presented in reference 6 with the modified data from the latest runs added. Where the ratios of the SSI loads exceeded GTSTRUDL loads, adjacent wall cuts with similar reinforcing and wall thicknesses were examined to see if higher GTSTRUDL loads were used. If so, the load ratio was made with the higher adjacent design load. Since the design bounded both, the second ratio is indicative of the level of design capacity in the wall section. In addition, the representative D/C ratio of the total load from reference 2 for that portion of the wall is shown as well to see the level of demand in the wall. The Out of Plane Moment Comparison Results are presented in attached tables and figures. When the GTSTRUDL/SSI Ratio is greater than 1.2, it is indicative that the design load used for the analysis is conservative.

Item 2

The accidental torsion is included with application of a load factors in the accelerations that are applied to the static model to represent the seismic loading. The boundary conditions in the static model will result in conservative results for the design loads in the basemat and structure above grade. The same modeling boundary conditions preclude proper representation of soil loading on the walls below grade. The pressures on the walls below grade that are extracted directly from the SSI analysis must include an additional load factor to account for accidental torsion. This was done in addressing the questions in the item b response.

Item 3

The resulting loads from the SSI analysis do not exceed those loads used for the design of the below grade walls as demonstrated in item (b). Therefore, a response to the second question of Item (a) is not necessary.

Conclusion

The results of the evaluation of Item 1 show that the design loads exceed the resulting loads from the SSI analysis. In the locations where the direct load comparison ratios fall below unity, a review of the actual design calculation D/C ratios demonstrate large design margins.

The source documentation for the summary tables is available for review. The source SSI data is documented and checked along with the data taken from the GTSTRUDL runs.

If you have any other questions related to these seismic and SSI results, please contact me at 371-8513.

Mark A. Scott, PE, SE
Sr. Structural Lead Engineer
RPP-WTP-PT-CS&A

PTF CS&A/mas

Attachments:

TABLE 1
SSI REV. 1A Vs. GT-STRUDL (0.77g) RESULTS COMPARISON FOR IN-PLANE SHEAR FORCE IN FIRE WATER PIT N-S DIRECTION WALL FOR COMBINED N-S and E-W DIRECTION EXCITATIONS

N-S wall 28:E-H			
	N-S excitation	**E-W excitation**	**1.0(N-S)+0.4 (E-W)**
SSI elem no.	**Sxy (ksf)**	**Sxy (ksf)**	**Sxy (ksf)**
3	4.80	1.84	5.54
216	6.90	1.11	7.34
217	5.20	1.06	5.62
218	5.60	0.60	5.84
219	5.20	0.75	5.50
220	4.97	1.42	5.54
	32.67	6.78	35.38
SSI AVG	5.4	1.1	5.90
1.2xSSI AVG	**6.5**	**1.4**	**7.08**
GT-STRUDL(0.77g)	**12.4**	**2.7**	**13.47**
GT-STRUDL/1.2SSI ratio	**1.90**	**2.01**	**1.90**
N-S wall 29.5:H-J			
	N-S excitation	**E-W excitation**	**1.0(N-S)+0.4 (E-W)**
SSI elem no.	**Sxy (ksf)**	**Sxy (ksf)**	**Sxy (ksf)**
221	2.00	2.81	3.12
222	2.80	2.71	3.88
	4.80	5.52	7.01
SSI AVG	2.4	2.8	3.5
1.2xSSI AVG	**2.9**	**3.3**	**4.2**
GT-STRUDL(0.77g)	**6.3**	**4.2**	**8.0**
GT-STRUDL/1.2SSI ratio	**2.20**	**1.27**	**1.91**
N-S wall 30:E-J			
	N-S excitation	**E-W excitation**	**1.0(N-S)+0.4 (E-W)**
SSI elem no.	**Sxy (ksf)**	**Sxy (ksf)**	**Sxy (ksf)**
223	6.10	2.25	7.00
21	7.42	1.03	7.83
224	4.60	0.26	4.70
225	4.90	2.13	5.75
226	5.50	1.85	6.24
227	5.20	2.71	6.28
228	4.30	0.72	4.59
229	3.90	0.61	4.14
	41.9	11.6	46.5
SSI AVG	5.2	1.4	5.8
1.2xSSI AVG	**6.3**	**1.7**	**7.0**
GT-STRUDL(0.77g)	**6.8**	**1.6**	**7.5**
GT-STRUDL/1.2SSI ratio	**1.09**	**0.95**	**1.07**

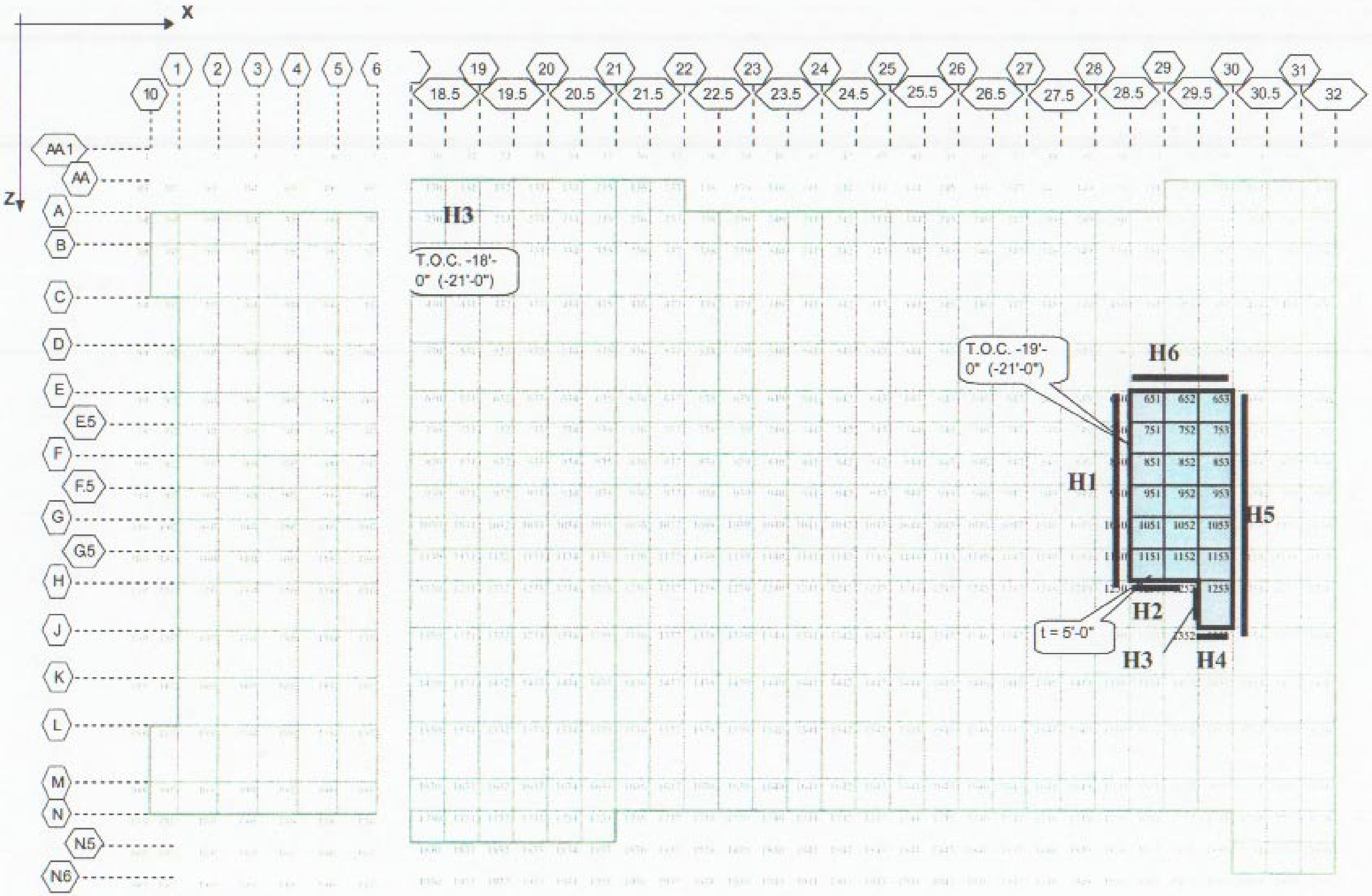
TABLE 2

SSI REV. 1A Vs. GT-STRUDL (0.77g) RESULTS COMPARISON FOR IN-PLANE SHEAR FORCE IN FIRE WATER PIT E-W DIRECTION WALL FOR COMBINED N-S and E-W DIRECTION EXCITATIONS

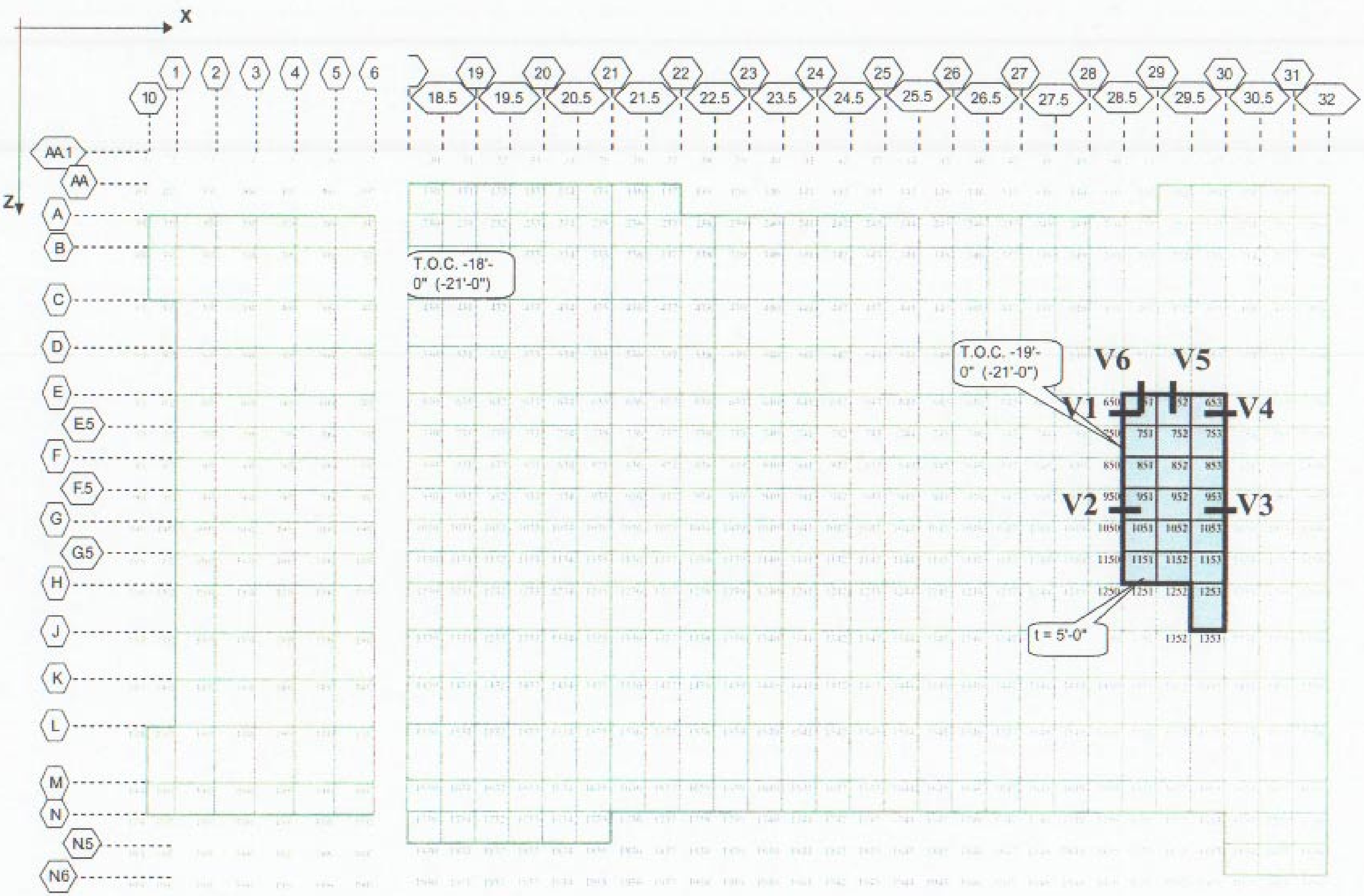
E-W Wall: E 28-30			
	E-W excitation	**N-S excitation**	**0.4(N-S)+1.0 (E-W)**
SSI elem no.	**Sxy (ksf)**	**Sxy (ksf)**	**Sxy (ksf)**
115	7.94	1.70	8.62
116	6.77	1.95	7.55
117	5.63	2.78	6.74
118	5.49	2.65	6.55
	25.83	9.08	29.46
SSI AVG	6.5	2.3	7.4
1.2xSSI AVG	**7.7**	**2.7**	**8.8**
GT-STRUDL(0.77g)	**11.9**	**3.7**	**13.3**
GT-STRUDL/1.2SSI ratio	**1.53**	**1.35**	**1.51**
E-W Wall: H 28-29.5			
	E-W excitation	**N-S excitation**	**0.4(N-S)+1.0 (E-W)**
SSI elem no.	**Sxy (ksf)**	**Sxy (ksf)**	**Sxy (ksf)**
123	9.09	1.58	9.72
124	8.37	1.71	9.05
125	6.73	2.38	7.68
	24.19	5.7	26.46
SSI AVG	8.1	1.9	8.8
1.2xSSI AVG	**9.7**	**2.3**	**10.6**
GT-STRUDL(0.77g)	**17.4**	**7.1**	**20.3**
GT-STRUDL/1.2SSI ratio	**1.80**	**3.12**	**1.92**
E-W Wall: J 29.5-30			
	E-W excitation	**N-S excitation**	**0.4(N-S)+1.0 (E-W)**
SSI elem no.	**Sxy (ksf)**	**Sxy (ksf)**	**Sxy (ksf)**
131	7.88	2.52	8.89
SSI AVG	7.9	2.5	8.89
1.2xSSI AVG	**9.456**	**3.024**	**10.67**
GT-STRUDL(0.77g)	**16.9**	**1.6**	**17.47**
GT-STRUDL/1.2SSI ratio	**1.78**	**0.51**	**1.64**

OUT OF PLANE MOMENT COMPARISON

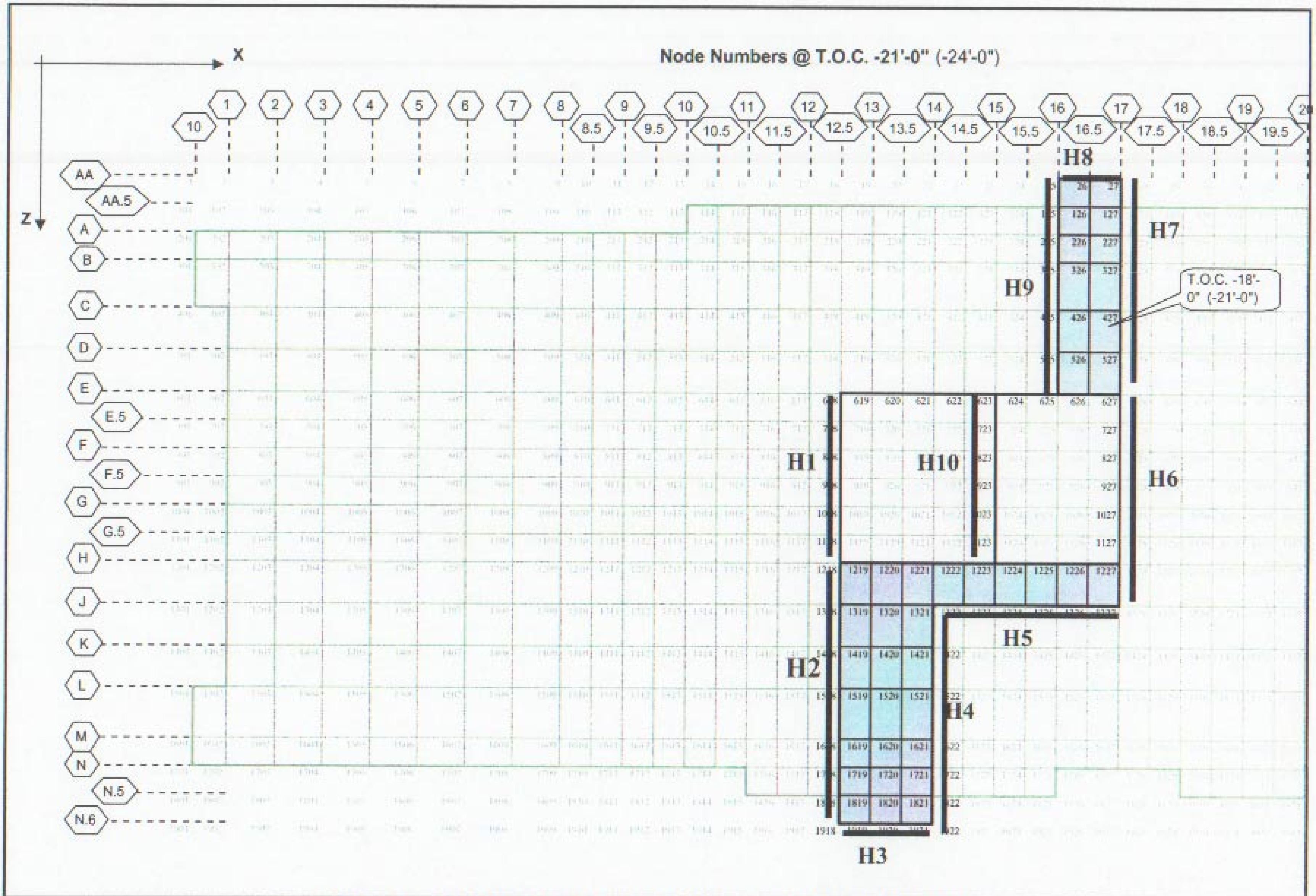
052558



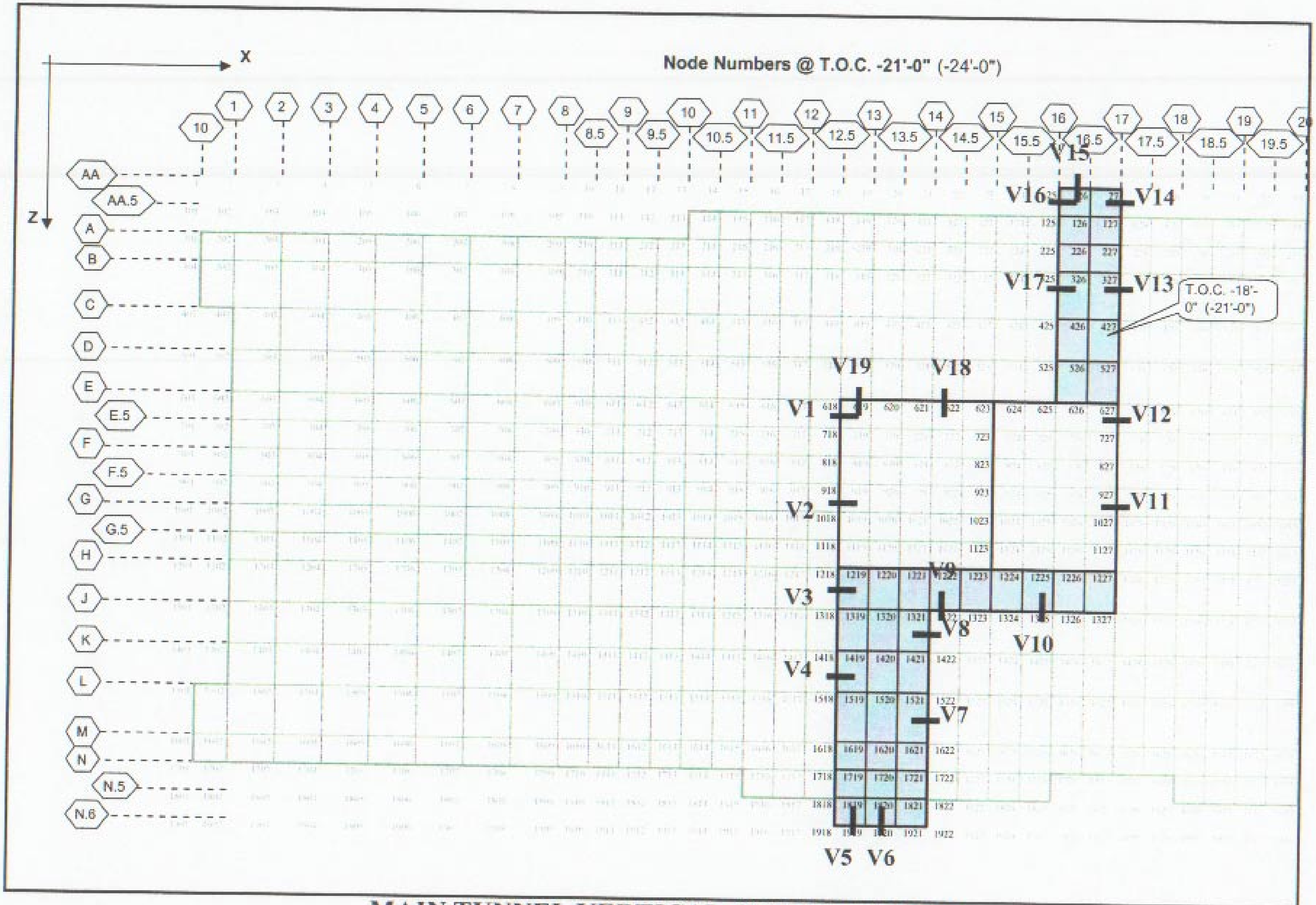
FIRE-WATER PIT HORIZONTAL CUT LOCATIONS



FIRE-WATER PIT VERTICAL CUT LOCATIONS



MAIN TUNNEL HORIZONTAL CUT LOCATIONS



MAIN TUNNEL VERTICAL CUT LOCATIONS

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SSI vs GTSTRUDL COMPARISON TABLE FOR THE FIRE-WATER PIT HORIZONTAL CUT BENDING MOMENTS MYY

8

East-West Exiction N-S WALL-FIRE/WATER PIT (WEST SDIE), TOP Grid Lines 28.5: E-H, EL. -8' (285:E-H=5250,4650)					$H1\text{-}X_{RUN}\text{-}11$
SASSI ELEMENT Rev 0	LOWER	MEAN	UPPER BOUND SOIL: MYY		
	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
3	31.0	27.8	24.9	3	75.0
211	34.9	31.5	28.1	216	78.4
212	37.3	33.4	29.9	217	79.7
213	38.0	33.3	30.3	218	78.8
214	37.0	32.9	29.5	219	79.4
215	33.8	32.4	26.8	220	81.3
SASSI AVG	35.3	31.9	28.2		78.8
GT-STRUDL*	184.0	184.0	184.0		353.0
GT-STRUDL/SSI RATIO	**5.2**	**5.8**	**6.5**		**4.5**

Units for MYY = ft-kips

15

North-South Excitation E-W WALL-FIRE/WATER PIT (SOUTH SIDE), TOP Grid Lines H: 28-29.5, EL. -8' (H:285-29=5250,5252)					$H2\text{-}Y_{RUN}\text{-}10$
SASSI ELEMENT Rev 0	LOWER	MEAN	UPPER BOUND SOIL: MYY		
	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
122	16.0	14.8	11.9	same	38.6
123	15.9	15.8	12.1	same	19.8
124	13.0	12.5	10.7	same	13.6
SASSI AVG	15.0	14.4	11.5		24.0
GT-STRUDL*	14	14	14		51.0
GT-STRUDL/SSI RATIO	**0.9****	**1.0**	**1.2**		**2.1**

Units for MYY = ft-kips

10

East-West Excitation N-S WALL-FIRE/WATER PIT (MIDDLE WEST SIDE), TOP Grid Lines 29.5: H-J, EL. -8' (295:H-J=5352,5252)					$H3\text{-}X_{RUN}\text{-}11$
SASSI ELEMENT Rev 0	LOWER	MEAN	UPPER BOUND SOIL: MYY		
	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
216	21.3	20.2	18.5	221	40.4
217	22.4	19.7	17.5	222	41.6
SASSI AVG	21.8	20.0	18.0		41.0
GT-STRUDL*	76.0	76.0	76.0		123.0
GT-STRUDL/SSI RATIO	**3.5**	**3.8**	**4.2**		**3.0**

Units for MYY = ft-kips

16

North-South Excitation E-W WALL-FIRE/WATER PIT (NORTH SIDE), TOP Grid Lines J: 29.5-30, EL. -8' (J:295-30=5352,5353)					$H4\text{-}Y_{RUN}\text{-}10$
SASSI ELEMENT Rev 0	LOWER	MEAN	UPPER BOUND SOIL: MYY		
	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
130	22.8	22.4	19.1	131	4.5
SASSI AVG	22.8	22.4	19.1		4.5
GT-STRUDL*	37	37	37		49.0
GT-STRUDL/SSI RATIO	**1.6**	**1.6**	**1.9**		**10.9**

Units for MYY = ft-kips

9

East-West Excitation N-S WALL- FIRE/WATER PIT (EAST SIDE), TOP Grid Lines 30: E-J, EL. -8' (285:E-H=5353,4653)					$H5\text{-}X_{RUN}\text{-}11$
SASSI ELEMENT Rev 0	LOWER	MEAN	UPPER BOUND SOIL: MYY		
	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
218	39.0	34.4	28.5	223	28.9
17	43.0	37.5	30.6	21	
219	44.6	38.6	31.6	224	28.8
220	45.1	38.3	31.2	225	24.3
221	45.9	39.4	32.1	226	26.6
222	47.3	41.8	34.6	227	27.1
223	45.4	40.1	33.0	228	26.4
224	39.3	34.0	27.3	229	26.9
SASSI AVG	43.7	38.0	31.1		27.0
GT-STRUDL*	338.0	338.0	338.0		319.0
GT-STRUDL/SSI RATIO	**7.7**	**8.9**	**10.9**		**11.8**

Units for MYY = ft-kips

14

North-South Excitation E-W WALL-FIRE/WATER PIT (NORTH SIDE), TOP Grid Lines E: 28-30, EL. -8' (E:285-30=4650,4653					$H6\text{-}Y_{RUN}\text{-}10$
SASSI ELEMENT Rev 0	LOWER	MEAN	UPPER BOUND SOIL: MYY		
	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
114	14.6	11.5	13.3	115	20.0
115	13.2	10.5	10.6	116	20.6
116	13.1	10.8	10.5	117	23.1
117	14.1	10.8	13.3	118	24.2
SASSI AVG	13.8	10.9	11.9		22.0
GT-STRUDL*	94	94	94		112.0
GT-STRUDL/SSI RATIO	**6.8**	**8.6**	**7.9**		**5.1**

Units for MYY = ft-kips

SSI vs GTSTRUDL COMPARISON TABLE FOR THE FIRE-WATER PIT
VERTICAL CUT BENDING MOMENTS MXX

13

East-West Exiction N-S WALL-FIRE/WATER PIT, VERTICAL AXIS NEAR GRID E Grid Lines 28.5: E-H (285:EE5I=650,4650)					V1-X_{RUN}-11
SASSI ELEMENT Rev 0	LOWER	MEAN	UPPER BOUND SOIL: MXX		
	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
3	5.2	4.6	3.8	Same No.	10.1
143	1.5	1.7	1.8	148	2.5
SASSI AVG	3.4	3.1	2.8		6.3
GT-STRUDL*	9.0	9.0	9.0		156.0
GT-STRUDL/SSI RATIO	**2.7**	**2.9**	**3.2**		**24.7**

Units for MXX = ft-kips

14

East-West Exiction N-S WALL-FIRE/WATER PIT, VERTICAL AXIS NEAR GRID F.5 Grid Lines 28.5: E-H (285:F-F5=950,4950)					V2-X_{RUN}-11
SASSI ELEMENT Rev 0	LOWER	MEAN	UPPER BOUND SOIL: MXX		
	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
213	6.3	5.8	5.0	223	5.4
146	7.8	7.3	6.4	156	0.8
SASSI AVG	7.0	6.5	5.7		3.1
GT-STRUDL*	41.0	41.0	41.0		31.0
GT-STRUDL/SSI RATIO	**5.8**	**6.3**	**7.2**		**10.0**

Units for MXX = ft-kips

16

East-West Exiction N-S WALL-FIRE/WATER PIT, VERTICAL AXIS NEAR GRID G Grid Lines 30: E-J (30:G-G5=1053,5053)					V3-X_{RUN}-11
SASSI ELEMENT Rev 0	LOWER	MEAN	UPPER BOUND SOIL: MXX		
	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
221	6.9	5.7	4.5	225	3.2
155	4.7	3.7	3.3	159	4.4
SASSI AVG	5.8	4.7	3.9		3.8
GT-STRUDL*	20.0	20.0	20.0		30.0
GT-STRUDL/SSI RATIO	**3.4**	**4.3**	**5.1**		**7.9**

Units for MXX = ft-kips

East-West Exiction N-S WALL-FIRE/WATER PIT, VERTICAL AXIS NEAR GRID E Grid Lines 30: E-J (30:EE5O=753,4753)					$V4\text{-}X_{RUN}\text{-}11$
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX		
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
218	4.7	4.2	3.6	Same No.	11.4
151	2.5	2.1	1.9	Same No.	14.4
SASSI AVG	3.6	3.2	2.7		12.9
GT-STRUDL*	31.0	31.0	31.0		42.0
GT-STRUDL/SSI RATIO	**8.6**	**9.8**	**11.4**		**3.3**

Units for MXX = ft-kips

25

North-South Exiction E-W WALL-FIRE/WATER PIT, VERTICAL AXIS NEAR GRID 29.5 Grid Lines E: 28.5-30 (E:295I=652,4652)					$V5\text{-}Y_{RUN}\text{-}10$	Compare **V4 vs V5**	Design **D/C** from calc
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX				
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A		
85	4	3.9	3.5	Same No.	9.8		
116	1.6	2.6	4	Same No.	9.2		
SASSI AVG	2.8	3.2	3.7		9.5	9.5	
GT-STRUDL*	25	25	25		6.0	42	
GT-STRUDL/SSI RATIO	**8.9**	**7.7**	**6.7**		**0.6**	**4.4**	**0.49**

Units for MXX = ft-kips

24

North-South Exiction E-W WALL-FIRE/WATER PIT, VERTICAL AXIS NEAR GRID 28.5 Grid Lines E: 28.5-30 (E:285I=651,4651)					$V6\text{-}Y_{RUN}\text{-}10$	Compare **V4 vs V6**	Design **D/C** from calc
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX				
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A		
83	2.7	3.7	4.2	84	7.3		
114	6	7.5	1.5	115	9.8		
SASSI AVG	4.3	5.6	2.8		8.6	8.6	
GT-STRUDL*	21	21	21		5.0	42	
GT-STRUDL/SSI RATIO	**4.9**	**3.7**	**7.4**		**0.6**	**4.9**	**0.49**

Units for MXX = ft-kips

SSI vs GTSTRUDL COMPARISON
MAIN TUNNEL PITS
HORIZONTAL CUT BENDING MOMENTS

SSI vs GTSTRUDL COMPARISON TABLE FOR THE PTF MAIN TUNNEL
HORIZONTAL CUT BENDING MOMENTS MYY

1A

East-West Excitation					
N-S WALL (WEST SIDE), TOP					$H1\text{-}X_{RUN}\text{-}11$
Grid Lines 12.5:E-H, EL. -8' (125:E-H=5218,4618)					
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MYY		
Rev 0	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
1	110.8	88.1	74.5	1	83.9
23	108.9	83.7	68.8	NA	
159	105.3	80.1	64.3	NA	
24	108.4	83.3	67.3	NA	
160	120.0	94.3	79.6	165	97.5
161	137.9	114.9	103.5	166	121.2
SASSI AVG	115.2	90.7	76.3		100.9
GT-STRUDL*	268.0	268.0	268.0		265.0
GT-STRUDL/SSI RATIO	**2.3**	**3.0**	**3.5**		**2.6**

Units for MYY = ft-kips

2

East-West Excitation					
N-S WALL (WEST SIDE), TOP					$H2\text{-}X_{RUN}\text{-}11$
Grid Lines 12.5: H-N.6, EL. -8' (125:H-N6=5918,5218)					
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MYY		
Rev 0	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
162	151.1	129.8	121.1	166	121.2
163	152.2	130.8	122.2	167	135.8
164	148.5	128.1	119.9	168	133.6
165	146.2	126.9	118.5	169	129.0
2	146.0	127.8	118.5	170	127.5
166	149.3	132.2	124.0	2	129.9
21	147.5	132.0	123.3	171	137.2
167	139.4	125.9	116.0	25	137.4
168	132.9	121.5	111.4	172	130.0
169	120.9	112.7	103.9	173	123.9
170	86.4	82.8	78.2	174	118.2
171	44.0	43.6	42.7	175	88.1
SASSI AVG	130.4	116.2	108.3		126.0
GT-STRUDL*	472.0	472.0	472.0		470.0
GT-STRUDL/SSI RATIO	**3.6**	**4.1**	**4.4**		**3.7**

Units for MYY = ft-kips

13

North-South Excitation E-W WALL-MAIN TUNNEL (SOUTH SIDE), TOP Grid Lines N.6: 12.5-14, EL. -8' (N6125-14=5918,5921)					H3-Y_{RUN}-10
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MYY		
Rev 0	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
5	13.1	14.2	13.2	NA	
131	17.3	18.8	17.7	NA	
132	17.2	18.6	17.7	133	21.1
1	12.4	13.7	13.5	1	14.5
SASSI AVG	15.0	16.3	15.5		17.8
GT-STRUDL*	19	19	19		63.0
GT-STRUDL/SSI RATIO	**1.3**	**1.2**	**1.2**		**3.5**

Units for MYY = ft-kips

1

East-West Excitation N-S WALL (EAST SIDE), TOP Grid Lines 14: J-N.6, EL. -8' (14:J-N6=5921,5321)					H4-X_{RUN}-11
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MYY		
Rev 0	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
172	114.7	105.5	102.1	177	118.5
173	118.9	108.0	103.8	178	121.8
25	126.0	114.2	108.8	29	128.1
174	134.3	121.9	114.5	NA	
26	137.1	124.9	120.3	NA	
175	132.9	121.4	116.0	NA	
176	129.0	118.9	112.4	181	129.9
177	119.8	111.8	106.2	182	121.3
178	86.6	82.5	80.1	183	89.8
179	44.3	43.1	43.1	184	47.1
SASSI AVG	114.4	105.2	100.7		108.1
GT-STRUDL*	589.0	589.0	589.0		587.0
GT-STRUDL/SSI RATIO	**5.2**	**5.6**	**5.8**		**5.4**

Units for MYY = ft-kips

12

North-South Excitation E-W WALL-MAIN TUNNEL (MIDDLE AREA), TOP Grid Lines J: 14-17, EL. -8' (J:125-17=5321,5327)					H5-Y_{RUN}-10
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MYY		
Rev 0	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
125	88.4	91.8	67.4	126	46.3
126	93.2	95.8	68.1	127	48.7
127	99.4	101.8	72.0	NA	
128	103.9	92.6	76.6	NA	
6	105.9	93.8	80.6	NA	
129	105.6	95.0	80.2	NA	
SASSI AVG	99.4	95.1	74.2		47.5
GT-STRUDL*	422	422	422		445.0
GT-STRUDL/SSI RATIO	**4.2**	**4.4**	**5.7**		**9.4**

Units for MYY = ft-kips

3

East-West Excitation N-S WALL (EAST SIDE), TOP Grid Lines 17: E-H, EL. -8' (17:E-H=5227,4627)					H6-X_{RUN}-11
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MYY		
Rev 0	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
205	127.8	112.8	99.4	210	112.0
19	113.1	95.5	77.7	23	94.5
206	104.8	100.0	67.9	211	85.4
20	103.7	86.1	68.1	24	81.7
207	109.6	90.9	77.3	212	87.5
208	119.3	104.5	95.2	213	104.2
209	118.1	105.0	98.4	213	104.2
210	103.1	88.1	81.1	215	99.0
SASSI AVG	112.4	97.9	83.1		96.0
GT-STRUDL*	556.0	556.0	556.0		554.0
GT-STRUDL/SSI RATIO	**4.9**	**5.7**	**6.7**		**5.8**

Units for MYY = ft-kips

5

East-West Excitation					
N-S WALL-MAIN TUNNEL (EAST SIDE), TOP Grid Lines 17: AA-E, EL. -8' (17:AA-E=4627,4027)					$H7\text{-}X_{RUN}\text{-}11$
SASSI ELEMENT Rev 0	LOWER	MEAN	UPPER BOUND SOIL: MYY		
	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
196	35.4	34.4	33.7	201	36.9
18	72.0	68.3	65.4	22	73.8
197	98.2	91.2	86.5	202	98.0
198	101.3	92.9	88.2	203	98.5
199	101.2	92.0	87.2	204	99.3
200	105.4	95.8	90.3	205	102.6
201	108.1	97.9	92.0	206	103.5
202	111.0	100.1	92.8	207	103.5
203	121.2	110.1	100.6	208	111.1
204	132.8	119.8	109.1	209	120.6
SASSI AVG	98.7	90.3	84.6		94.8
GT-STRUDL*	494.0	494.0	494.0		493.0
GT-STRUDL/SSI RATIO	**5.0**	**5.5**	**5.8**		**5.2**

Units for MYY = ft-kips

11

North-South Exiction					
E-W WALL-MAIN TUNNEL (NORTH SIDE), TOP Grid Lines AA: 16-17, EL. -8' (AA:1 6-17=4025,4027)					$H8\text{-}Y_{RUN}\text{-}10$
SASSI ELEMENT Rev 0	LOWER	MEAN	UPPER BOUND SOIL: MYY		
	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
104	6.6	7.6	7.5	105	8.8
105	6.9	7.6	7.2	106	9.1
SASSI AVG	6.8	7.6	7.4		8.9
GT-STRUDL*	25	25	25		25.0
GT-STRUDL/SSI RATIO	**3.7**	**3.3**	**3.4**		**2.8**

Units for MYY = ft-kips

East-West Excitation N-S WALL-MAIN TUNNEL, TOP Grid Lines 16: AA-E, EL. -8' (16:AA-E=4625,4025)					H9-X_{RUN}-11
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MYY		
Rev 0	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
186	34.8	33.7	32.9	191	36.5
187	71.2	67.3	63.8	192	73.3
188	97.7	90.5	84.4	193	99.0
189	100.6	92.5	85.5	194	102.6
190	99.4	93.0	85.6	195	102.8
191	101.1	95.9	89.2	196	106.0
192	100.2	94.8	89.0	197	105.3
193	97.9	95.2	87.5	198	102.6
194	101.2	99.1	91.4	199	105.5
195	105.8	101.2	97.8	200	110.4
SASSI AVG	91.0	86.3	80.7		94.4
GT-STRUDL*	385.0	385.0	385.0		383.0
GT-STRUDL/SSI RATIO	**4.2**	**4.5**	**4.8**		**4.1**

Units for MYY = ft-kips

6

East-West Exiction N-S WALL-MAIN TUNNEL (INTERIOR), TOP Grid Lines 15: E-H, EL. -8' (15:E-H=5223,4623)					H10-X_{RUN}-11
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MYY		
Rev 0	MYY	MYY	MYY-Rev. 0	Elem Rev. 1A	MYY - Rev. 1A
180	13.6	13.3	12.0	NA	
181	9.6	9.4	9.6	186	45.7
182	7.0	6.9	7.2	187	46.6
183	6.0	6.3	6.4	188	43.6
184	8.2	7.9	8.1	189	42.2
185	11.9	12.3	11.4	190	45.4
SASSI AVG	9.4	9.4	9.1		44.7
GT-STRUDL*	23.0	23.0	23.0		90.0
GT-STRUDL/SSI RATIO	**2.5**	**2.5**	**2.5**		**2.0**

Units for MYY = ft-kips

SSI vs GTSTRUDL COMPARISON TABLE FOR THE MAIN TUNNEL PITS
HORIZONTAL CUT BENDING MOMENTS MXX

1

East-West Exiction N-S WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID E Grid Lines 12.5: E-H (125:EE5I=60618,4618)					V1-X_{RUN}-11	Compare V1 vs V2	Design D/C from calc
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX				
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A		
33	3.1	2.7	2.2	37	2.9		
51	6.3	4.7	3.7	55	4.2		
67	4.8	4.3	3.5	71	4.6		
83	6.9	4.5	4.5	87	4.5		
1	11.1	8.6	7.1	1	9.9		
SASSI AVG	6.5	5.0	4.2		5.2	5.2	
GT-STRUDL*	36.6	36.6	36.6		1.0	171	
GT-STRUDL/SSI RATIO	**5.6**	**7.3**	**8.7**		**0.2**	**32.9**	**0.64**

Units for MXX = ft-kips

2

East-West Excitation N-S WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID G Grid Lines 12.5: E-H (125:F-F5=60918,4918)					V2-X_{RUN}-11
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX		
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
36	22.9	19.7	18.3	40	21.3
54	16.9	12.4	8.4	58	10.7
70	5.9	5.3	6.2	74	6.7
86	12.8	12.1	13.1	NA	
24	24.6	18.7	15.4	NA	
SASSI AVG	16.6	13.7	12.3		12.9
GT-STRUDL*	17.0	17.0	17.0		171.0
GT-STRUDL/SSI RATIO	**1.0**	**1.2**	**1.4**		**13.3**

Units for MXX = ft-kips

3

East-West Excitation N-S WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID H Grid Lines 12.5: H-N.6 (125:H-JO=1318,5318)					V3-X_{RUN}-11
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX		
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
162	20.2	20.7	21.9	167	19.4
89	42.9	37.4	34.2	93	39.8
SASSI AVG	31.6	29.1	28.0		29.6
GT-STRUDL*	27.0	27.0	27.0		190.0
GT-STRUDL/SSI RATIO	0.9 **	0.9 **	1.0		**6.4**

Units for MXX = ft-kips

East-West Exiction N-S WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID K Grid Lines 12.5: H-N.6 (125:J-M=1518,5518)					V4-X_{RUN}-11
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX		
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
2	22.9	19.6	17.6	2	21.0
7	10	8.4	7.9	97	9.9
SASSI AVG	16.5	14.0	12.8		15.4
GT-STRUDL*	18.0	18.0	18.0		117.0
GT-STRUDL/SSI RATIO	**1.1**	**1.3**	**1.4**		**7.6**

Units for MXX = ft-kips

21

North-South Excitation E-W WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID 12.5 Grid Lines N.6: 12.5-14 (N6:1250,1918,5918)					V5-Y_{RUN}-10
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX		
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
5	3.3	2.8	3.3	Not Available	Not Available
100	1.1	0.9	1.4	Not Available	Not Available
SASSI AVG	2.2	1.9	2.3		
GT-STRUDL*	22.0	22.0	22.0		29.0
GT-STRUDL/SSI RATIO	**9.9**	**11.8**	**9.4**		**Not Available**

Units for MXX = ft-kips

22

North-South Excitation E-W WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID 14 Grid Lines N.6: 12.5-14 (N6:135I=1920,5920)					V6-Y_{RUN}-10
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX		
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
132	3.3	2.2	2.3	133	5.4
102	8.0	8.5	7.7	103	6.7
SASSI AVG	5.6	5.4	5.0		6.1
GT-STRUDL*	5.0	5.0	5.0		32.0
GT-STRUDL/SSI RATIO	**0.9****	**0.9****	**1.0**		**5.3**

Units for MXX = ft-kips

Not Available = Data for this SASSI element not included in supplied information.

East-West Excitation N-S WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID L Grid Lines 14: J-N.6 (14:L-MO=1621,5621)					V7-X_{RUN}-11
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX		
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
26	33.4	32.7	33.0	29	21.0
103	9.1	7.9	7.2	9	13.9
SASSI AVG	21.2	20.3	20.1		17.5
GT-STRUDL*	97.0	97.0	97.0		42.0
GT-STRUDL/SSI RATIO	4.6	4.8	**4.8**		**2.4**

Units for MXX = ft-kips

11

East-West Excitation N-S WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID J Grid Lines 14: J-N.6 (14:J-KI=1421,5421)					V8-X_{RUN}-11
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX		
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
172	16.8	16.6	16.2	177	19.0
100	18.5	14.0	10.9	105	12.3
SASSI AVG	17.6	15.3	13.6		15.6
GT-STRUDL*	42.0	42.0	42.0		156.0
GT-STRUDL/SSI RATIO	**2.4**	**2.7**	**3.1**		**10.0**

Units for MXX = ft-kips

19

North-South Excitation E-W WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID 14 Grid Lines J: 14-17 (J:18I=1325,5325)					V9-Y_{RUN}-10
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX		
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
125	10.2	10.3	8.2	126	6.3
93	12.2	11.5	8.4	94	6.7
SASSI AVG	11.2	10.9	8.3		6.5
GT-STRUDL*	29.0	29.0	29.0		8.0
GT-STRUDL/SSI RATIO	**2.6**	**2.7**	**3.5**		**1.2**

Units for MXX = ft-kips

North-South Excitation E-W WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID 16 Grid Lines J: 14-17					V10-Y_{RUN}-10
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX		
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
128	16.3	16	12.5	Not Available	Not Available
96	14.7	12.7	9	Not Available	Not Available
SASSI AVG	15.5	14.3	10.8		
GT-STRUDL*	29.0	29.0	29.0		
GT-STRUDL/SSI RATIO	**1.9**	**2.0**	**2.7**		**Not Available**

Units for MXX = ft-kips

Not Available = Data for this SASSI element not included in supplied information.

6

East-West Excitation N-S WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID G Grid Lines 17: E-H (17:F-F5=60927,4927)					V11-X_{RUN}-11
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX		
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
20	20.4	15.8	13.2	24	16.2
138	9.6	10.5	11.4	143	11.6
80	9.6	6.2	6.2	84	7.1
64	19.2	13.7	9.6	68	12.7
48	23.0	20.2	18.7	62	12.4
SASSI AVG	16.4	13.3	11.8		12.0
GT-STRUDL*	54.0	54.0	54.0		176.0
GT-STRUDL/SSI RATIO	**3.3**	**4.1**	**4.6**		**14.7**

Units for MXX = ft-kips

5

East-West Excitation N-S WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID E Grid Lines 17: E-H (17:EE5O=60727,4727)					V12-X_{RUN}-11
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX		
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
205	27.2	24.1	23.7	210	27.5
135	13.9	12.3	11.9	140	12.8
77	16.6	14.9	14.8	81	15.5
61	5.5	4.9	5.1	65	4.4
45	2.8	3.1	3.9	49	3.2
SASSI AVG	13.2	11.8	11.9		12.7
GT-STRUDL*	22.0	22.0	22.0		67.0
GT-STRUDL/SSI RATIO	**1.7**	**1.9**	**1.9**		**5.3**

Units for MXX = ft-kips

East-West Excitation N-S WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID B Grid Lines 17: AA-E (17:B-CI=327,4327)					$V13\text{-}X_{RUN}\text{-}11$	Compare V13 vs V14	Design D/C from calc
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX				
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A		
200	27.3	25.6	25.5	205	28.5		
130	5.2	4.3	3.5	135	3.7		
	16.2	14.9	14.5		16.1	16.1	
GT-STRUDL*	103.0	103.0	103.0		3.0	142	
GT-STRUDL/SSI RATIO	**6.4**	**6.9**	**7.1**		**0.2**	**8.8**	**0.79**

Units for MXX = ft-kips

7

East-West Exiction N-S WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID AA Grid Lines 17: AA-E (17:AA-AI=27,4027)					$V14\text{-}X_{RUN}\text{-}11$
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX		
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
196	5.7	6.1	5.6	201	7.4
125	15.0	14.8	13.8	130	16.3
SASSI AVG	10.3	10.4	9.7		11.9
GT-STRUDL*	12.0	12.0	12.0		142.0
GT-STRUDL/SSI RATIO	**1.2**	**1.2**	**1.2**		**12.0**

Units for MXX = ft-kips

23

North-South Excitation E-W WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID 16 Grid Lines AA: 16-17 (AA:165I=26,4026)					$V15\text{-}Y_{RUN}\text{-}10$
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX		
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A
104	1.5	1.5	1.7	105	1.0
73	2.5	2.6	2.2	74	3.8
SASSI AVG	2.0	2.1	1.9		2.4
GT-STRUDL*	5.0	5.0	5.0		7.0
GT-STRUDL/SSI RATIO	**2.5**	**2.4**	**2.6**		**2.9**

Units for MXX = ft-kips

East-West Excitation						V16-X_{RUN}-11
N-S WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID AA						
Grid Lines 16: AA-E (16:AA-AI=25,4025)						
SASSI ELEMENT Rev 0	LOWER	MEAN	UPPER BOUND SOIL: MXX			
	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A	
186	8.2	8.2	7.4	191	9.4	
115	15.4	14.9	14.0	120	16.6	
SASSI AVG	11.8	11.5	10.7		13.0	
GT-STRUDL*	15.0	15.0	15.0		183.0	
GT-STRUDL/SSI RATIO	**1.3**	**1.3**	**1.4**		**14.1**	

Units for MXX = ft-kips

East-West Excitation						V17-X_{RUN}-11	10 Compare V16 vs V17	Design D/C from calc
N-S WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID C								
Grid Lines 16: AA-E (16:B-CO=325,4325)								
SASSI ELEMENT Rev 0	LOWER	MEAN	UPPER BOUND SOIL: MXX					
	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A			
191	25.7	25.2	25.5	196	30.0			
120	5.3	4.3	3.5	125	3.7			
SASSI AVG	15.5	14.8	14.5		16.8		16.8	
GT-STRUDL*	23.0	23.0	23.0		15.0		183	
GT-STRUDL/SSI RATIO	**1.5**	**1.6**	**1.6**		**0.9**		**10.9**	**0.59**

Units for MXX = ft-kips

North-South Excitation						18 V18-Y_{RUN}-10
E-W WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID 14						
Grid Lines E: 12.5-16 (E:14I=60621,4621)						
SASSI ELEMENT Rev 0	LOWER	MEAN	UPPER BOUND SOIL: MXX			
	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A	
110	22.3	18.8	13.0	Same No.	12.4	
79	12.4	11.7	8.7	Same No.	11.7	
57	18.6	18.9	13.1	Same No.	21.8	
37	23.6	21.4	20.6	Same No.	25.3	
17	27.5	25.9	26.8	Same No.	25.2	
SASSI AVG	20.9	19.3	16.4		19.3	
GT-STRUDL*	45.0	45.0	45.0		55.0	
GT-STRUDL/SSI RATIO	**2.2**	**2.3**	**2.7**		**2.9**	

Units for MXX = ft-kips

North-South Excitation						V19-Y_{RUN}-10	Compare	Design
E-W WALL-MAIN TUNNEL, VERTICAL AXIS NEAR GRID 12.5							V18 vs V19	D/C
Grid Lines E: 12.5-16 (E:125I=60619,4619)								from calc
SASSI ELEMENT	LOWER	MEAN	UPPER BOUND SOIL: MXX					
Rev 0	MXX	MXX	MXX-Rev. 0	Elem Rev. 1A	MXX - Rev. 1A			
106	13.4	13	9.8	107	9.3			
75	18.4	12.9	9.2	76	10.2			
53	19.6	17.3	12.3	54	12.0			
33	17.3	15.5	10.6	34	10.2			
13	7.6	5.1	3.5	14	2.8			
SASSI AVG	15.3	12.8	9.1		8.9		8.9	
GT-STRUDL*	25.0	25.0	25.0		2.0		55	
GT-STRUDL/SSI RATIO	**1.6**	**2.0**	**2.8**		**0.2**		**6.2**	**0.83**

Units for MXX = ft-kips

Distribution

PDC	MS5-K.1
Houghton, David	MS11-A
Scribner, Don	MS5-I
Bob Lawrence	MS4-B1
Richard Garrett	MS6-P1
Mark Braccia	MS5-G
Taber Hersum	MS4-B1

Signature Pages of Structural Calcs

R10000824

ISSUED BY RPP-WTP PDC 1/15/03 INIT DATE

Calculation Cover Sheet

ISSUED BY RPP-WTP PDC 3/5/03 INIT DATE

Sheet i

RIVER PROTECTION PROJECT-WASTE TREATMENT PLANT	JOB NO.: 24590
CALC NO. 24590-PTF-S0C-S15T-00002	GROUP CS&A
SUBJECT Pretreatment Facility (PTF) - Structural Model for SSI Analysis	

CALCULATION STATUS DESIGNATION: ☐ PRELIMINARY ☒ COMMITTED ☐ CONFIRMED ☐ SUPERSEDED ☐ VOIDED

COMPUTER PROGRAM/TYPE	N/A	QAS	SCP	PROGRAM NAME	VERSION/RELEASE NO.
	☐	☒ YES ☒ NO	☒ YES ☒ NO	See *Note below	See *Note below

Notes/Comments

This calculation is intended to describe the structural model for the seismic analysis of Pretreatment Facility.

The attached CD contains the input and output files for the analysis and calculations (See Appendix I)

This calculation report has been completed using Excel 2000 SR-1 and Word 2000 SR-1 on a stand alone PC. The PC is networked for printing and file storage but the programs used are loaded on the PC. These programs started and operated normally during calculation preparation.

***Note:** Two computer programs were used to produce this calculation, GTStrudl Version 25 that is QAS and SCP and GTS2Sassi Version 2.1 that is Non-QAS and Non-SCP.

Verification and Validation of GTSTRUDL has been completed on the machine used to complete the calculation report. Refer to memo CCN: 039564.

GTS2Sassi is considered Non-QAS since the results are checked by hand calculations. This is a simple program produced in Java and is not required to be added to the WTP IT Baseline. The source code and validation of this program is contained in this calculation and can be reproduced without recourse to the originator. This Non-QAS program is developed, validated and run on the machine used to complete the calculation report.

Design Verification Report Documented in DVR No. 24590-PTF-DVR-CSA-02-016, Rev. 1

NO.	REASON FOR REVISION	TOTAL NO. OF SHEETS	LAST SHEET NO.	BY	CHECKED	APPROVED/ ACCEPTED	DATE
1A	Revised as noted for seismic analysis of modified building configuration	1337	I-3	EWU ED ULLE	TC THOMAS CHIN	FO / DTS	12/24/02 1/10/03
1	Revised as noted for seismic analysis of modified building configuration	~~1304~~ 1306 [illegible] 1-7-03	I-2	EWU	TC	FO / DTS	9/23/02 9/23/02
0	Original issue	995	I-3	EWU / SM	SM / EWU / SB	FO / DTS	6/10/02 6/17/02

RECORD OF REVISIONS

ISSUED BY RPP-WTP PDC [handwritten initials and date]

Calculation Cover Sheet

Sheet i

RIVER PROTECTION PROJECT-WASTE TREATMENT PLANT	JOB NO.: 24590
CALC NO. 24590-PTF-S0C-S15T-00003	GROUP CS&A
SUBJECT Pretreatment Building Seismic Analysis: SSI Analysis	

CALCULATION STATUS DESIGNATION ☐ PRELIMINARY ☒ COMMITTED ☐ CONFIRMED ☐ SUPERSEDED ☐ VOIDED

COMPUTER PROGRAM/TYPE	N/A	QAS	SCP	PROGRAM NAME	VERSION/RELEASE NO.
	☐	☒ YES ☐ NO	☐ YES ☒ NO	SASSI2000	1.0

Notes/Comments

This calculation documents the Soil-Structure Interaction (SSI) analysis for the Pretreatment Building.

The computer program SASSI2000 is utilized in performing the analysis. Verification and Validation of SASSI 2000 has been completed on the machine used to complete the calculation report. Refer to calculation 24590-WTP-S0C-S15T-00005, Rev. 1 0A [handwritten initials] 12-28-01

This calculation report has been completed using Excel 2000 SR-1 and Word 2000 SR-1 on a stand alone PC. The PC is networked for printing and file storage but the programs used are loaded on the PC. These programs started and operated normally during calculation preparation.

This calculation includes one CD-ROM for all attachments.

Design Verification Report Documented in DVR No. 24590-PTF-DVR-CSA-02-019, Rev. 1

NO.	REASON FOR REVISION	TOTAL NO. OF SHEETS	LAST SHEET NO.	BY	CHECKED	APPROVED/ ACCEPTED	DATE
1A	Complete Revision for seismic analysis of modified building configuration	54	54	[signature]	THOMAS MA [signature] TWM	FO / DTS	12-26-02 / 1/10/03
1	Revised as noted for seismic analysis of modified building configuration	9	9	ND	TWM	FO DTS	9/23/02 9/23/02
0	Original Issue	32	32	ND	TWM	FO DTS	6/11/02 6/17/02

RECORD OF REVISIONS

Calculation Cover Sheet

RIVER PROTECTION PROJECT-WASTE TREATMENT PLANT					JOB NO.: 24590		
CALC NO. 24590-PTF-S0C-S15T-00004					GROUP CS&A		
SUBJECT Pretreatment Building Seismic Analysis -- Seismic Loads							
CALCULATION STATUS DESIGNATION	☐ PRELIMINARY ☐ SUPERSEDED			☒ COMMITTED		☐ CONFIRMED ☐ VOIDED	
COMPUTER PROGRAM/TYPE	N/A ☐	QAS ☒ YES ☐ NO	SCP ☒ YES ☐ NO	PROGRAM NAME GT Strudl		VERSION/RELEASE NO. 25	

Notes/Comments

This calculation is intended to describe and document the development of the Seismic Loads for the Pretreatment Facility.

This calculation report has been completed using Excel 2000 SR-1 and Word 2000 SR-1 on a stand alone PC. The PC is networked for printing and file storage but the programs used are loaded on the PC. These programs started and operated normally during calculation preparation.

Verification and Validation of GT Strudl has been completed on the machine used to complete the calculation report in appendix A. Refer to memo CCN: 039564.

Main calculation, sheets 1 thru 6 ----- Originated by T. W. Ma, Checked by N. Deng
Main calculation, sheets 7 thru 89 ----- Originated by B. Shakibnia, Checked by T. W. Ma
Main calculation, sheets 90 thru 122 ----- Originated by T. W. Ma, Checked by N. Deng
Appendix A, sheets A-1 thru A-185, and sheet A-29a. Total = 186 sheets
----- Originated by Ed. Ulle, Checked by T. W. Ma

All sheets in the main calculation have been revised. See sheet 122 for a description of the revised sheets in Appendix A.

Design Verification Report Documented in DVR No.24590-PTF-DVR-CSA-02-018, Rev.1

NO.	REASON FOR REVISION	TOTAL NO. OF SHEETS	LAST SHEET NO.	BY	CHECKED	APPROVED/ ACCEPTED	DATE
1A	Revised as noted for seismic analysis of modified building configuration	308	A-185	TWM BS EWU	SCL TWM	FO DTS	12-26-02 1/10/03
1	Revised as noted for seismic analysis of modified building configuration	280	A-185	TWM EWU	ND TWM	FO DTS	9/23/02 9/23/02
0	Original Issue	319	A-185	TWM EWU	ND TWM	FO DTS	6/11/02 6/11/02

RECORD OF REVISIONS

ISSUED BY RPP-WTP PDC 01/15/03
DS 1/15/03 1/21/03
INIT DATE

Calculation Cover Sheet

Sheet i

RIVER PROTECTION PROJECT-WASTE TREATMENT PLANT	JOB NO.: 24590
CALC NO. 24590-PTF-S0C-S15T-00005	GROUP CS&A
SUBJECT Pretreatment Building Seismic Analysis -- In-Structure Response Spectra (ISRS)	
CALCULATION STATUS DESIGNATION ☐ PRELIMINARY ☐ SUPERSEDED ☒ COMMITTED ☐ CONFIRMED ☐ VOIDED	

COMPUTER PROGRAM/TYPE	N/A	QAS	SCP	PROGRAM NAME	VERSION/RELEASE NO.
	☐	☒ YES ☐ NO	☐ YES ☒ NO	(See note below)	(See note below)

Notes/Comments

This calculation is intended to determine the in-structure acceleration response spectra (ISRS) at various locations on the Pretreatment building.

This calculation report has been completed using Excel 2000 SR-1 and Word 2000 SR-1 on a stand-alone PC. The PC is networked for printing and file storage but the programs used are loaded on the PC. These programs started and operated normally during calculation preparation. For a list of all other programs (SASSI 2000, SRSEQ, ENVBRD, PTARS2 and DPLOT) used in this calculation and their corresponding verification/validation, refer to section 7.6 of this calculation.

Main calculation, sheets 1 thru 57 -------- Originated by B. Shakibnia, Checked by T. W. Ma
Attachment 1, Total = 384 sheets --------- Originated by P. Chiu, Checked by T. W. Ma
Attachment 2, Total = 68 sheets --------- Originated by P. Chiu, Checked by T. W. Ma
Attachment 3 (1 CD-ROM's) -------------- Originated by N. Deng, Checked by P. Chiu

All sheets (in the main calculation and in the attachments) have been revised to revision ~~1.~~ 0A Kunguta 12-28-02

Design Verification Report Documented in 24590-PTF-DVR-CSA-02-020, revision 0.

NO.	REASON FOR REVISION	TOTAL NO. OF SHEETS	LAST SHEET NO.	BY	CHECKED	APPROVED/ ACCEPTED	DATE
0A	Completely revised for seismic analysis of modified building configuration	509	Figure 66E	BS PC [signature]	TWM PC	[signature] DTS	12-26-02 1/10/03
0	Original Issue	316	II-2	T. W. Ma	N. Deng	F. Ostadan D. Scribner	07/25/2002 07/25/2002

RECORD OF REVISIONS